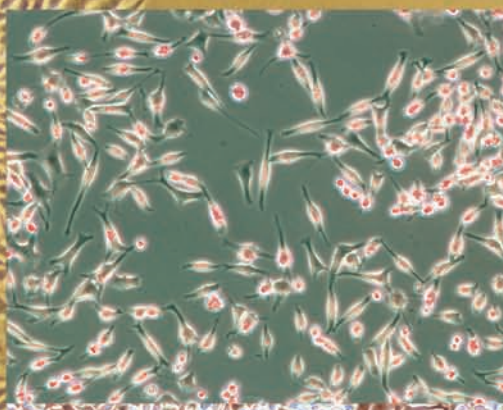
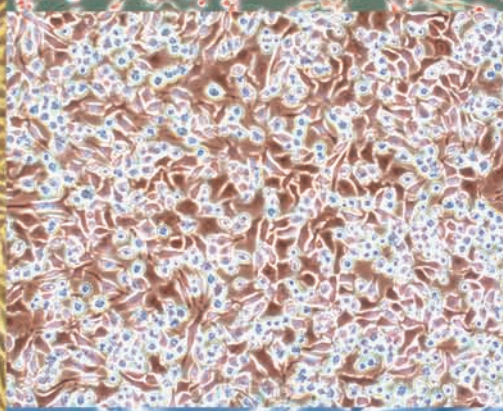
Atlas of Living Cell Cultures

Toni Lindl
and Rosemarie Steubing





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Contents

Preface and Acknowledgments

This comprehensive collection of photographs of various living cells and cell lines cultured *in vitro* represents the first of its kind.

Within the last decades the use of cells in culture has not only increased dramatically in basic research but also expanded into many industrial processes and techniques, for example, for the generation of antibodies and biopharmaceuticals.

In industrial processes, the cells used are tested thoroughly with the aid of many and diverse direct and indirect analytical methods. As such sophisticated and time consuming testing is not always possible in basic research laboratories, a fast first control check for their viability under the microscope would be done and no other control seemed to be necessary in the past and even in the present.

This cell culturing in T-flasks, in Petri-dishes or in multiwell-plates is a technique that can be deduced since more than 100 years without great improvements if you look just for the behavior of the seeded cells on the substratum and their image under the microscope: Either they are attached after one or two days (as normal cells derived from a body's tissue do) or they keep rounded up in suspension like blood cells do. Dying or dead cells do not attach to the substrate and they keep rounded up or even disintegrate into small-vesiculated membrane particles.

For many years the cell morphology was the main and nearly only characteristic for the viable cells in culture, taking advntage of the invention of the phase contrast microscopy in the 1930s. This kind of microscopy was almost the only technique for the observation of live cells in greater magnification and therefore indispensable for people who worked with cells in culture.

But even now, although modern analytic methods at the cell's molecular level are in use after the rapid developments within the last 30 years to look into cells, light microscopy is still the most important tool in the routine field for viewing cells in culture.

Working with live cells and cell lines and observing them as vital organisms still means using an inverted phase contrast microscope to control continuously not only the morphology but at the same time the proliferation of a cell under culture condition in the T-flask. Each cell type and each cell line has its own morphological features even though cells originating from the same tissue may differ from each other.

Although many photographs of cells and cell lines exist and various pictures from respective cell lines can be found, for example, in the World Wide Web, it may be a tedious and time consuming task to find them at the various websites and/or in numerous journals and other publications. In addition, the morphology of cultured cells varies from the onset of seeding until

they become confluent and also from passage to passage. Density of cells causes striking changes of the morphology *in vitro* due to the availability of the substratum and their overgrowth. It is therefore very important to have a comparison of different densities of cultured cells in the flasks.

On the other hand, it must be emphasized that variations of the cell morphology during cultivation may derived from the use of different media, from the incubation conditions (seeding concentrations, CO_2-concentrations, humidity, and temperature in the incubator, length of incubation time) and from the individual (!) treatment during passages and from laboratory to laboratory. Therefore, our pictures taken from the T-flaks at different times were made under certain and defined condition (media, temperature and CO_2-concentration in the incubator, etc.) and these conditions are depicted within the text sides opposite to the pictures.

Our aim is to give a first impression of the individual cultivated cell line, but it must be emphasized again that our pictures of the cell morphology are derived from individual laboratory personnel. But nevertheless they may be representative for the respective cell line.

In our opinion, no 100% ideal picture of the respective cell exists. Our aim was to give an impression of an image of the cultured cells which comes closer to the truth than any other picture which may be found, for example, in the World Wide Web.

We want to introduce for the first time a comprehensive but limited number of living cell lines the photographs of which were taken during cultivation of the cells. This atlas may lead to a better control how these cultured cell lines may look alike under good cell culture practice (**GCCP**).

Our selection was certainly to some extent random. We could not introduce nearly all of the estimated 3500–4000 (?) cell lines listed in all scientific publications or in the catalogues of the cell banks. Our choice was to list the most used or most "popular" cell lines but certainly our choice may not find the consent of all people working with cell cultures. Proposals for introducing further cell lines are welcome.

Furthermore, it was not our aim to make "star pictures" for the "haute couture" of cells in culture, instead we made photographs under routine culture conditions with a "normal" microscopic equipment such as an inverted microscope equipped with a digital camera and a pdf-conversion program in the computer and/or printer. It was also not the aim to give pictures of contaminated or of sick cells in culture in all details. People, who had these kinds of problems may look further in the textbooks of cell and tissue culture.

Instead we recommend in the context of all cell culture practices to withdraw contaminated cell cultures immediately and not try to cure them with antibiotics.

In Chapter 2, the most basic cell culture techniques are described. For further reading we refer to very detailed and informative cell culture manuals such as "*Culture of Animal cells*" by R. Ian Freshney (6th ed. Wiley-Blackwell New York, 2010) or "*Zell- und Gewebekultur*" by Toni Lindl and G. Gstraunthaler (6th ed. Spektrum Verlag Heidelberg, 2008). Chapter 3 contains the list of all cell lines. Chapter 4 is divided into three subchapters, namely human cell lines originating from various tissues and animal cell lines originating from various animals and from various tissues. Also included are primary cells of human origin that are characterized by a finite life span. The photographs of the primary cells are courtesy of PromoCell GmbH, Heidelberg, Germany. We thank Dr. Hüttner for providing these highly informative photographs of these cells.

STR-analyses were performed using the cell lines of CLS Cell Lines Service GmbH in Eppelheim and are consistent with STR data published by ATCC (if available). All cell lines are listed alphabetically, and the search for one particular cell line should be an easy task. Each cell line comes with a short description and some basic information.

The authors would like to acknowledge Jessica Hirscher who has been busy with culturing the cell lines; Dagmar Lojewski for spending many hours to take the photographs and to arrange the best photographs at differing magnifications; Ute Fischer and Dott. Francesca Maggi Herbring for controlling the contamination status of the cell lines.

Eppelheim and Munich, April 2013

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Abbreviations

ACTH	Adrenocorticotropic hormone
AML	Acute myeloid leukemia
ANP	Atrial natriuretic peptide
AP-1	Activator protein 1
Arg	Argenin
ATCC	American Type Culture Collection
ATPase	Adenosintriphosphatase
BBS	Balanced salt solution
BCG	Bacille Calmette-Guérin
bp	Base pair
BMP-6	Bone morphogenetic protein
°C	Degree Celsius
C3b receptor	Complement receptor
Ca^2	Calcium
CCD camera	Charge-coupled device camera
CD2AP	CD2-associated protein
CEO	Chief Executive Officer
CFTR	Cystic fibrosis transmembrane conductance regulator
CLS	Cell Lines Service GmbH
CM-1	Cryomedium-1
CM-5	Cryomedium-5
cm^2	Square centimeter
CO_2	Carbon dioxide
CSA	Colony stimulating activity
Cys	Cystein
DAPI	4′,6-diamidino-2-phenylindole
DKFZ	Deutsches Krebsforschungszentrum (German Cancer Research Center)
DMBA	Metabolism of 7,12-dimethylbenzanthraeene
DMEM	Dulbecco's modified Eagle's medium
DMSO	Dimethylsulfoxide
DNA	Deoxyribonucleic acid
EBNA	Epstein-Barr nuclear antigen

ECACC	European Collection of Cell Cultures
EDTA	Ethylendiamintetraacetate
EEA	Erythroid-enhancing activity
EGF-biotin	Epidermal growth factor-biotin
ER	Endoplasmic reticulum
EUB -polymerase	Eubacterial polymerase
FBS	Foetal bovine serum
Fc receptor	Fragment crystallizable
g	Gramm
G418	Geneticin
G6PD	Glucose-6-phosphate dehydrogenase
GABA	Gamma-aminobutyric acid
G-CFS	Granulocyte-colony-stimulating factor
GenTSV §5	Gentechnik-Sicherheitsverordnung
GLO-1	Lactoylglutathione lyase
GM-CSF	Granulocyte macrophage colony-stimulating factor
h	hour
H-2d antigen	Histoincompatibility
HAT sensitive	Hypoxanthine/aminopterin/thymidine sensitive
HBsAg	Hepatitis B virus surface antigen
HEPES-buffer	N-2-hydroxyethylpiperazine-N-2′-ethanesulfonic acid buffer
His	Histidin
HIV	Human immunodeficiency virus
HLA	Human leukocyte antigen system
HPV-16, HPV-18	Human papillomavirus type
IGF II	Insulin-like growth factor II
IGFBP	Insulin-like growth factor binding proteins
IFN-g-inducible	Interferon-gamma-inducible
IL-1, IL-6	Interleukin 2, 6
IST premix	Insulin selenium transferrin complex premix
KMG-2,KMG-5	Konditioniertes medium growth
LAV	Lymphadenopathy associated virus
L-DOPA decarboxylase	L-3,4-dihydroxyphenylalanine decarboxylase
LCM	Lymphocytic choriomeningitis
LDV	Lactate dehydrogenase-elevating *virus*
Ltd	Limited
Lmx1b	LIM homeobox transcription factor 1-beta
LPS.	Lipopolysaccharide
MAP-Test	Mitogen-activated protein test
MEM	Minimum essential medium
Mg^{2+}	Magnesia
MHV	Mouse hepatitis virus
min	Minute
ml	Milliliter
mM	Millimolar

mRNA	Messenger ribonucleic acid
m-THPC-PEG	Meta-tetra(hydroxyphenyl)chlorin-PEG
MUC-1, MUC-2	Mucin
MVM	Minute *virus* of mice
Na	Sodium
Na_2CO_3	Sodium carbonate
$NaHCO_3$	Sodium hydrogen carbonate
NEAA	Nonessential amino acids
NGF	Nerve growth factor
NK	Natural killer
PAS positive	Periodic acid Schiff reaction
PBS	Phosphate buffered saline
PCR	Polymerase chain reaction
Pen/Strep-solution	Penicillin/Streptomycin- solution
PGM1	Isozyme of phosphoglucomutase
pH	Potentia Hydrogenii
Phe	Phenylalanine
PPD	Purified protein derivative
pRB	Retinoblastoma suppressor
PTH	Parathyroid hormone
RCV/SDA	Rat Corona Virus/Sialoda Cryoadenitis Virus
RD114	Endogenous retrovirus
rpm	Revolutions per minute
SCF	Stem cell factor
Ser	Serin
SMV provirus	Soybean mosaic virus
STR	Short tandem repeat
SV40	Simian Virus 40
T75 flask	Tissue 75 cm^2 flask
TBE buffer	Tris, boracid, EDTA buffer
TBST	Tris-buffered saline containing 0.1% Triton X-100
TNF alpha	Tumor necrosis factor alpha
TPA	Tissue plasminogen activator
TSH	Thyroid stimulating hormone
WT-1	Wilms-Tumor-Protein

1
Introduction

1.1
Introduction and Usage of This Book

To culture living cells in the laboratory and to keep them proliferating have become a revolutionary part in the Life Sciences. For more than 60 years now researchers are using permanent cell lines and in recent years the so-called primary cell lines. Within this time frame the number of these cell lines has increased tremendously since the first cell line (the mouse fibroblast cell L-929) has been established in 1943. When the first human cell line (HeLa) was introduced in 1952, a boom in the development of such cell lines started and continues until today.

During this development the increasing knowledge regarding the establishment of human and animal cell lines has influenced the culture of cell lines; however, the scientists suffered from various setbacks and problems which could not be reduced to cell's biology alone but rather to the cell culture practice. This started with the definition of the meaning of "cell line" which has not been defined as uniformly as it may be desirable for the biological scientific research.

Both cell lines mentioned above, L-929 and HeLa, have been cloned originally, it means these cell lines originate from one single cell. This basic principle of uniformity or clonality of cell lines has not been followed strictly within the last 50 years. Furthermore, the problem of cross-contamination, that is, the mixing of different cells with each other still poses a serious problem that is not overcome completely.

In the last couple of years a movement within the area of cell culture has established, which makes a point of a more stringent and careful maintenance of the cell lines regarding all the steps in cell culturing and the general handling of the cells. Strict rules of handling cell lines in particular were established (GCCP-Good Cell Culture Practice), and along with the application of these rules a reproducible and transparent work will be possible in the future.

This "Good Cell Culture Practice" should have been basic routine from the beginning, but 60 years ago cell culture work has not been as good resulting in mistakes not only during sterile handling of the cells. Also, the diagnostic instrumentation in the analysis of cells and cell lines in these early times of cell handling have not been present to be able to recognize any modification of a particular cell line on the molecular basis during cultivation such as a switch of the number of passages.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

In the very beginning the analysis of vital cells was restricted to watching them in the microscope (without phase contrast at first); this represented the only possibility besides the analysis of the chromosomes. Still today, a relatively simple inverted microscope equipped with phase contrast and a digital camera is sufficient to visualize the viable cultures routinely. The distance between the light source and the object table should be large enough to be able to watch cells which are kept in large culture flasks such as roller bottles.

However, the microscope being equipped with the phase contrast is necessary to efficiently evaluate the morphology *in vitro*. A modern inverted microscope is fitted with an ocular tube and a second tube which is connected to a digital camera or a CCD camera together with a monitor.

Another useful tool for an inverted microscope is an object table with a coordinating device for exactly locating the cell colonies unambiguously. Special object clamps at the microscope table may facilitate working with the various culture flasks and petri dishes. Inverted microscopes equipped with a fluorescent device are available; however, it is recommended to purchase a conventional upright microscope with fluorescent device together with an inverted microscope to achieve maximum sensitivity and accuracy through the higher magnification and better light yield for maximal performance of the fluorescence technique.

The analysis of specific isozymes as diagnostic tools has been introduced for the first time in the 1960s and 1970s. Within the last decade the diagnostics of cells changed dramatically, at first DNA hybridization emerged to be followed by DNA-fingerprinting and today the DNA profiling in the characterization of cells has become almost routine testing.

1.2 General Remarks

All efforts to characterize human and animal cells and cell lines unequivocally rise and fall with the knowledge of the morphology of the cells. This oldest, most direct and simplest way to visualize and characterize the cells is based on the histology of the cells existing in the body of human beings and animals, how they arrange and appear.

It is important to distinguish between the situations "*in vivo*" and "*in vitro*", which is evident and manifold; therefore simple extrapolation of cell pictures from a histological textbook can be misleading. Thus, observing the vital morphology by phase-contrast microscopy in routine cell culture life is highly recommended.

The environment and the development of the cells *in vitro* are not the same as they are *in vivo*, and these specific characteristics *in vitro* regarding the cellular morphology have to be taken into account and have to be observed and followed up intensely.

Normal epithelial cells cultured "*ex vivo*" as primary cells "*in vitro*" have almost all characteristics of epithelial cells; however, most cell lines may loose defined properties (of molecular kind) if they are transformed or transfected for example, which they may express in a different morphology under the microscope.

Culturing animal tissue cells on a chemically inert but charged material results in large differences to the situation "*in vivo*", which poses a serious problem regarding this type of the morphological characterization. Culture of adherent cells results in the formation of a monolayer on the substrate. The image of a cell line, which can spread out on the bottom

of the cell culture flask when seeded at low density may reflect best the morphological image of the cells in the "*in vitro*" environment.

If the optimum cell density "*in vitro*" is exceeded, the cells are being pushed together as soon as confluency is reached. At this stage formations and structures may arise that are less characteristic. It is evident that the morphology of the cells under the phase contrast microscope are studied best when the cells have not reached confluence yet; then, their origin can be defined as epithelial or fibroblastoid. However, as mentioned above, this conclusion is not always unambiguous.

An obvious discrimination between epithelial cells and fibroblasts in the microscope is as follows: cells are defined as being fibroblastoid if their length is more than twice their width. This structure is also called spindle-like. Epithelial cells in culture appear polygonal and plane. Furthermore, the characteristics of the division process of these two main cell types are differing. Following cytokinesis, the daughter cells of fibroblasts move away from each other and find their position on the substrate. Epithelial cells keep contact with their daughter cells via specific epithelial complexes such as tight junctions. Colonies of growing epithelial cells may arise.

Other environmental factors besides the substrate may play a major role in the formation of cellular morphology, such as the composition of the medium or the presence or absence of serum. The transformation of the cell line in question is an important criterion for the morphology. Diploid, that is, nontransformed cell lines, can be characterized much better than those whose status of ploidy differs from the original tissue.

In addition, the number of diploid cell lines is restricted, as almost all healthy tissue cells are subject to apoptosis. This means that the passage number is constrained, and therefore not many non-transformed lines exist which are useful for *in vitro* culturing compared to the majority of transformed cell lines. Therefore, the number of passages in the case of diploid, nontransformed cell lines is always required. A passage number of about 30–35 in human diploid fibroblasts, for example, MRC-5 or Wi-38, is sufficient to induce apoptosis. These apoptotic cells cease their proliferation and have to be substituted with cells of a lower passage number.

In this case the creation of a "Master Cell Bank" as a prohibitive strategy is very helpful, as nearly all healthy diploid cell lines possess a limited life span *in vitro* as well as *in vivo*. Regarding the maintenance *in vitro*, transformed cell lines can be cultured much easier than diploid cells but still this transformation process represents a dramatic change of the biology of the cell. This holds for the situation *in vivo* as well as *in vitro*. As transformed cells have been and are still widely used, a few remarks regarding the observation and analysis of the cellular morphology follow:

1) Transformed cell lines do not undergo apoptosis, because many of the events that induce a transformation of cells are part of the cell cycle control which is affected.
2) Transformed cell lines mostly, but not always, loose many of the characteristics of the *in vivo* topology.
3) Transformed cell lines can loose their original morphology in many cases, preventing an unequivocal classification to their original tissue.
4) Transformed cell lines are most likely aneuploid, that is, the chromosome set is not euploid or the set of chromosomes switches during the process of culturing and transformation as

does the morphology in dependence of culture conditions, such as serum-free cell culture, change of medium or pH.

5) Recently introduced transformation techniques may keep the diploid stage within the mechanism of senescence. Such cells can undergo many divisions and can be induced to differentiate *in vitro* into cells very similar to the former tissue origin.

Our whole set of pictures represents viable cells cultured as monolayers or as suspension cells. The adherent cells attach to the respective surface or substrate, that is plasma-treated polystyrene with negative charges. No special treatments of the surface nor any other conditioning with, for example, collagen, extracellular matrices were used unless specified. No attempts were made to fix and/or to stain the cells and no three dimensional constructs were used for the pictures.

The pictures were made with a professional equipment (inverted microscope with phase contrast and a digital camera), no further retouch or improvements by digital processing were made. This guarantees that pictures taken in the laboratories of the readers may be comparable to our pictures without any manipulations or "improvements."

Last but not the least, this book is not a textbook nor will give any detailed and special guidelines or protocols how to treat and process the respective cell lines in culture. Please refer to the many textbooks in this field and even the growing number of protocols and procedures of cell culturing appearing in the World Wide Web.

This book may be dedicated mainly to people with previous knowledge in cell culture techniques working in the laboratory.

2
Basic Cell Culture Techniques

2.1
Safety Precautions for Frozen Cell Lines

Protective gloves and clothing should be used and a facemask or safety goggles must be worn when storing in and/or removing from liquid nitrogen. The removal of a cryovial from liquid nitrogen can result in the explosion of the cryovial creating flying fragments.

2.2
Sterile Working

To assure a sterile working environment, all cell culture tasks should be performed within a class 2 safety laminar air flow cabinet.

2.3
Handling Procedure for Cell Lines

2.3.1
Frozen Cells

- Thaw by rapid agitation in a 37 °C water bath. Thawing should be completed within 40–60 s. The water bath should have clean water containing an antimicrobial agent. As soon as the ice is melted except for a small piece of ice left, remove the ampoule from the water bath. All of the operations from this point on should be carried out under strict sterile conditions.
- Wipe the ampoule with 70% ethanol or isopropylalcohol and transfer it to a sterile flow cabinet.
- Transfer the cell suspension into a 50 ml-centrifuge-tube with 20 ml of warmed growth medium in order to dilute the cryoprotectant. Gently resuspend the cells and centrifuge at $200 \times g$ for 10 min.
- For some cell lines, centrifugation after thawing is not recommended. In this case, transfer the cells into a T-flask (T-25 max.: 10 ml and T-75 20 ml of the suspension) and change the medium 24 h later.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

- Following centrifugation remove the supernatant from the pelleted cells using a sterile pipette and resuspend in fresh, pre warmed growth medium. Transfer the cells into a cell culture flask. To ensure a rapid recovery it is recommended that cells should be seeded between 1/4 to 1/2 of their maximum density. In practice the maximum density for suspension lines is 10^6/ml and for attached lines in the range $1–3 \times 10^6$ cells/cm^2. See also the references for the seeding concentrations of the respective cell line.
- Incubate at 37 °C at the desired CO_2 concentration in the incubator, according to the content of the $NaHCO_3$-buffer system of the growth medium.

2.3.2
Receipt of Growing Adherent Cultures in T-flasks

The cell culture flask before shipping are completely filled with growth medium eventually with antibiotic/antimycotic solution to prevent loss of cells in transit and prevent from contamination. Remove all of the medium except for a small but sufficient volume to cover the inner surface of the flask. Incubate at 37 °C for 1 h. Then change to the desired incubation medium without antibiotics as recommended. (DMEM or RPMI-1640 or other incubation medium of your choice. Please check carefully the recommended CO_2-concentration in the incubator.) But if you use routine antibiotics (e.g., pen/strep-solution) in the media, you can use your respective media without problems.

Sometimes the cultures are handled roughly in transit and some or even most of the cells may become detached and float in the culture medium. If this has occurred remove the entire contents of the flask after gently suspending the medium with a pipette and centrifuge at $200 \times g$ for 10 min. Draw off the excess supernatant medium, resuspend the cells in 10 ml of the culture medium, and plate the entire cell suspension in a single flask of suitable size.

2.3.3
Receipt of Growing Suspension Cultures

The culture flask are completely filled up with growth medium for shipment. Remove the entire contents of the flask with a pipette into a centrifuge tube and centrifuge at $200 \times g$ for 10 min. Resuspend the cell pellet as suggested under subculture procedure described in the cell lines descriptions with the respecitve incubation media.

2.3.4
Medium Replacement of Cells in Suspension

If medium is to be replaced with fresh cell culture medium, the flask containing the cells should be placed in an upright position to sediment the cells. After about 30–45 min, carefully remove an aliquot without removing cells, and replace it with the same amount of fresh medium.

If the cells do not sediment, transfer the cell suspension into sterile centrifuge tubes, centrifuge at $200 \times$ g for 10 min, remove the spent medium and add an equal amount of fresh cell culture medium.

2.3.5
Subculture of Cells in Suspension

If the cells have reached the plateau phase, subculture them by preparing fresh flasks, label the flasks with the name of the cell line, passage number, the respective cell culture medium, and the date. Pipette an aliquot of fresh cell culture medium, add an aliquot of the dense cell suspension and resuspend the cells. Transfer the flasks into the incubator.

2.3.6
Subculture of Adherent Cells

If the cells cover about 85–90% of the substrate, subculture adherent cells using trypsin or alternative detaching enzymes. A split ratio of 1 : 2 to 1 : 16 is recommended, as described on the respective cell line information sheet.

Before trypsinization, wash the cell layer very carefully twice with balanced salt solution (BBS) without Ca 2+,Mg 2+ and without any serum. Thus, all remaining serum residues have been removed. If serum-free medium is used, one washing step using BBS is sufficient.

Trypsinization should be carried out according to general trypsinization protocols. It is advised to stop the trypsin activity using media containing serum, or using serum inhibitors, if serum-free media has been used.

Resuspend the cells carefully, centrifuge at 200 × g for 10 min, resuspend the cells in fresh medium and count the cells. Seed the cells at a concentration of 1×10^4 to 5×10^4 cellls/cm^2 into new flasks or refer to the cell lines description.

If the trypsinization solution is free of EDTA, the centrifugation step can be omitted.

It is recommended to follow the instructions on the apropriate datasheet which contains details or routine maitenance including feeding and subculturing.

2.3.7
Subculture of Mixed Cell Lines (Adherent and Floating Cells)

Few cell lines grow as adherent as well as floating cells. In this case, collect the floating cells in sterile centrifuge tubes, detach the adherent cells according to the protocol described above for adherent cells, and combine both fractions. Following one centrifugation step at 300 × *g* for 5 min, resuspend the cells for cell counting, and dilute them in cell culture flasks as described.

2.3.8
Cell Counting

The counting of the cells can be performed using a Hemocytometer or using an electronic cell counter.

2.3.9
Cryopreservation of Cell Lines

To achieve best results, the cells to be frozen should be in the log-phase of the growth curve. Harvest these cells as usual.

Centrifuge the cell suspension at 200 × g for 10 min at room temperature and remove the supernatant. Wash once with fresh cell culture medium.

Resuspend the cell pellet using icecold cryomedia (see for composition the manufactor's catalogs or the textbooks), adjusted to a cell number of 2–4 × 10^6 cells/ml.

Quickly distribute the cell suspension into appropriate cryovials and close them tightly.

Do not allow the suspension to warm up to room temperature.

Place these cryovials containing the cells in a Cryo Freezing Container and cool down at a rate of 1 °C/min to at least −70 °C. At this point the frozen cryovials can be stored directly in liquid nitrogen or better in the gaseous phase of liquid nitrogen.

If you do not possess a Cryo Freezing Container, place the rack with the ampoules without covering in a freezer (−30 °C to −40 °C) for at least 60–120 min.

Immediately afterwards put the rack into an ultra freezer or into a container filled with dry ice (−72 °C – −80 °C) and keep the cryovials for at least 1 h.

Following this procedure, the cryovials can be stored in liquid nitrogen. To control the success of the freezing procedure, it is recommended to revitalize one cryovial 24 h after the cryovial had been placed into the liquid nitrogen. Thus, follow the general recommendations for thawing of cells.

2.3.10
Long Term Storage of Cells

It is not recommended to store cryopreserved cells on dry ice, as many biological processes are still going on at temperatures as low as the sublimation temperature of dry ice of about −78 °C. Biological activity substantially slows below the glass transition point of aqueous solutions of around −136 °C.

Therefore, the storage in the gas phase of liquid nitrogen at −196 °C is required for successful preservation of cells lines and primary cells.

2.3.11
Detection and Elimination of Contaminations

When cells are contaminated with bacteria, fungi, molds, and mycoplasm, they should be withdrawn and autoclaved, and the sterile routine should be examined step by step. Contaminations can be recognized in the microscope and by a sudden change in pH, which results in yellow medium. Fungi and yeast contamination appears at least within 3 days often without visible change of the media pH.

Mycolasma contamination cannot be recognized neither by eye nor in the microscope. Diagnosis of mycoplasma contamination can be carried out by staining fixed cells with DNA-specific fluorescent dyes (Hoechst 33258 or DAPI) or by polymerase-chain-recation (PCR). Direct culturing of mycoplasmas for diagnostic purposes in the cell culture laboratory is not recommended.

Although it is recommended to discard mycoplasma-infected cultures like those infected with bacteria and fungi, it was reported that some bactericidal agents (Tylosine, Minocyclin, Tiamulin and Ciprofloxacin and derivates there of) can be used to cure contaminated cells. But care should be taken that these infected and probably cured cell are monitored at least every

three months (!) if reinfection occurs. Please consider the manufacture's recommendation for the appropriate concentration.

Viral contamination cannot be seen by visual inspection nor by phase contrast microsopy. Viral contamination can be part of the serum used, but there are no reliable methods for detecting or even eliminating viruses from cultures.

2.3.12 Cross-contaminations/Authentication

Cross-contamination is a very common problem in cell cultivation. The most prominent cell line HeLa, which has overgrown many slower growing cells. Other fast growing cell lines, like the T-24-line, have cross-contaminated at least three different cell lines.

Cross-contamination can be avoided, if good cell culture practice has been applied. However, authenticating the cell line(s) on a regular basis by standard STR analysis technique helps to avoid cross-contaminations.

2.4 Special Remarks on the Origin of the Cell Lines

The cell lines described in this book are deposited at ATCC (American Culture Tissue Collection), HPACC/ECACC (Health Protection Agency), DKFZ (German Research Cancer Institute), CLS Cell Lines Service GmbH and IAZ (Institut für Allgemeine Zellkultur).

2.5 Photographic Equipment

All photographs of the cell lines shown in this book were taken using the inverted microscope

LEICA DMIL LED equipped with the LEICA DFC300 FC camera and the following objectives:
HI PLAN I, 10x/0.22, PH 1
HI PLAN I, 20x/0.30, PH 1
HI PLAN I, 40x/0.50, PH 2.

3
List of Cell Lines and Human Primary Cells (in Alphabetical Order)

3.1
Human Cell Lines

- 5637
- 769-P
- A-64 CLS
- A-204
- A-375
- A-427
- A-431
- A-498
- A-549
- A-673
- A-704
- AGS
- AsPC-1
- BeWo
- BT-20
- BT-474
- BT-549
- C-643
- Caco-2
- Caki-1
- Caki-2
- Calu-1
- CaLu-6
- Capan-1
- Capan-2
- CCRF-CEM
- CERV-186
- CERV-196
- CERV-215
- Chang-Liver
- CLS-54
- CLS-117
- CLS-354
- CLS-439
- CLS-54
- Colo-60H
- Colo-94H
- Colo-205
- Colo-320DM
- Colo-680N
- Colo-824
- DAN-G
- DMS-79
- DU-145
- ECV-304
- FAMPAC
- GCT
- H-4
- HB-CLS-1
- HB-CLS-2
- HBL-52
- HEK-293
- HEL-299
- HeLa
- HeLa-S3
- Hep-2
- Hep-G2
- HGC-27
- HOS
- HRT-18 (HCT-8)
- HS1-CLS
- HS-683
- HS-695T
- HS-729
- HSB
- HT-29
- HT-1080
- HuTu-80
- IGR-1
- IMR-32
- JAR
- Jurkat E6.1
- K-562
- Kasumi-1
- KATO-III
- KG-1A
- KHOS-240S
- KHOS-312H
- KHOS-NP
- LCLC-97TM1
- LnCaP
- LOVO
- LXF-289
- Ma-CLS-2
- MCF-7
- MDA-MB-231
- MDA-MB-436
- MDA-MB-468
- MEL-CLS-2
- MEL-CLS-3

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- MEL-CLS-4
- MeWo
- MG-63
- MML-1
- MNNG-HOS
- MRC-5
- MSTO-211H
- MX-1
- NB-4
- NCI-H69
- NCI-H82
- NCI-H209
- NIH:Ovcar-3
- NIS-G
- OAW-42
- PA-CLS-52
- Panc-1
- PC-3
- PLC-PRF-5
- RC-124
- RCC-ER
- RCC-FG1
- RCC-FG2
- ZR-75-1
- RCC-LR
- RCC-MH
- RCC-OF1
- RCC-PR
- RCC-WK
- RD
- RD-ES
- RPMI 8226
- RT-4
- RT-112
- RT-112-D21
- SaOS-2
- SH-SY5Y
- Sk-BR-3
- Sk-LMS-1
- Sk-LU-1
- Sk-MEL-1
- Sk-MEL-2
- Sk-MEL-5
- Sk-MEL-28
- Sk-MES-1
- Sk-NEP-1
- Sk-N-LO
- Sk-OV-3
- Sk-UT-1
- SW-480
- SW-579
- SW-684
- SW-872
- SW-948
- SW-1736
- T-47D
- T-84
- T-406
- TF-1
- THP-1
- TK-6
- U-87 MG
- U-118 MG
- U-251 MG
- U-937
- UM-SCC-14C
- WS-1
- Wi-38VA-13_2RA
- WS-1
- WS1-CLS
- WT-CLS1
- Y-79

3.2 Animal Cell Lines

3.2.1 Rat

- AR42J
- AS-30-D
- BRL-3A
- DSL-6A-C1
- Zajdela Hepatoma
- FRTL-5
- L-5222
- MH-3924
- NRK-49F
- O-342
- PC-12
- RBL-1
- Walker-256

3.2.2 Mouse

- 3T3-Swiss Albino
- 3T6-Swiss Albino
- C2C12
- CaD2
- CLS-103
- CLS-138
- Colon-26
- E11
- EL4.IL-2
- FS-C3H
- J-774A.1
- KERA-308

- KERA-SP1
- KLN-205
- L-138
- L-929
- MCA-3D
- Meth-A-Sarcoma
- MSC-P5
- NFS-60
- NIH-3T3
- P3X63Ag8.653
- P-19
- P388-D1
- PDV
- RAW-264.7
- RenCa
- Sp2-O-AG14
- STO
- SVI
- WEHI-3b
- YAC-1

3.2.3 Hamster

- BHK-21

3.2.4 Chicken

- ECF-R
- MDCC-MSB1

3.2.5 Monkey

- Cos-7
- CV-1
- VERO

3.2.6 Pig

- LLC-PK1
- PK-15

3.2.7 Opossum

- OK

3.2.8 Potoroo

- PtK-1 (NBL-3)
- PtK-2

3.2.9 Bovine

- BFA

3.2.10
Dog

- MDCK

3.2.11
Insect

- SF-9

3.3
Human Primary Cells

- Airway Small Epitelial
- Chondrocytes
- Endothelial Cells (Dermal Microvascular)
- Fibroblasts Dermal Normal
- Hepatocytes
- Human Follicle Dermal Papilla Cells (HFDPC) culture in phase contrast
- Human Skeletal Muscle Cells (SkMC)
- Human Tracheal Smooth Muscle Cell (HTSMC) culture in phase contrast
- Human Umbilical Vein Endothelial Cells (HUVEC)
- Keratinocytes Normal Epidermal
- Mammary Epithelial Cells
- Melanocytes Epidermal Normal
- Melanocytes Epidermal in Melanocytes Growth Medium
- Mesenchymal Stem Cells from Bone Marrow undifferentiated (Human)
- Muscle Cells Skeletal Human differentiated
- Myocytes
- Osteoblasts
- Papillar Follicle Dermal Cells
- Pericytes from the placenta proliferating
- Preadipocytes undifferentiated
- Preadipocytes after *in vitro* differentiation into Adipocytes
- Skeletal Muscle Cells undifferentiated
- Smooth muscle cells (Artery Pulmonary)
- Tracheal Epithelial Cells
- Umbellical Vene Endothlial Cells, spheroid
- Vascular Endothelial Growth Factor (VEGF)

4
Cell Lines and Human Primary Cells

4.1
Human Cell Lines

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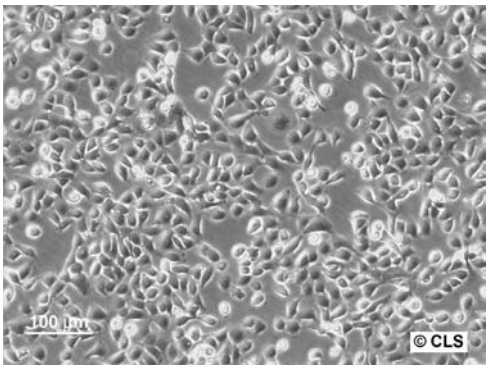
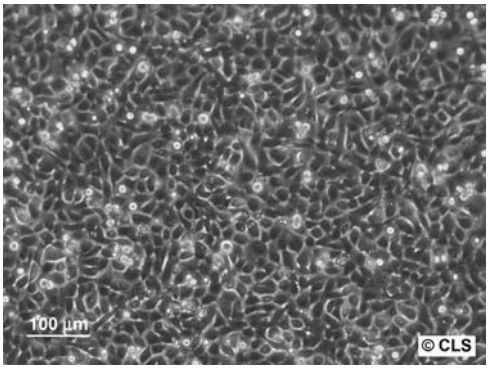
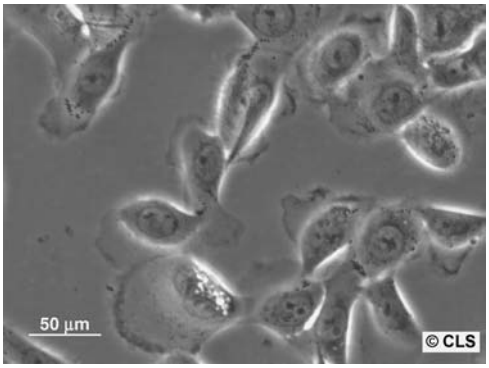


5637, 100× Leica.



5637, 100× Leica.



5637, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

5637

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	68 years
Tissue:	Bladder (urinary)
Cell type:	Carcinoma
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The 5637 cell line has been established from the primary bladder carcinoma (grade II) of a patient by Dr G. Cannon in 1974

Culture Conditions and Handling

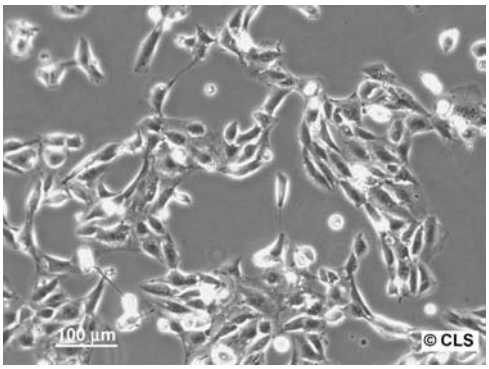
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02 EDTA (versene). Add fresh 0.025% trypsin/0.02% EDTA solution at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 5 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

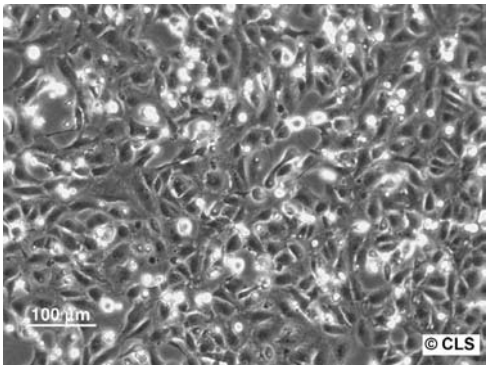
Karyotype:	Phenotype Frequency Product: 0.0056
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 12, 13; D13S317: 9, 11; D16S539: 13; D18S51: 14; D21S11: 30, 31; D3S1358: 15, 18; D5S818: 9, 10; D7S820: 10, 11; D8S1179: 13; FGA: 24, 25; Penta D: 10, 13; Penta E: 10, 20; THO1: 6, 9.3; TPOX: 11; vWA: 17, 18
Tumorigenic:	In nude mice
Isoenzymes:	Me-2, 1; PGM3, 2; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 1–2; G6PD, B
Products:	IL-1, IL-6, G-CFS, GM-CSF, SCF
ATCC number:	HTB-9
CLS number:	300105

Further Reading

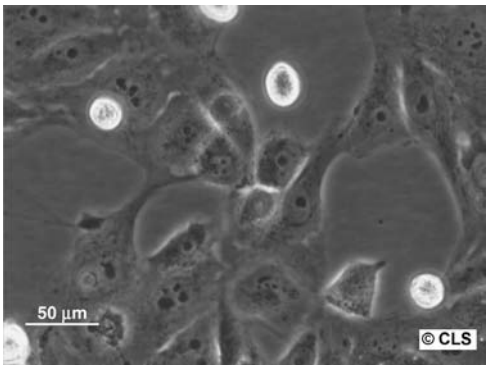
Fogh, J. *et al.* (1977) One hundred and twenty-seven cultured human tumor cell lines producing tumors in mice. *J. Natl. Cancer Inst.*, **59**, 221–226.



769-P, 100× Leica.



769-P, 100× Leica.



769-P, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

769-P

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 63 years
Gender: Female
Tissue: Kidney
Morphology: Epithelial
Cell type: Renal cell adenocarcinoma
Growth properties: Monolayer
Description: This cell line was derived from a primary clear cell adenocarcinoma. The cells are globular with indistinct borders, have a high nucleus to cytoplasm ratio, and exhibit both microvilli and desmosomes. They can be cultured in soft agar

Culture Conditions and Handling

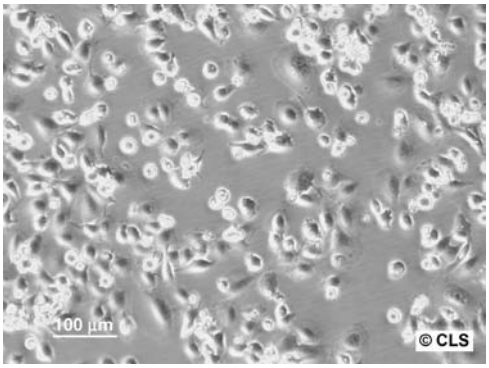
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Remove trypsin by centrifugation, add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 12 is recommended
Fluid renewal: Every two to three days
Doubling time: 35
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

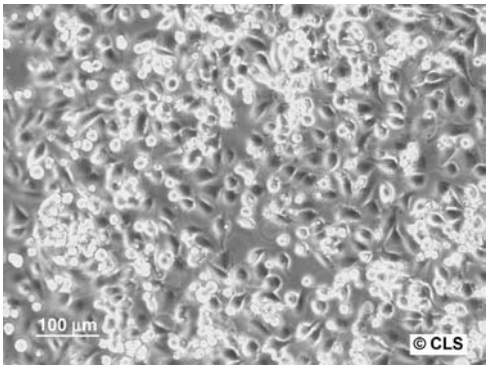
DNA profile (STR): Amelogenin: X, X; CSF1PO: 11, 12; D13S317: 10, 14; D16S539: 9, 13; D18S51: 14, 17; D21S11: 28, 30; D3S1358: 16, 16; D5S818: 12; D7S820: 10, 11; D8S1179: 12, 16; FGA: 20, 22; Penta D: 12, 16; Penta E: 7, 18; THO1: 6, 9.3; TPOX: 8, 11; vWA: 18, 18
Tumorigenic: Yes, in immunosuppressed hamsters and nude mice
ATCC number: CRL-1933
CLS number: 300106

Further Reading

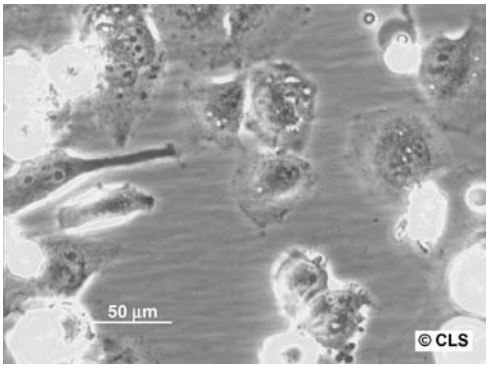
Williams, R.D. *et al.* (1976) *In vitro* cultivation of human renal cell cancer. I. Establishment of cells in culture. *In Vitro*, **12**, 623–627.



A-64 CLS, 100× Leica.



A-64 CLS, 100× Leica.



A-64 CLS, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

A-64 CLS

Origin and General Characteristics

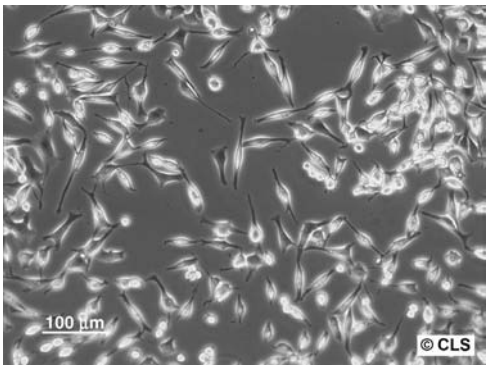
Organism:	*Homo sapiens* (human)
Ethnicity:	European
Age:	63 years
Tissue:	Submaxillary gland (submandibular gland)
Cell type:	Adenoma
Growth properties:	Monolayer
Description:	Established from the primary adenoma of the submaxillary gland

Culture Conditions and Handling

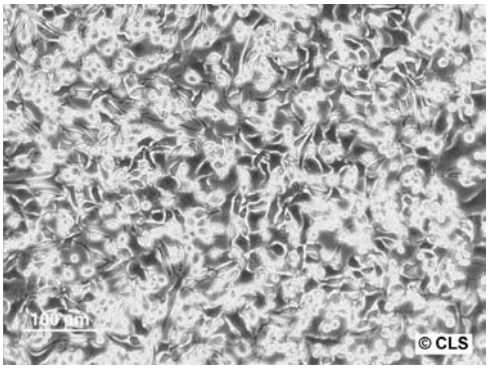
Culture medium:	Minimum essential media supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add complete cell culture medium, resuspend the cells, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended growth
Fluid renewal:	Every three to five days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

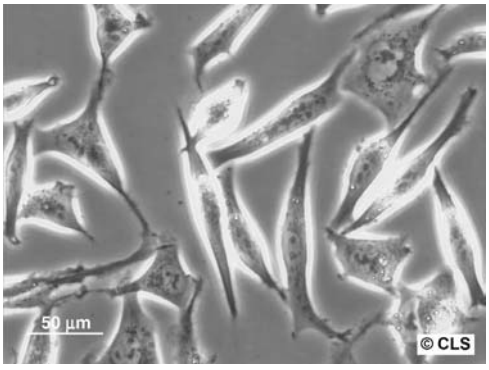
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 12; D13S317: 11, 12; D16S539: 12, 13; D18S51: 12, 14; D21S11: 30, 31; D3S1358: 17, 18; D5S818: 11, 12; D7S820: 10, 11; D8S1179: 11; FGA: 21.2; Penta D: 9, 10; Penta E: 10, 11; THO1: 9.3; TPOX: 10, 11; vWA: 14, 17
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300199



A-204, 100× Leica.



A-204, 100× Leica.



A-204, 400× Leica.

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A-204

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Gender:	Female
Age:	1 year
Tissue:	Muscle
Cell type:	Rhabdomyosarcoma
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The A-204 cell line was established in 1973 by D.J. Giard

Culture Conditions and Handling

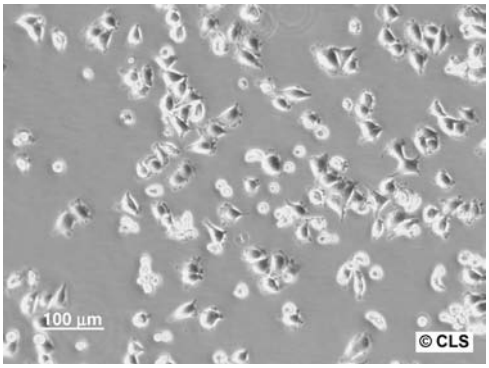
Culture medium:	DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 6 to 1 : 10 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

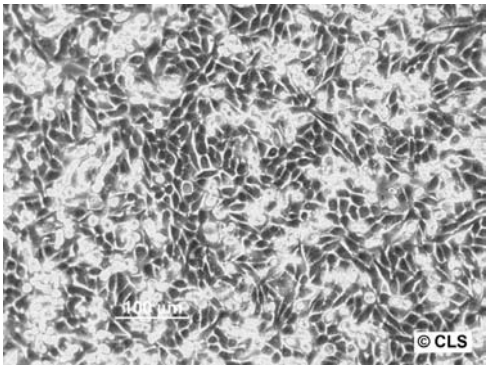
Karyotype:	Diploidy and tetraploidy
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 10, 13; D13S317: 11, 12; D16S539: 11, 12; D18S51: 17, 18; D21S11: 28, 30; D3S1358: 14, 17; D5S818: 12, 12; D7S820: 8, 10; D8S1179: 13, 15; FGA: 21, 21; Penta D: 9, 12; Penta E: 7, 10; THO1: 8, 9, 3; TPOX: 8, 9; vWA: 15, 17
Tumorigenic:	In nude mice; forms small malignant tumors which conform to embryonal rhabdomyosarcoma
Isoenzymes:	PGM3, 1; PGM1, 1; ES-D, 1; Me-2, 1; AK-1, 1; GLO-1, 1; G6PD, B
ATCC number:	HTB-82
CLS number:	300109

Further Reading

Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



A-375, 100× Leica.



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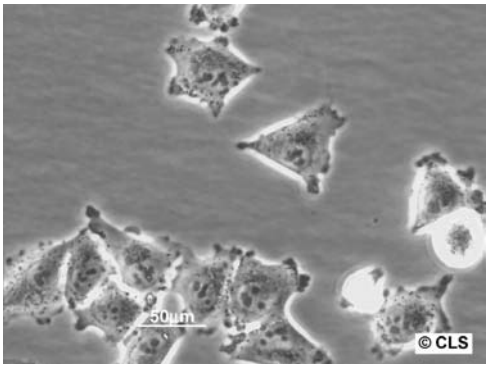

A-375, 400× Leica.

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A-375

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 54 years
Tissue: Skin
Cell type: Malignant melanoma
Growth properties: Monolayer
Description: The A-375 cell line was established by D.J. Giard in 1973

Culture Conditions and Handling

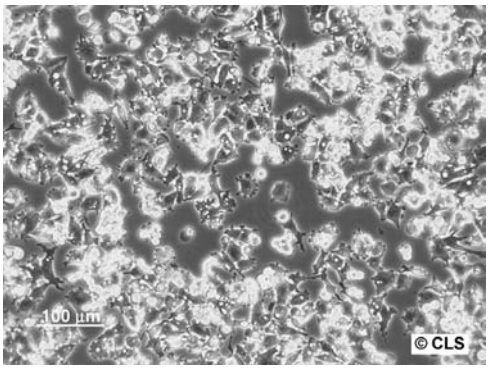
Culture medium: DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal: Every two to three days
Biosaftey level: 1

Special Features of the Cell Line and Recommended Use

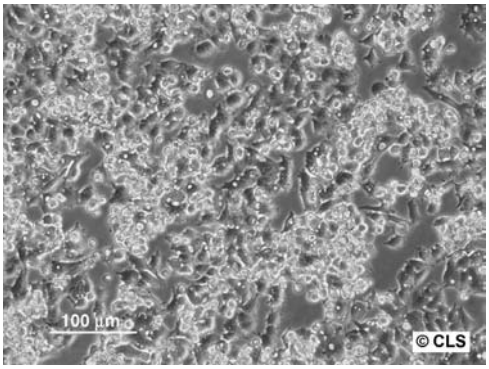
DNA profile (STR): Amelogenin: X, X; CSF1PO: 11, 12; D13S317: 11, 14; D16S539: 9; D18S51: 12, 17; D21S11: 29, 30; D3S1358: 15, 17; D5S818: 12; D7S820: 9; D8S1179: 11, 14; FGA: 2; Penta D: 9, 15; Penta E: 10, 12; THO1: 8; TPOX: 8, 10; vWA: 16, 17
Tumorigenic: Yes, in nude mice
CLS number: 300110
ATCC number: CRL-1619

Further Reading

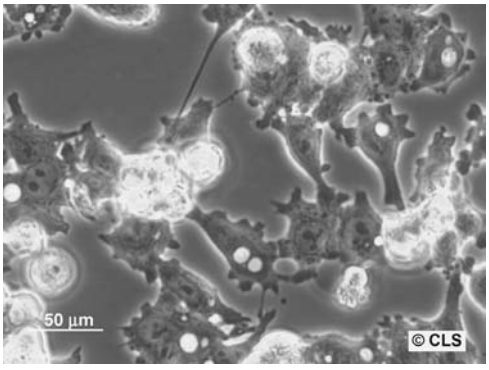
Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1413.



A-427, 100× Leica.



A-427, 100× Leica.



A-427, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

A-427

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 52 years
Gender: Male
Tissue: Lung
Morphology: Epithelial
Cell type: Carcinoma
Growth properties: Monolayer
Description: The A-427 cell line was established by D.J. Giard in 1973

Culture Conditions and Handling

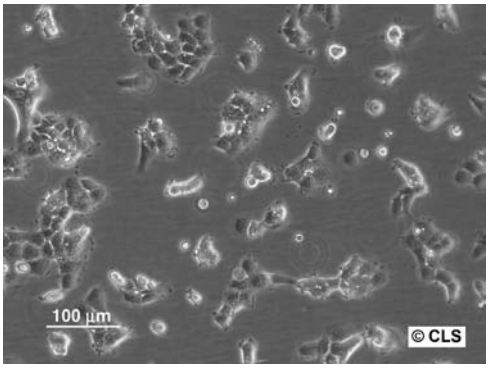
Culture medium: EMEM medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

Karyotype: (P60) hypotriploid to hypertriploid with abnormalities including dicentrics, minutes, and large subtelocentric marker
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 11, 12; D16S539: 11, 13; D18S51: 12; D21S11: 31.2; D3S1358: 16; D5S818: 12; D7S820: 8, 12; D8S1179: 12, 13; FGA: 18; Penta D: 13; Penta E: 15, 17; THO1: 9; TPOX: 8, 11; vWA: 17
Tumorigenic: Yes, in nude mice; forms an undifferentiated tumor suggestive of adenocarcinoma
Isoenzymes: PGM3, 1; PGM1, 1-2; ES-D, 1; AK-1, 2; GLO-1, 1; G6PD, B; Phenotype Frequency Product: 0.00006
ATCC number: HTB-53
CLS number: 300111

Further Reading

Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



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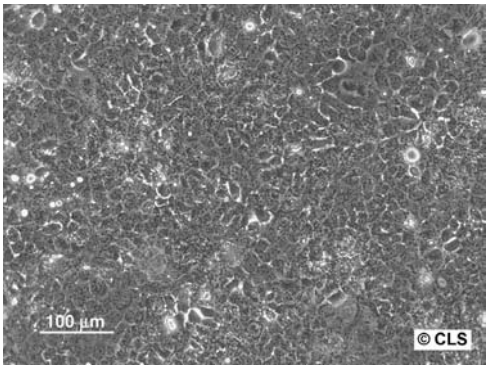

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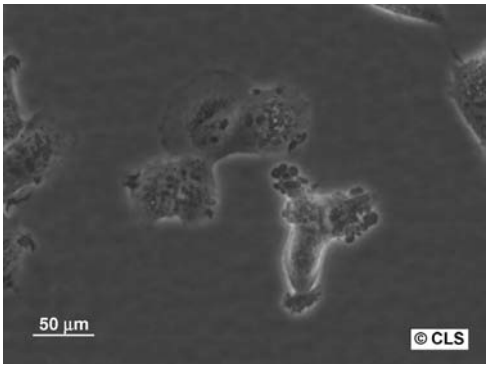

A-431, 400× Leica.

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A-431

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Gender:	Female
Age:	85 years
Tissue:	Skin
Cell type:	Epidermoid (squamous cell) carcinoma
Morphology:	Epithelial, flat polygonal
Growth properties:	Monolayer
Description:	The A-431 cell line was established by D.J. Giard in 1973

Culture Conditions and Handling

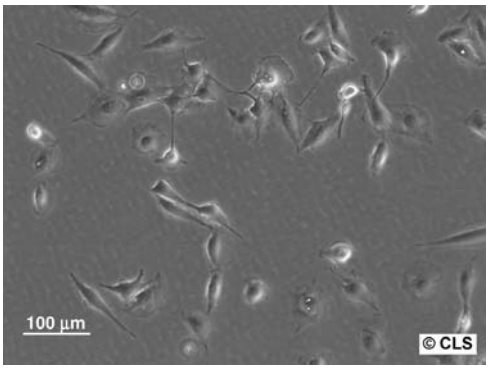
Culture medium:	DMEM supplemented with 4 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal:	Every two to three days
Biosaftey level:	1

Special Features of the Cell Line and Recommended Use

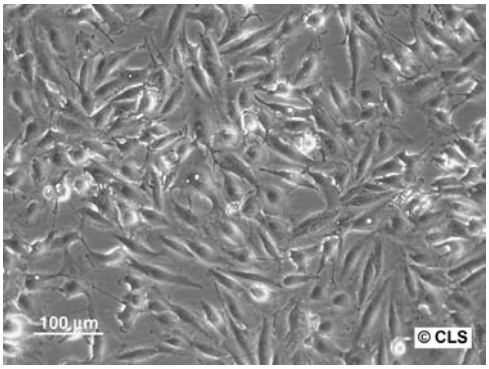
Karyotype:	Six marker chromosomes with rearrangements: der(6), der(7), der(17), der(21), dic(13;14), and dic(14;18). Amplification of the C-MYC oncogene at 8q24 in two marker chromosomes: dup(8)(q24) and der(15)t(8;15)(q22;p11)
Tumorigenic:	Yes, in immunosuppressed mice
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 11, 12; D13S317: 9, 13; D16S539: 12, 14; D5S818: 12, 13; D7S820: 10; THO1: 9; TPOX: 11; vWA: 15, 17; D3S1358: 14; D21S11: 28, 30; D18S51: 13, 17; Penta E: 12, 13; Penta D: 9, 11; D8S1179: 13; FGA: 20
Receptors expressed:	EGF-binding sites
Isoenzymes:	G6PD, B; PGM1, 1; PGM3, 1; ES-D, 1; Me-2, 0; AK-1, 1; GLO-1, 2
Products:	HBp17
ATCC number:	CRL-1555
CLS number:	300112

Further Reading

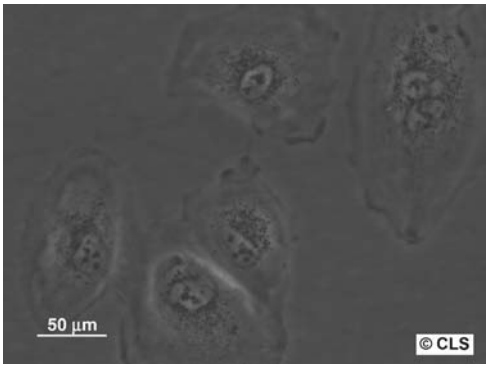
Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



A-498, 100× Leica.



A-498, 100× Leica.



A-498, 400× Leica.

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A-498

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Cell type:	Human kidney carcinoma
Gender:	Male
Morphology:	Epithelial
Growth properties:	Monolayer
Age:	52 years
Description:	The A-498 cell line was established by D.J. Giard in 1973

Culture Conditions and Handling

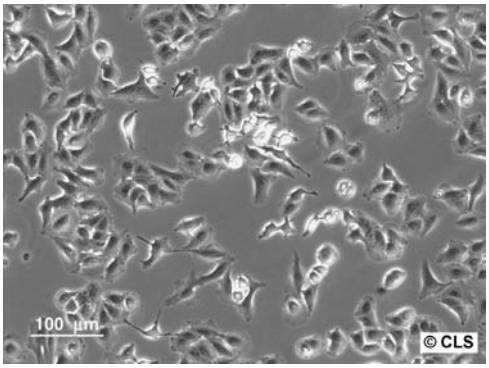
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS with sodium bicarbonate, 2 mM L-glutamine and 1.0 mM sodium pyruvate, 1% nonessential amino acids 90%, fetal bovine serum (FBS) 10%; G6PD, B. Instead: DMEM with sodium bicarbonate, 2 mM L-glutamine, 1.0 mM sodium pyruvate + 10% FBS
Subculture routine:	Remove medium, add fresh 0.05% trypsin/0.02% trypsin EDTA-solution and incubate for 5–10 min at 37 °C. Stop with double volume of fresh medium when cells are detached. Centrifugalize down at 200 × *g* for 5–10 min, resuspend pellet in fresh medium and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Twice weekly

Special Features of the Cell Line and Recommended Use

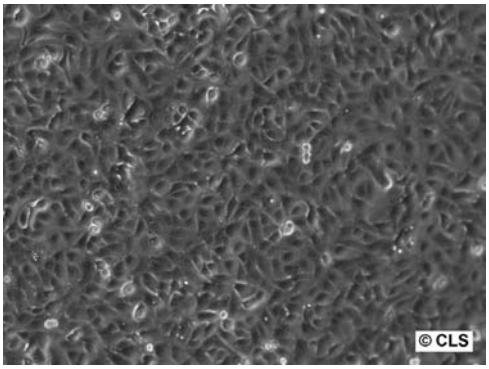
DNA Profile (STR):	Amelogenin: X; CSF1PO: 11,12; D13S317: 12; D16S539: 12; D5S818: 11,13; D7S820: 11,12; THO1: 6,9.3; TPOX: 8,11; vWA: 18; D3S1358: 15; D21S11: 28,32; D18S51: 17; Penta E: 10,14; Penta D: 9,14; D8S1179: 13,15 FGA: 18,20
Karyotype:	$2n = 46$
Tumorigenic:	Yes; in nude mice; forms undifferentiated carcinoma; also forms tumors in antithymocyte serum-treated newborn mice
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D13S317: 12; D3S1358: 15; D16S539: 12; D5S818: 11, 13; D7S820: 11, 12; D8S1179: 13, 15; D18S51: 17; D21S11: 28, 32; FGA: 18, 20; Penta D: 9, 14; Penta E: 10, 14; THO1: 6, 9.3; TPOX: 8, 11; vWA: 18.
Isoenzymes:	PGM3, 1; PGM1, 1-2; ES-D, 2; Me-2, 1; AK-1, 1; GLO-1, 2; G6PD, B
ATCC number:	HTB 44
CLS number:	300113

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



A-549, 100× Leica.



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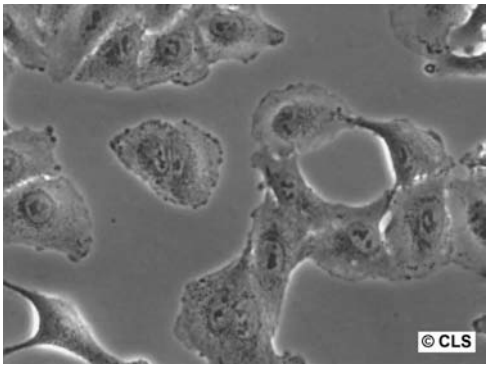

A-549, 400× Leica.

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A-549

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	58 years
Gender:	Male
Tissue:	Lung
Morphology:	Epithelial
Cell type:	Carcinoma
Growth properties:	Monolayer
Description:	The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

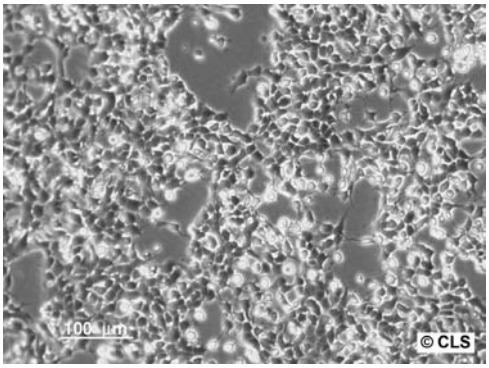
Culture medium:	DMEM:Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum.
Subculture routine:	Remove medium and rinse with 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation and dispense into new flasks.
Split ratio:	A ratio of 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

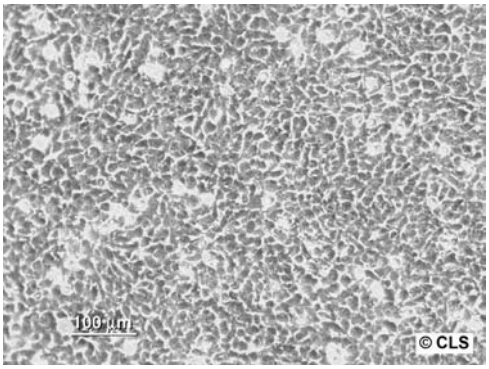
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 11, 11; D16S539: 11, 12; D18S51: 14, 17; D21S11: 29, 29; D3S1358: 16, 16; D5S818: 11, 11; D7S820: 8, 11; D8S1179: 13, 14; FGA: 23, 23; Penta D: 9, 9; Penta E: 7, 11; THO1: 8, 9, 3; TPOX: 8, 11; vWA: 14, 14
Isoenzymes:	G6PD, type B
Reverse transcriptase:	Negative
Products:	keratin
ATCC number:	CCL-185
CLS number:	300114

Further Reading

Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



A-673, 100× Leica.



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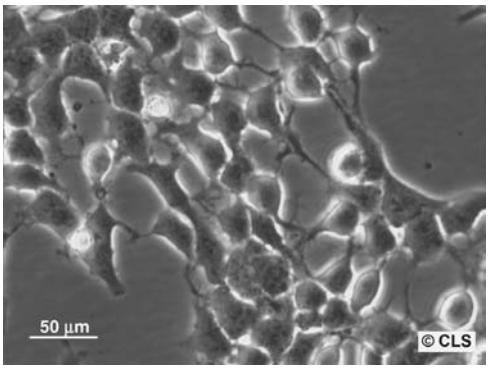

A-673, 400× Leica.

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A-673

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Gender:	Female
Age:	15 years
Tissue:	Rhabdomyosarcoma
Morphology:	Fibroblast
Growth properties:	Monolayer

Culture Conditions and Handling

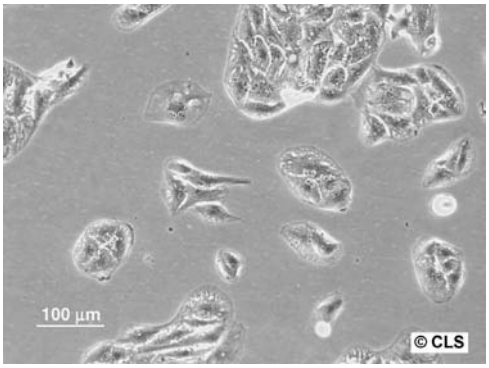
Culture medium:	DMEM supplemented with 4.5 g/l glucose, 2 mM L-glutamine, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse monolayer with 0.02% EDTA (versene). Add fresh 0.025% trypsin/0.02% EDTA (versene) solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 5 to 1 : 20 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

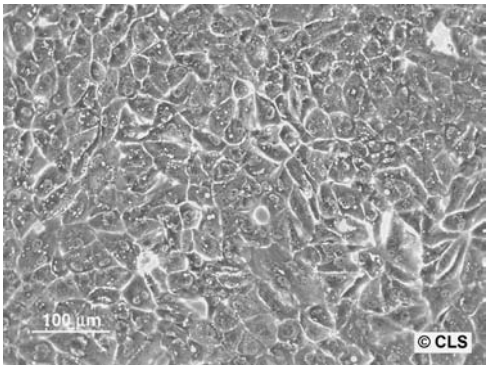
DNA profile (STR):	Amelogenin: X, X; vWA: 15, 18; D3S1358: 15, 17; D18S51: 13, 13; FGA: 20, 21; THO1: 9.3, 9.3; TPOX: 8, 8; D13S317: 8, 13; D16S539: 11, 11; D5S818: 11, 11; D21S11: 28, 29; Penta D: 11, 13; D8S1179: 11, 15; D7S820: 10, 12; CSF1PO: 11, 12; Penta E: 12, 12
Tumorigenic:	Yes, in immunosuppressed mice
Virus susceptibility:	Very sensitive to human adenoviruses
ATCC number:	CRL-598
CLS number:	300454

Further Reading

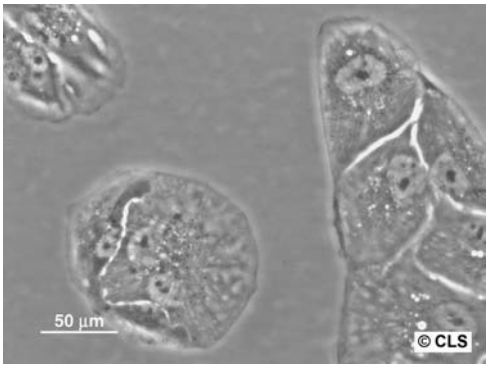
Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



A-704, 100× Leica.



A-704, 100× Leica.



A-704, 400× Leica.

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A-704

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Age:	78 years
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Adherent; monolayer

Culture Conditions and Handling

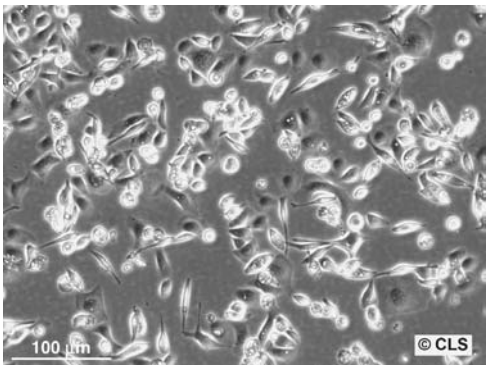
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with L-glutamine, 1% NEAA (nonessential amino acids), 1 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at room temperature (or at 37 °C) until the cells detach (about 10 min). Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

Karyotype:	(P59) diploid to hyperdiploid, hypertriploid to hypertetraploid with abnormalities including breaks, dicentrics, and endoreduplication
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 7, 8; D13S317: 8; D16S539: 12, 13; D18S51: 16, 17; D21S11: 28, 32; D3S1358: 15; D5S818: 10, 11; D7S820: 10; D8S1179: 13, 15; FGA: 22, 23; Penta D: 2.2, 11; Penta E: 8, 17; THO1: 7, 9; TPOX: 11; vWA: 14, 18
Tumorigenic:	No
Isoenzymes:	Me-2, 1; PGM3, 1–2; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD, B
ATCC number:	HTB-45
CLS number:	300217

Further Reading

Giard, D.J. *et al.* (1973) *In vitro* cultivation of human tumors: establishment of cell lines derived from a series of solid tumors. *J. Natl. Cancer Inst.*, **51**, 1417–1423.



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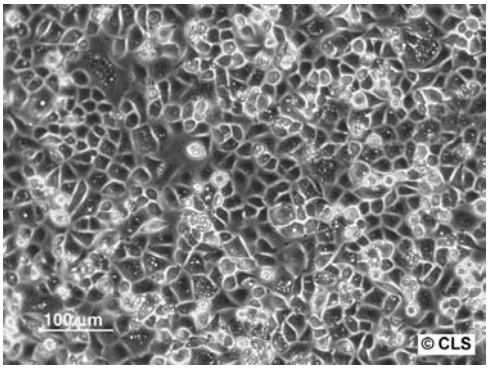

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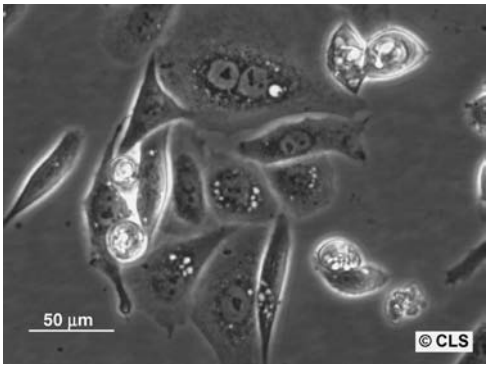

AGS, 400× Leica.

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AGS

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	54 years
Gender:	Female
Tissue:	Stomach
Morphology:	Epithelial
Cell type:	Gastric adenocarcinoma
Growth properties:	Monolayer
Description:	The AGS cell line was derived from fragments of a biopsy specimen of an untreated human adenocarcinoma of the stomach

Culture Conditions and Handling

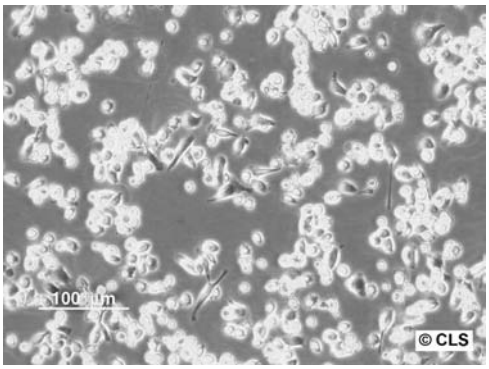
Culture medium:	DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse monolayer with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.020% EDTA solution and let the culture incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	20 hours
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

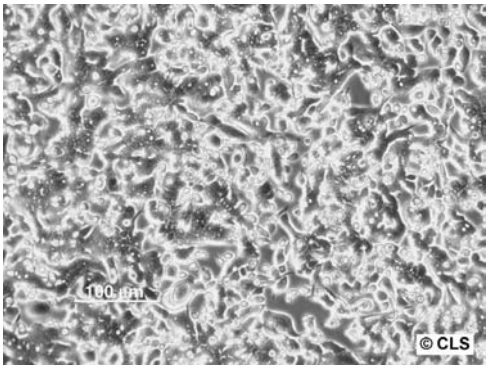
Karyotype:	Modal number = 47; range = 39–92
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D13S317: 12; D16S539: 11/13; D18S51: 13; D21S11: 29; D3S1358: 16; D5S818: 9, 12; D7S820: 10, 11; D8S1179: 13; FGA: 23/24; Penta D : 9, 10; Penta E: 13, 6; THO1: 6, 7; TPOX: 11, 12; vWA: 16, 17
Tumorigenic:	Yes, in athymic BALB/c mice
ATCC number:	CRL 1739
CLS number:	300408

Further Reading

Barranco, S.C. *et al.* (1983) Establishment and characterization of an *in vitro* model system for human adenocarcinoma of the stomach. *Cancer Res.*, **43**, 1703–1709.



AsPC-1, 100× Leica.



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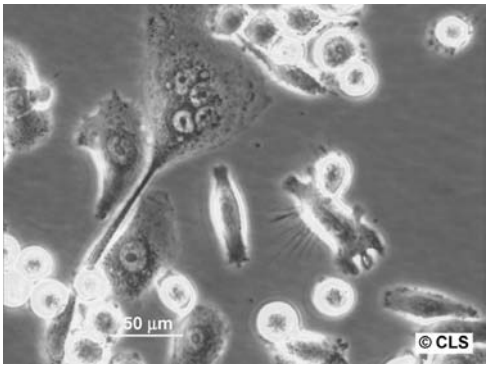

AsPC-1, 400× Leica.

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AsPC-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Female
Age: 62 years
Tissue: Pancreas; ascites
Cell type: Adenocarcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: The line was derived from nude mouse xenografts initiated with cells from the ascites of a patient with cancer in the pancreas

Culture Conditions and Handling

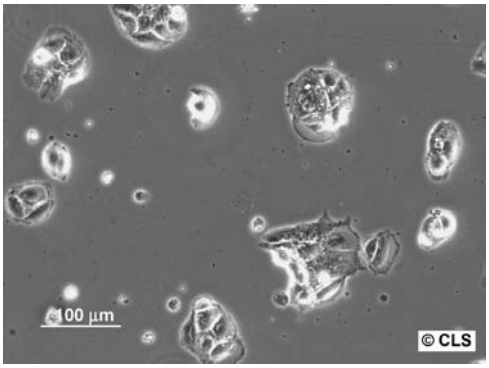
Culture medium: RPMI 1640 media supplemented with 2 mM L-glutamine, 1 mM sodium pyruvate, and 10–20% fetal bovine serum
Subculture routine: Remove medium and rinse with EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, resuspend the pellet in fresh culture media, and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

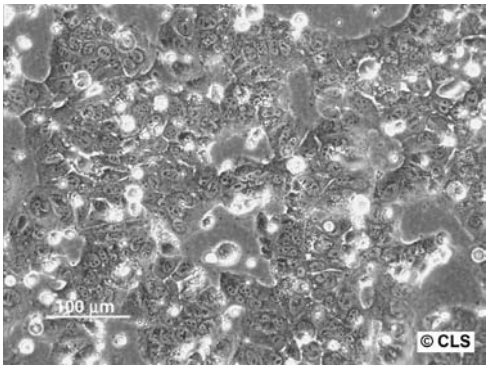
DNA profile (STR): Amelogenin: X; CSF1PO: 10, 13; D13S317: 12; D16S539: 11; D18S51: 18; D21S11: 28, 30; D3S1358: 16; D5S818: 12; D7S820: 12, 13; D8S1179: 13, 15; FGA: 24; Penta D: 9, 12; Penta E: 5, 12; THO1: 7, 9.3; TPOX: 8/10; vWA: 17
Products: Carcinoembryonic antigen (CEA); human pancreas-associated antigen; human pancreas-specific antigen; mucin
ATCC number: CRL-1682
CLS number: 300158

Further Reading

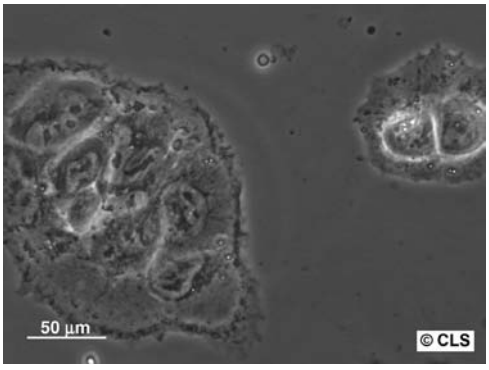
Tan, M.H. *et al.* (1981) Differential localization of human pancreas cancer-associated antigen and carcinoembryonic antigen in homologous pancreatic tumoral xenograft. *J. Natl. Cancer Inst.*, **67**, 563–569.



BeWo, 100× Leica.



BeWo, 100× Leica.



BeWo, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

BeWo

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Tissue: Placenta
Morphology: Epithelial
Cell type: Choriocarcinoma
Growth properties: Monolayer
Description: The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

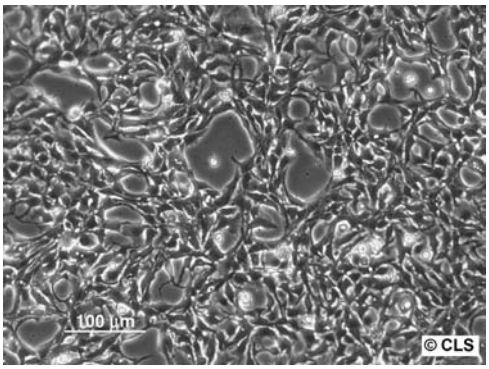
Culture medium: DMEM supplemented with L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin, 0.03% EDTA for several minutes, remove trypsin, and let culture sit at 37 °C for 10–20 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 3 is recommended
Fluid renewal: Three to four times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

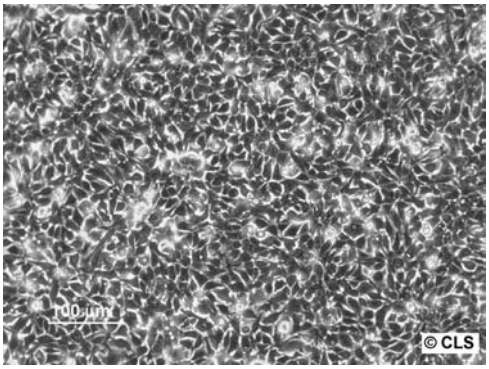
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 9, 11; D16S539: 13, 14; D18S51: 14, 16; D21S11: 30; D3S1358: 15; D5S818: 10, 11; D7S820: 10, 12; D8S1179: 12; FGA: 22, 23, 24; Penta D: 9, 12; Penta E: 8, 12; THO1: 9, 9.3; TPOX: 8; vWA: 16
Isoenzymes: G6PD, B
Reverse transcriptase: Negative
Virus susceptibility: Poliovirus 3; vesicular stomatitis (Indiana)
Products: Hormones; progesterone; human chorionic gonadotropin (hCG); human chorionic somatomammotropin (placental lactogen); estrogen; estrone; estriol; estradiol; keratin
ATCC number: CCL-98
CLS number: 300123

Further Reading

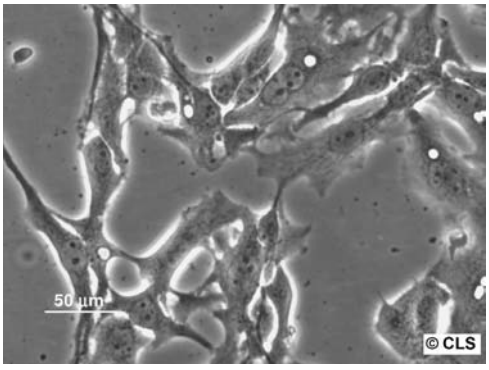
Hertz, R. (1959) Choriocarcinoma of women maintained in serial passage in hamster and rat. *Proc. Soc. Exp. Biol. Med.*, **102**, 77–81.



BT-20, 100× Leica.



BT-20, 100× Leica.



BT-20, 400× Leica.

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BT-20

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 74 years
Gender: Female
Tissue: Breast
Cell type: Mammary gland
Morphology: Epithelial
Growth properties: Monolayer
Description: BT-20 was established by Lasfargues and Ozzello in 1958 by isolation and cultivation of cells spilling out of the tumor when it was cut into thin slices. Growth is inhibited by TNF alpha. Negative for estrogen receptor, but do express an estrogen receptor mRNA that has deletion of exon 5

Culture Conditions and Handling

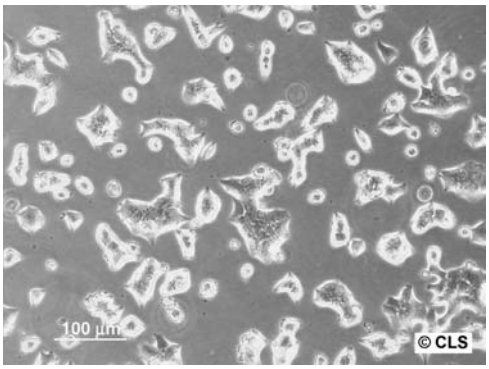
Culture medium: DMEM:Ham's F12 mixture (1 : 1) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

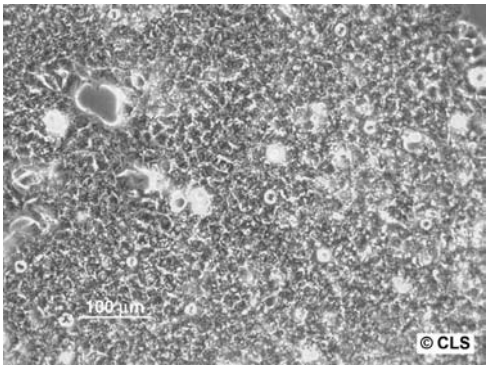
Karyotype: Hyperdiploid modal number = 50
DNA profile (STR): Amelogenin: X, X; CSF1PO: 12; D13S317: 11; D16S539: 11, 14; D18S51: 17; D21S11: 28, 29; D3S1358: 17; D5S818: 12; D7S820: 10; D8S1179: 12; FGA: 22, 24; Penta D: 10, 11; Penta E: 11, 13; THO1: 7, 9.3; TPOX: 11; vWA: 16, 17
Tumorigenic: Yes, in nude mice; forms grade II adenocarcinomas
Oncogene: wnt4 +; wnt7h +
Antigen expression: HLA A1, Bw16 (+/−)
Isoenzymes: PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1–2; G6PD, B; GLO-1, 1–2; Phenotype Frequency Product: 0.0115
Reverse transcriptase: Negative
ATCC number: HTB-19
CLS number: 300130

Further Reading

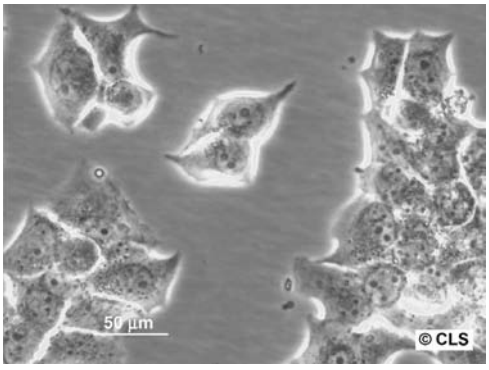
Lasfargues, E.Y. and Ozello, L. (1958) Cultivation of human breast carcinomas. *J. Natl. Cancer Inst.*, **21** (6), 1131–1147.



BT-474, 100× Leica.



BT-474, 100× Leica.



BT-474, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

BT-474

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Female
Age:	60 years
Tissue:	Breast
Cell type:	Mammary gland
Morphology:	Epithelial
Growth properties:	Monolayer; the cells form compact, multilayered colonies; growing slowly, and rarely becoming confluent
Description:	The BT-474 line was isolated by E. Lasfargues and W.G. Coutinho from a solid, invasive ductal carcinoma of the breast

Culture Conditions and Handling

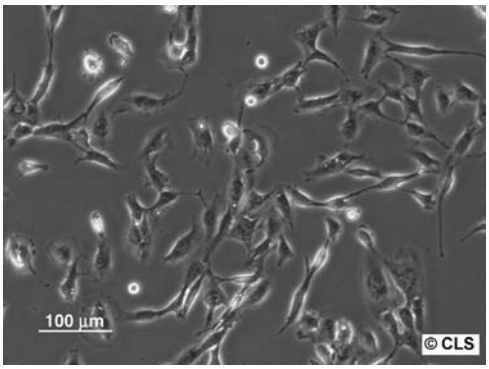
Culture medium:	DMEM Ham's F12 (1 : 1 mixture) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin, and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

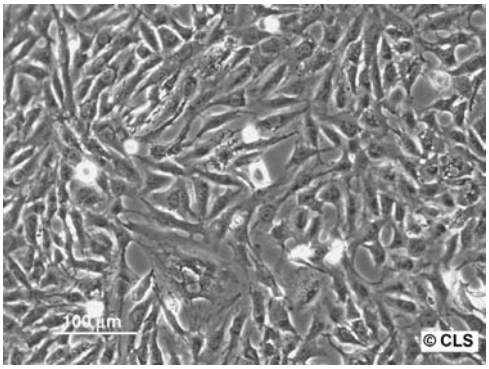
Karyotype:	Mode = 55; range = 50–112; bimodal shift 58–59 and 100 in later passages with 3 marker chromosomes
DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 11; D13S317: 11; D16S539: 9, 11; D18S51: 13, 18; D21S11: 28, 32.2; D3S1358: 17; D5S818: 11, 13; D7S820: 9, 12; D8S1179: 10, 12; FGA: 22, 25; Penta D: 9, 14; Penta E: 5; THO1: 7; TPOX: 8; vWA: 15, 16
Tumorigenic:	Yes, in nude mice
Receptors expressed:	HER-2/NEU+
Isoenzymes:	G6PD, B; PGM3, 1; PGM1, 1; ES-D, 1; Me-2, 0; AK-1, 1; GLO-1, 1; Phenotype Frequency Product: 0.0426
Viruses:	Tested for SMR-Provirus: *env*-gene negative/*gag*-gene negative
Virus susceptibility:	Mouse mammary tumor virus (RIII-MuMTV)
ATCC number:	HTB 20
CLS number:	300131

Further Reading

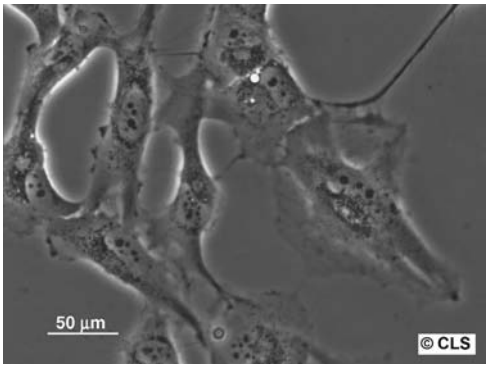
Lasfargues, E.Y. *et al.* (1978) Isolation of two human tumor epithelial cell lines from solid breast carcinomas. *J. Natl. Cancer Inst.*, **61**, 967–978.



BT-549, 100× Leica.



BT-549, 100× Leica.



BT-549, 400× Leica.

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BT-549

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Gender: Female
Ethnicity: Caucasian
Age: 72 years
Tissue: Breast
Morphology: Epithelial
Cell type: Mammary gland
Growth properties: Monolayer
Description: The BT-549 line was isolated in 1978 by W.G. Coutinho and E.Y. Lasfargues. Source tissue consisted of a papillary, invasive ductal tumor which had metastasized to 3 of 7 regional lymph nodes. The established population was polymorphic with epithelial-like components and multinucleated giant cells. A mucin-like material was secreted into the medium

Culture Conditions and Handling

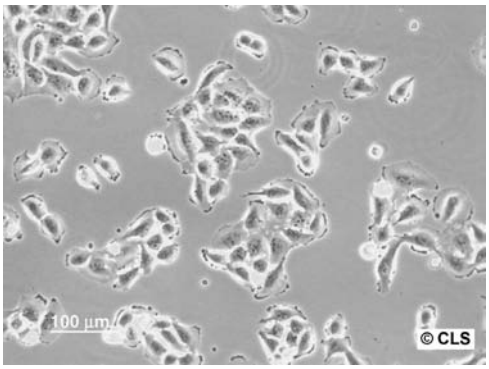
Culture medium: DMEM medium supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum has been applied successfully by CLS. (RPMI 1640 medium supplemented with 2 mM L-glutamine, 4.5 g/l glucose, 1 mM sodium pyruvate, 10 mM Hepes, and 10% fetal bovine serum, as recommended by others)
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium containing serum, resuspend the cells, and dispense into new flasks. When cultures become confluent, some cells will slough off into the medium, these cells can be centrifuged and placed into new culture flasks
Split ratio: A ratio of 1 : 2 is recommended
Fluid renewal: Two to three times weekly

Special Features of the Cell Line and Recommended Use

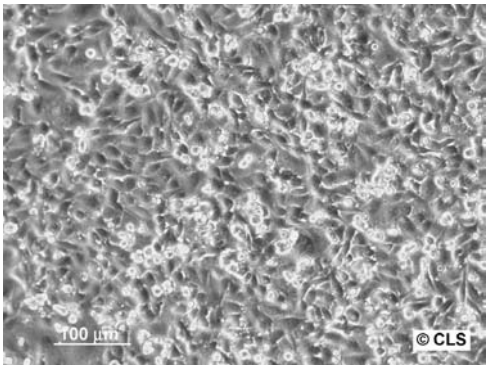
Karyotype: Mode = 74; range = 53–140; three marker chromosomes
DNA profile (STR): Amelogenin: X, X; CSF1PO: 10, 12; D13S317: 11; D16S539: 8, 8; D18S51: 15; D21S11: 32.2; D3S1358: 18; D5S818: 11; D7S820: 9, 10; D8S1179: 14, 16; FGA: 19; Penta D: 13; Penta E: 14; THO1: 9, 3; TPOX: 8; vWA: 15
Isoenzymes: G6PD, B; PGM1, 2; PGM3, 1; ES-D, 1; Me-2, 1; AK-1, 1; GLO-1, 1–2; Phenotype Frequency Product: 0.0048
ATCC number: HTB-122
CLS number: 300132

Further Reading

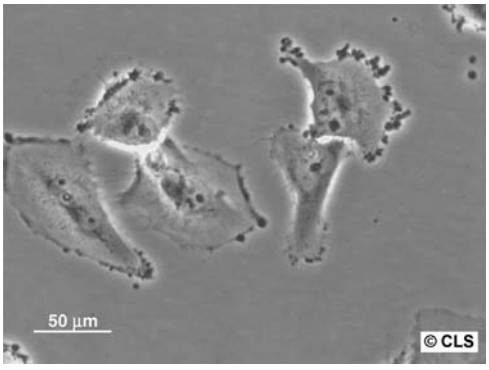
Katayose, Y. *et al.* (1997) Promoting apoptosis: a novel activity associated with the Cyclin-dependent kinase inhibitor p27. *Cancer Res.*, **57**, 5441–5445.



C-643, 100× Leica.



C-643, 100× Leica.



C-643, 400× Leica.

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C-643

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Anaplastic thyroid carcinoma; thyroid
Morphology: Epithelial
Growth properties: Monolayer

Culture Conditions and Handling

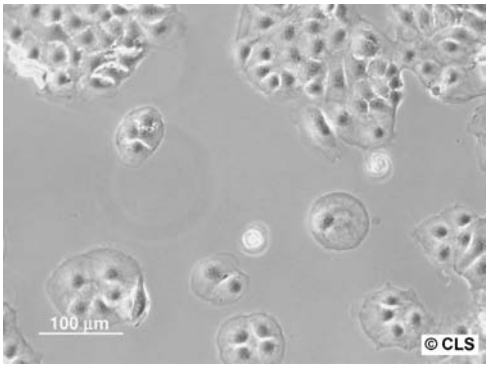
Culture medium: RPMI 1640 medium, 90%; fetal bovine serum, 10%
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at room temperature (or at 37 °C) until the cells detach (about 10 min). Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 5 to 1 : 10 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

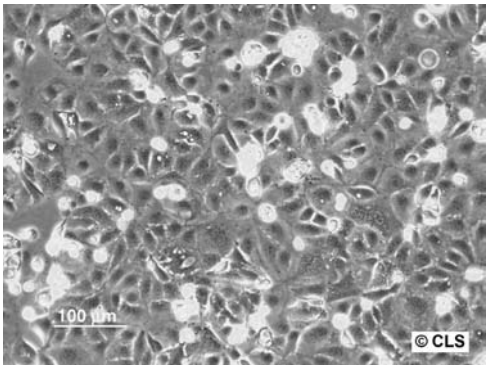
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 10, 11; D13S317: 8, 10; D16S539: 9, 13; D18S51: 14, 18; D21S11: 28; D3S1358: 15; D5S818: 11, 12; D7S820: 9, 12; D8S1179: 11, 13; FGA: 18, 21; Penta D: 9; Penta E: 5, 15; THO1: 9. 3, 10; TPOX: 11, 12; vWA: 15, 17
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300298

Further Reading

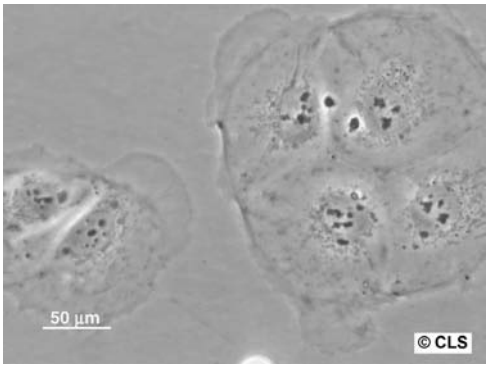
Heldin, N.E. *et al.* (1988) Aberrant expression of receptors for platelet-derived growth factor in an anaplastic thyroid carcinoma cell line. *Proc. Natl. Acad. Sci. USA.*, **85**, 9302–9306.



Caco-2, 100× Leica.



Caco-2, 100× Leica.



Caco-2, 400× Leica.

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Caco–2

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 72 years
Gender: Male
Tissue: Colon
Cell type: Colorectal adenocarcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: This line was isolated from a primary colonic tumor. Upon reaching confluence, the cells express characteristics of enterocytic differentiation. Caco-2 cells express retinoic acid binding protein I and retinol binding protein II and are keratin positive

Culture Conditions and Handling

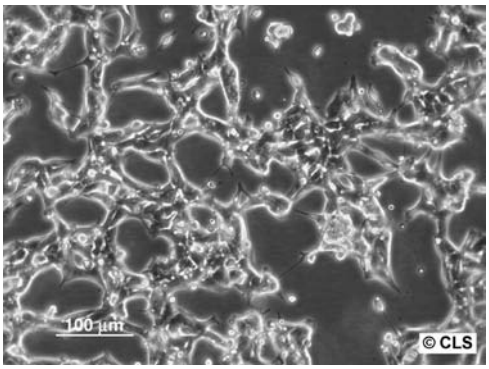
Culture medium: MEM Eagle's medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA (Versene) solution. Add fresh 0.025 trypsin/0.02% EDTA (Versene) solution; let culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge, aspirate supernatant, add fresh medium and dispense into new flasks. Subculture every six to eight days
Split ratio: A ratio of 1 : 2 to 1 : 3 is recommended
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

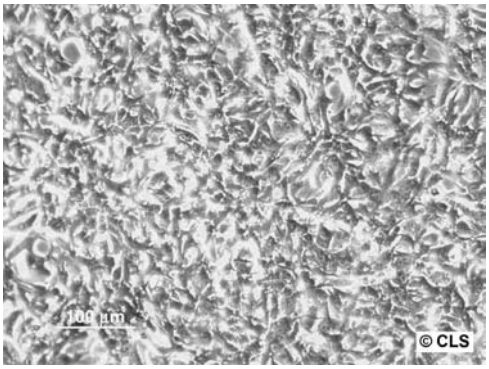
DNA profile (STR): Amelogenin: X; CSF1PO: 11; D13S317: 11, 13, 14; D16S539: 12, 13; D18S51: 12; D21S11: 30; D3S1358: 14, 17; D5S818: 12, 13; D7S820: 12; D8S1179: 12, 14; FGA: 19; Penta D: 9; Penta E: 7; THO1: 6; TPOX: 9, 11; vWA: 16, 18
Tumorigenic: Yes, in nude mice; form moderately well differentiated adenocarcinomas consistent with colonic primary (grade II)
Antigen expression: Blood type O; Rh+
Karyotype: (P14), hypertetraploid
Immunology: HLA class II negative
Receptors expressed: Heat stable enterotoxin (Sta, E. coli); epidermal growth factor (EGF)
Isoenzymes: Me-2, 1; PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 1; G6PD, B; Phenotype Frequency Product: 0.0187
Virus resistance: Human immunodeficiency virus (HIV, LAV)
ATCC number: HTB 37
CLS number: 300137

Further Reading

Fogh, J., Wright, W.C., and Loveless, J.D. (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



Caki-1, 100× Leica.



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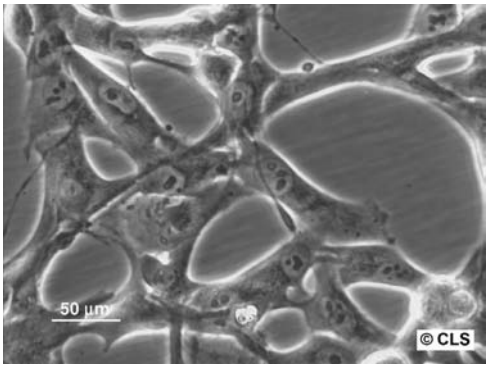

Caki-1, 400× Leica.

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Caki-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	49 years
Gender:	Male
Tissue:	Kidney
Cell type:	Clear cell carcinoma
Growth properties:	Monolayer
Morphology:	Epithelial

Culture Conditions and Handling

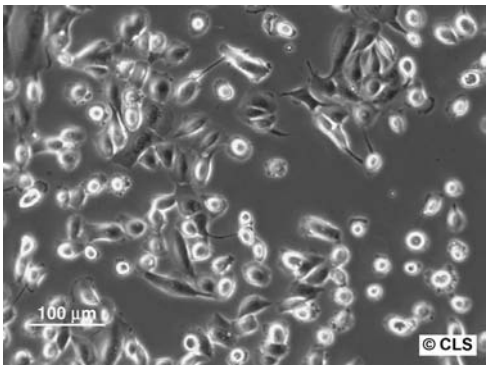
Culture medium:	EMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Passage no:	20
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, collect the cells, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly

Special Features of the Cell Line and Recommended Use

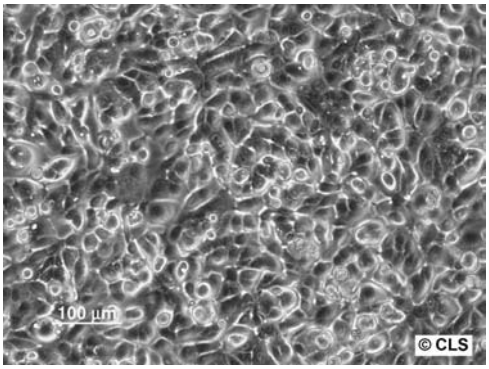
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 10, 11; D13S317: 11, 12; D16S539: 12; D18S51: 9.1, 14; D21S11: 28, 30; D3S1358: 17; D5S818: 11, 12; D7S820: 8, 12; D8S1179: 12, 14; FGA: 26; Penta D: 11, 12; Penta E: 22, 23; THO1: 6, 8; TPOX: 8, 11; vWA: 15, 17
Tumorigenic:	Yes, in nude mice
Biosaftey level:	1
ATCC number:	HTB-46
CLS number:	300149

Further Reading

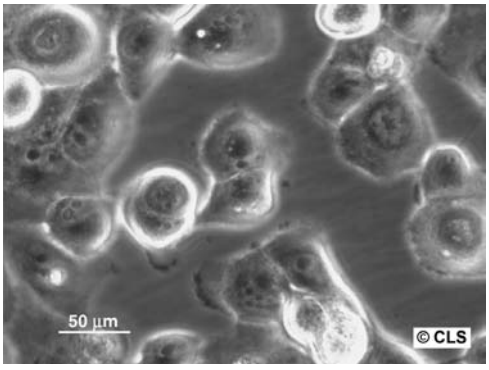
Fogh, J. and Trempe, G. (1975) *Human Tumor Cells In Vitro* (ed. J. Fogh), Academic Press, New York, pp. 115–159.



Caki-2, 100× Leica.



Caki-2, 100× Leica.



Caki-2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Caki-2

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	69 years
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Clear cell carcinoma
Growth properties:	Monolayer
Description:	Ultrastructural features include microvilli and microfilaments. Few mitochondria, lysosomes, or lipid droplets. Frequent multilamellar bodies. No virus particles

Culture Conditions and Handling

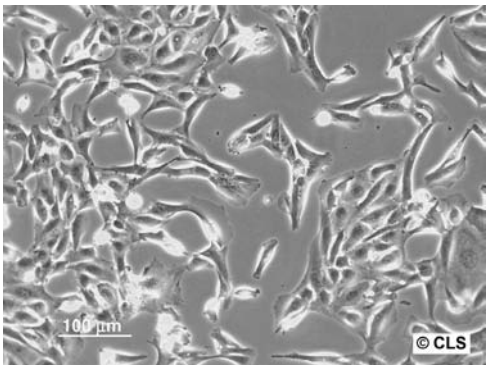
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, collect the cells, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

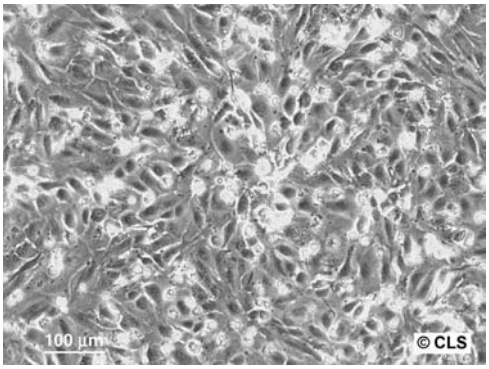
Karyotype:	(P8) hypopentaploid to hypohexaploid (+A2, +A3, +B, +C, +D, +F, +G, −A) with abnormalities including dicentrics, acrocentric fragments, minutes, breaks, and large subtelocentric markers
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 10; D16S539: 9, 13; D18S51: 17; D21S11: 27, 31; D3S1358: 14; D5S818: 11; D7S820: 12; D8S1179: 10; FGA: 22; Penta D: 10, 13; Penta E: 7, 17; THO1: 6; TPOX: 9, 11; vWA: 16, 17
Tumorigenic:	Yes, in nude mice; forms clear cell carcinoma
Antigen expression:	Blood type A; Rh-
Isoenzymes:	Me-2, 1; PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 1–2; G6PD, B; Phenotype Frequency Product: 0.0511
ATCC number:	HTB-47
CLS number:	300140

Further Reading

Fogh, J. and Trempe, G. (1975) *Human Tumor Cells In Vitro* (ed. J. Fogh) Academic Press, New York, pp. 115–159.



Calu-1, 100× Leica.



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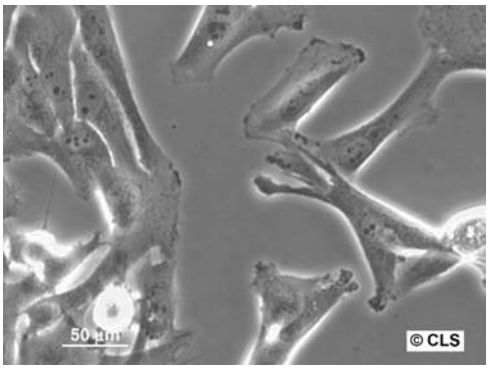


Calu-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Calu-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	47 years
Gender:	Male
Tissue:	Lung (from metastatic site: pleura)
Morphology:	Epithelial
Cell type:	Epidermoid carcinoma
Growth properties:	Monolayer
Description:	Ultrastructural features include numerous microvilli, prominent RER, lysosomes, lipid inclusions, no virus particles. Contains the ras (K-ras) oncogene

Culture Conditions and Handling

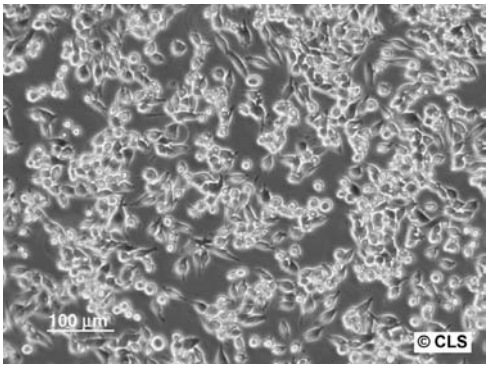
Culture medium:	Minimum essential medium supplemented with 4 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh EDTA (versene). Add fresh 0.025% trypsin/0.02% EDTA (versene) solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

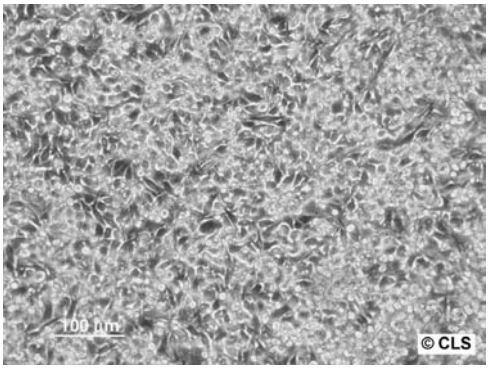
Karyotype:	The stem line chromosome number is hypotriploid and the 2S component occurred at 14.2%. Modal chromosome number is 62. Seven markers occurred frequently, M1 (two copies per cell), M6 and M7 were found in most cells; M2 and M3, and M4 and M5 appeared to be mutually exclusive, i.e., only one of M2 or M3, and one of M4 or M5 were present in each cell. Y chromosome was not detected by QM band examination, although the cell line was initiated from a male
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 11, 12; D16S539: 11; D18S51: 14, 17; D21S11: 28; D3S1358: 17; D5S818: 10, 12; D7S820: 9, 10; D8S1179: 10; FGA: 20, 21; Penta D: 9; Penta E: 11; THO1: 9, 9.3; TPOX: 8; vWA: 15, 16
Tumorigenic:	Yes, in nude mice; forms epidermoid carcinomas
Antigen Expression:	Blood type A; Rh + ; HLA A10, A11, B15, Bw35
Isoenzymes:	Me-2, 1–2; PGM3, 1; PGM1, 1–2, ES-D, 1; AK-1, 1; GLO-1, 1–2; G6PD, B; Phenotype Frequency Product: 0.0359
ATCC number:	HTB-54
CLS number:	300141

Further Reading

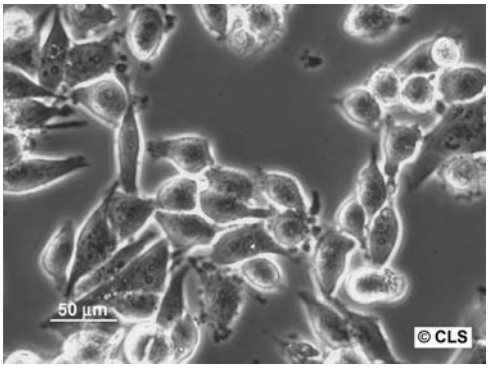
Fogh, J. (ed.) (1975) *Human Tumor Cells In Vitro*, Plenum Press, New York, pp. 115–159.



CaLu-6, 100× Leica.



CaLu-6, 100× Leica.



CaLu-6, 400× Leica.

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CaLu-6

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Female
Age:	61 years
Tissue:	Anaplastic carcinoma; unknown, probably lung
Morphology:	Epithelial
Growth properties:	Monolayer

Culture Conditions and Handling

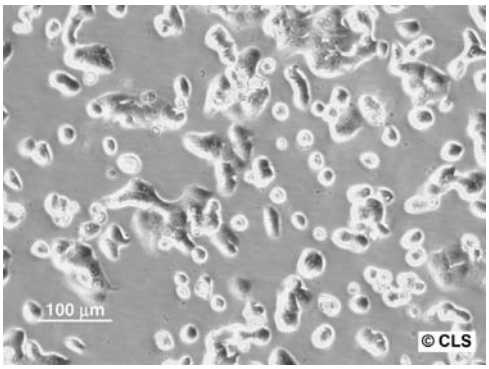
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with 1% nonessential amino acids, sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with fresh 0.025% trypsin, 0.02% EDTA solution, remove trypsin, and let the culture sit at room temperature (or at 37 °C) until the cells detach (about 10 min). Add fresh medium, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 2 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

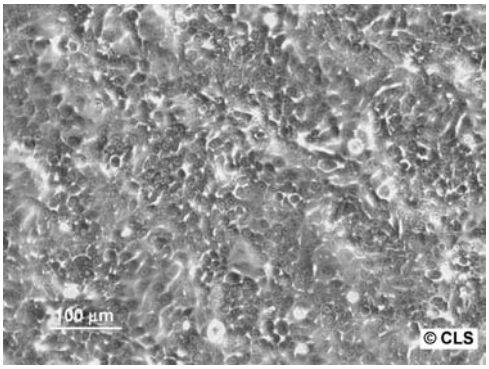
Karyotype:	The stemline chromosome number is hypotriploid and the 2S component occurred at 5.8%. Modal chromosome number is 59. Fourteen marker chromosomes (constitutive) were common to most S metaphases. No Y chromosome was detected in the QM stained preparation
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 11; D16S539: 13; D18S51: 12, 16; D21S11: 31; D3S1358: 16; D5S818: 11; D7S820: 10; D8S1179: 10, 14; FGA: 22; Penta D: 13; Penta E: 5, 14; THO1: 9; TPOX: 8; vWA: 17
Tumorigenic:	Yes, in nude mice; forms poorly differentiated carcinoma
Isoenzymes:	Me-2, 1; PGM3, 1; PGM1, 2; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0031
ATCC number:	HTB-56
CLS number:	300135

Further Reading

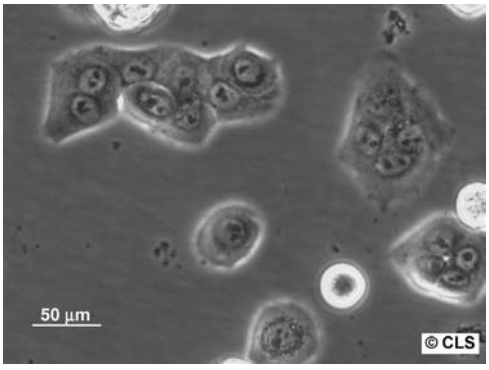
Fogh, J. (ed.) (1975) *Human Tumor Cells In Vitro*, Plenum Press, New York, pp. 115–159.



Capan-1, 100× Leica.



Capan-1, 100× Leica.



Capan-1, 400× Leica.

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Capan-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	40 years
Tissue:	Pancreas (from metastatic site: liver)
Cell type:	Adenocarcinoma
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The cells will slough off of the growth surface if they become too heavy. Capan-1 expresses the cystic fibrosis transmembrane conductance regulator (CFTR) and secretes gastric type mucin

Culture Conditions and Handling

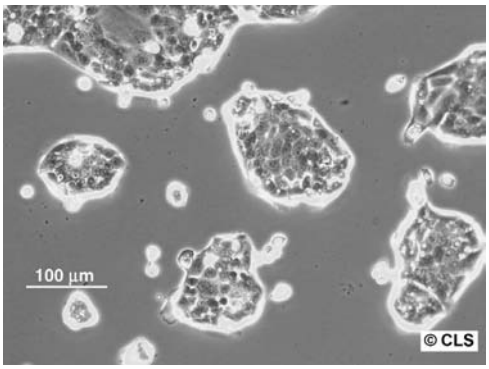
Culture medium:	RPMI 1640 medium supplemented with 2 mM Glutamine and 10% fetal bovine serum. Using EMEM medium results in improved adherence of the cells
Subculture routine:	Remove medium and rinse with EDTA (versene) solution. Add fresh 0.025% trypsin/EDTA (versene) solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, resuspend in fresh medium, and dispense into new flasks. Alternative detachment protocols using trypsin replacements may be applied as well
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

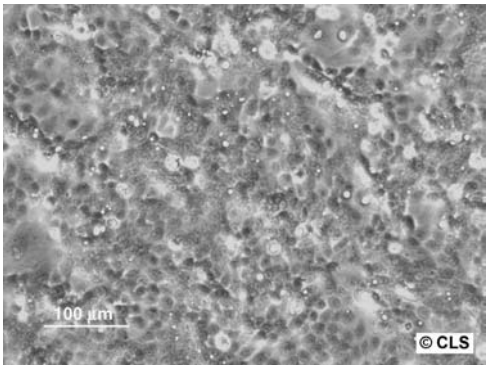
Karyotype:	(P7) hypotriploid with abnormalities including dicentrics, breaks, acrocentric fragments, large submetacentric, and subtelocentric chromosomes plus minute marker
DNA profile (STR):	Amelogenin: X; CSF1PO: 11; D13S317: 9; D16S539: 13, 14; D18S51: 12; D21S11: 28, 30; D3S1358: 15; D5S818: 11; D7S820: 10, 11; D8S1179: 14, 16; FGA: 24; Penta D: 9, 13; Penta E: 10, 12; THO1: 6; TPOX: 8, 11; vWA: 16
Tumorigenic:	Yes, in nude mice; forms adenocarcinoma consistent with pancreatic duct carcinoma
Antigen expression:	Blood type A; Rh+; HLA A2, A9, B13, B17
Isoenzymes:	Me-2, 1; PGM3, 1; PGM1, 1–2; ES-D, 1; AK-1, 1; G6PD, B; GLO-1, 1–2; Phenotype Frequency Product: 0.0311
Products:	Mucin
ATCC number:	HTB-79
CLS number:	300143

Further Reading

Pollack, M.S. *et al.* (1981) HLA-A, B, C and DR alloantigen expression on forty-six cultured human tumor cell lines. *J. Natl. Cancer Inst.*, **66**, 1003–1012.



Capan-2, 100× Leica.



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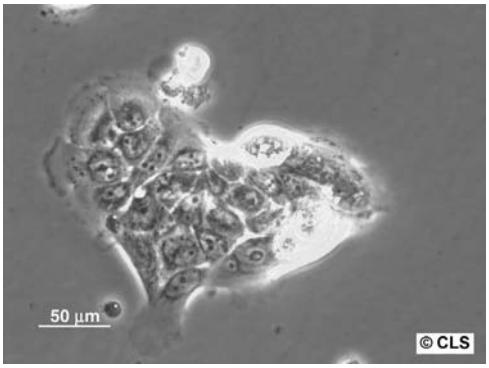

Capan-2, 400× Leica.

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C

Capan-2

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	56 years
Tissue:	Pancreas
Cell type:	Adenocarcinoma
Morphology:	Polygonal
Growth properties:	Adherent
Description:	The cells produce high levels of MUC-1 mucin mRNA, low levels of MUC-2 mRNA but do not express the MUC-3 gene

Culture Conditions and Handling

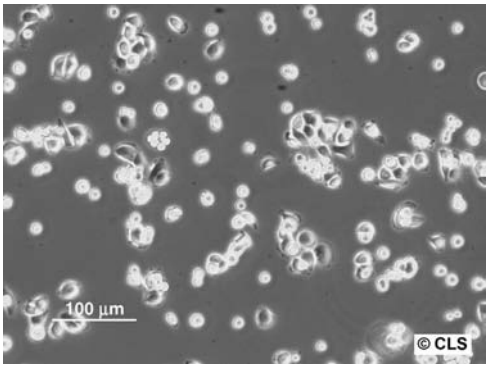
Culture medium:	McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

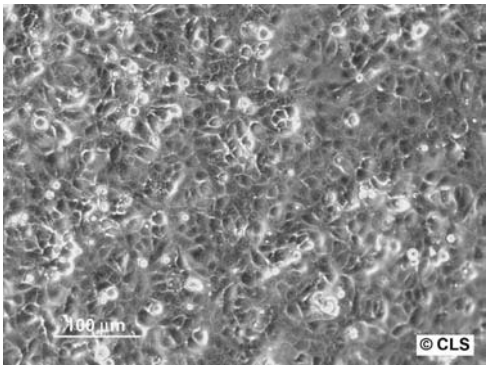
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D13S317: 11, 12; D16S539: 9, 13; D18S51: 13; D21S11: 31; D3S1358: 17, 18; D5S818: 11, 12; D7S820: 9, 11; D8S1179: 12, 13; FGA: 21, 24; Penta D: 13, 15; Penta E: 11; THO1: 9.3; TPOX: 8; vWA: 17
Tumorigenic:	Yes, in nude mice; forms well differentiated adenocarcinoma consistent with pancreatic carcinoma
Antigen expression:	Blood type B; Rh+
Isoenzymes:	Me-2, 2; PGM3, 2; PGM1, 1; ES-D, 1; AK-1, 1; G6PD, B; GLO-1, 2; Phenotype Frequency Product: 0.0004
Products:	Mucin (apomucin, MUC-1, MUC-2)
ATCC number:	HTB-80
CLS number:	300144

Further Reading

Dahiya, R. *et al.* (1993) Mucin synthesis and secretion in various human epithelial cancer cell lines that express the MUC-1 mucin gene. *Cancer Res.*, **53**, 1437–1443.



CaSki, 100× Leica.



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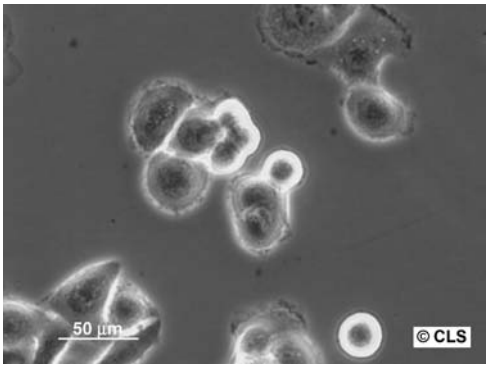

CaSki, 400× Leica.

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CaSki

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Female
Age: 40 years
Tissue: Cervix
Cell type: Epidermoid carcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: The line was established from cells of a metastasis in the small bowel mesentery. The cells are reported to contain an integrated human papillomavirus type 16 genome (HPV-16, about 600 copies per cell) as well as sequences related to HPV-18

Culture Conditions and Handling

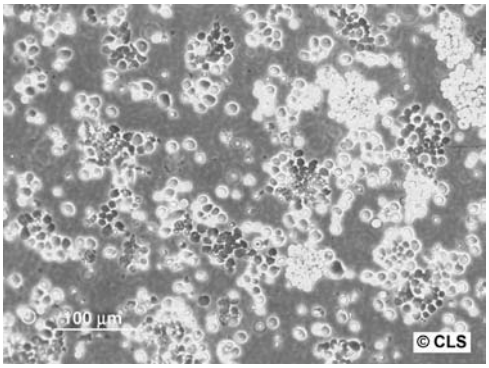
Culture medium: DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove media and rinse with EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium, resuspend the cells, and centrifuge at 250 × *g*, 3–5 min. Add fresh medium, resuspend, and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended
Fluid renewal: Every two to three days
Biosafety level: According to the ZKBS (Zentralkommittee für Biologische Sicherheit, Germany), the CaSki cell line is classified as BSL 1, when incubated as monolayer culture. However, any development and release of HPV 16 virus particles cannot be excluded when inoculated into animals followed by tumorigenesis or kept as Raft-culture. In this case, the CaSki is categorized as BSL 2 and should be handled accordingly

Special Features of the Cell Line and Recommended Use

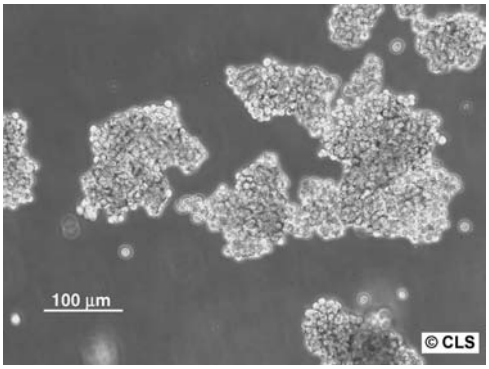
DNA Profile (STR): Amelogenin: X; CSF1PO: 10, 10; D3S1358: 15, 17; D5S818: 13, 13; D7S820: 11, 11; D8S1179: 11, 15; D13S317: 8, 12; D16S539: 11, 12; D21S11: 28, 29; D18S51: 13, 13; FGA: 20, 21; Penta E: 12, 12; Penta D: 11, 13; THO1: 7, 7; TPOX: 8, 8; vWA: 17, 17.
Isoenzymes: G6PD, B
Products: Beta subunit of human chorionic gonadotropin (hCG); tumor-associated antigen
ATCC number: CRL-1550
CLS number: 300145

Further Reading

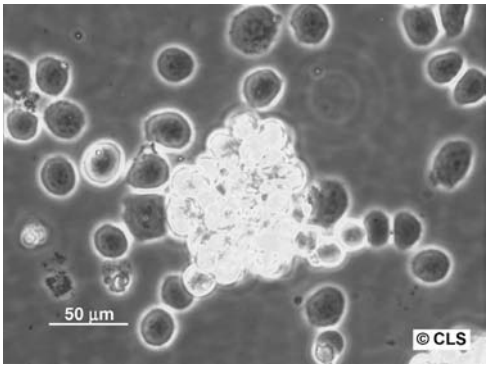
Pattillo, R.A. *et al.* (1977) Tumor antigen and human chorionic gonadotropin in CaSki cells: a new epidermoid cervical cancer cell line. *Science*, **196**, 1456–1458.



CCRF-CEM, 100× Leica normal flask.



CCRF-CEM, 100× Leica low attachment flask.



CCRF-CEM, 400× Leica normal flask.

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CCRF-CEM

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	4 years
Gender:	Female
Tissue:	Peripheral blood
Morphology:	Polymorph cells, big nuclei; formation of microvilli
Cell type:	T lymphoblast
Growth properties:	Suspension
Description:	CCRF-CEM cells were derived from the peripheral blood buffy coat of a child (CEM) with acute lymphoblastic leukemia who had originally presented with lymphosarcoma

Culture Conditions and Handling

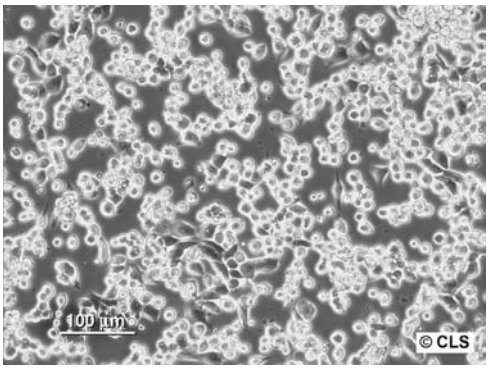
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Subculture by diluting an appropriate volume of the cell suspension in a new flask containing fresh medium. Establish new cultures at 3×10^5 viable cells/ml. Upon thawing, culture in 1–2 T-25 cell culture flasks, incubate at 37 °C/5% CO_2. Renew the medium 24 h later by centrifuging and resuspend the cells in the same amount of fresh medium unless the cell concentration exceeds 2×10^6 cells/ml
Doubling time:	Approx. 24 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

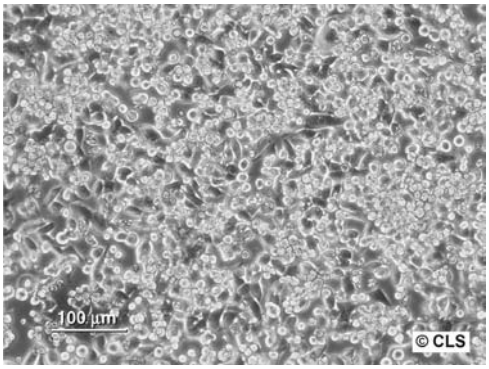
DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 13; D13S317: 11, 11; D16S539: 10, 13; D18S51: 13, 18; D21S11: 30, 33.2, 34.2; D3S1358: 14, 15, 16; D5S818: 12, 13; D7S820: 9, 13; D8S1179: 12, 13; FGA: 23, 24, 25; Penta D: 10, 11; Penta E: 5, 14; THO1: 6, 7; TPOX: 7, 8; vWA: 17, 18, 19, 20
Tumorigenic:	Yes, in nude mice
Antigen expression:	CD3 B (37%), CD4 (50%), CD5 (95%), CD7 (77%)
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
ATCC number:	CCl-119
CLS number:	300147

Further Reading

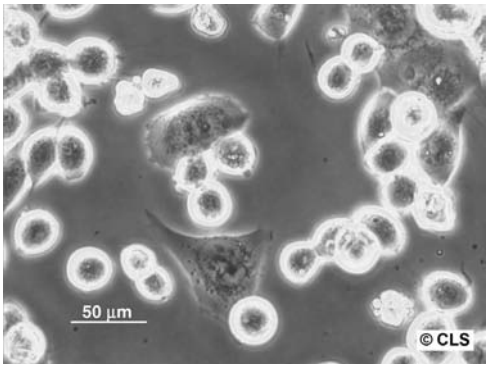
Foley, G.E. *et al.* (1965) Continuous culture of human lymphoblasts from peripheral blood of a child with acute leukaemia. *Cancer*, **18**, 522–529.



CERV-186, 100× Leica.



CERV-186, 100× Leica.



CERV-186, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CERV-186

Origin and General Characteristics

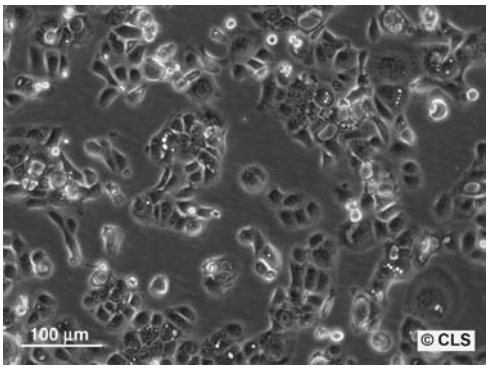
Organism:	*Homo sapiens* (human)
Ethnicity:	Black
Age:	42 years
Gender:	Female
Tissue:	Cervix
Morphology:	Epithelial
Cell type:	Invasive, large cell, squamous carcinoma; HPV-16 positive
Growth properties:	Monolayer
Description:	CERV-186 cell line was established In Vitro from the xenotransplant Cervix carcinoma MRI-H-186 by Cell Lines Service. Primary xenotransplant were adapted to *in vivo* transplantation by Dr. Bodgen, Mason Research Institute. Cervix, invasive, large cell, non-keratinizing, squamous cell carcinoma; HPV-16 positive

Culture Conditions and Handling

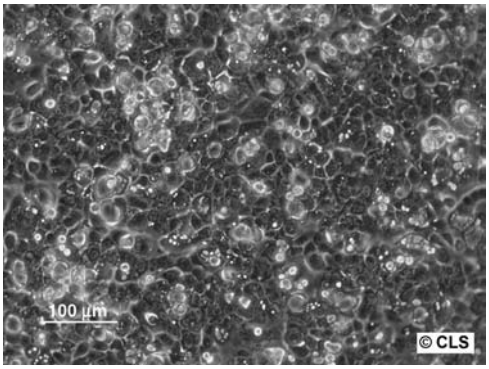
Culture medium:	DMEM:Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Add fresh 0.025% trypsin/0.02% EDTA for 2–3 min, remove, and allow standing for 5–10 min at 37 °C. Add fresh culture medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	About 34 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

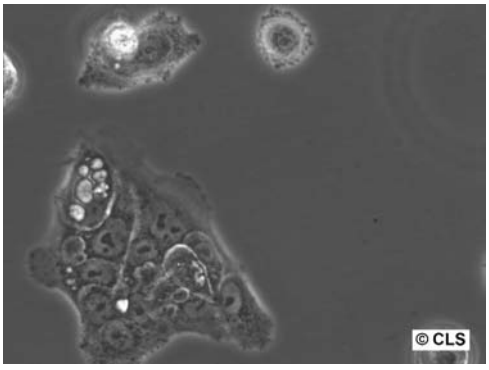
DNA profile (STR):	Amelogenin: X; CSF1PO: 9, 11; D13S317: 12; D16S539: 13; D18S51: 16; D21S11: 29, 30; D3S1358: 15, 18; D5S818: 11, 12; D7S820: 8, 12; D8S1179: 14; FGA: 19, 20; Penta D: 10, 12; Penta E: 5, 7; THO1: 6; TPOX: 8, 11; vWA: 14, 17
Tumorigenic:	Yes, in nude mice
Products:	Cytokeratine 8, 18, Vimentin, Desmoplakin
ATCC number:	Not available
CLS number:	300290



CERV-196, 100× Leica.



CERV-196, 100× Leica.



CERV-196, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CERV-196

Origin and General Characteristics

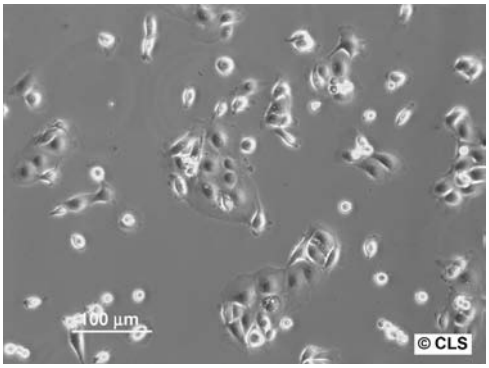
Organism: *Homo sapiens* (human)
Ethnicity: Black
Gender: Female
Age: 49 years
Morphology: Epithelial
Tissue: Cervix
Cell type: Carcinoma; HPV-16 positive
Growth properties: Monolayer
Description: The CERV-196 cell line was established from a poorly differentiated squamous cell carcinoma of the cervix; HPV-16 positive. *In vitro* established from the xenotransplant cervix carcinoma MRI-H-196 by Cell Lines Service. Primary xenotransplant was adapted to *in vivo* transplantation by Dr. Bodgen, Mason Research Institute

Culture Conditions and Handling

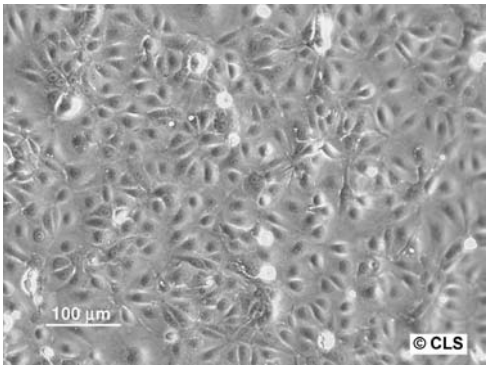
Culture medium: DMEM:Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Add fresh 0.25% trypsin/0.02% EDTA for 2–3 min, remove, and allow standing for 5–10 min at 37 °C. Add fresh culture medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

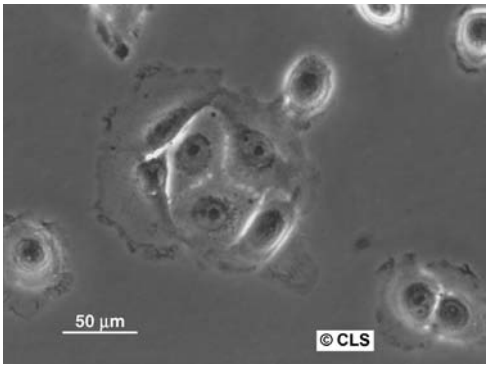
DNA profile (STR): Amelogenin: X; CSF1PO: 12, 13; D13S317: 18, 11; D16S539: 12; D18S51: 14; D21S11: 30; D3S1358: 17; D5S818: 11; D7S820:11, 12; D8S1179: 13; FGA: 20; Penta D: 12; Penta E: 12, 16; THO1: 6; TPOX: 8; vWA: 14
Tumorigenic: Yes, in nude mice
Products: Cytokeratine 8, 18, Vimentin
ATCC number: Not available
CLS number: 300291



CERV-215, 100× Leica.



CERV-215, 100× Leica.



CERV-215, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CERV-215

Origin and General Characteristics

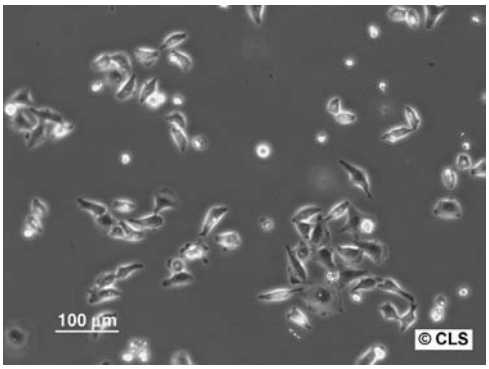
Organism:	*Homo sapiens* (human)
Ethnicity:	Black
Age:	39 years
Gender:	Female
Tissue:	cervix carcinoma; epidermoid carcinoma, HPV-16 positive
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	Cervix, invasive, large cell, non-keratinizing, poorly differentiated, epidermoid carcinoma, HPV-16 positive. In vitro established from the xenotransplant cervix carcinoma MRI-H-215 by Cell Lines Service. Primary xenotransplant adepted to *in vivo* transplantation by Dr. Bodgen, Mason Research Institute

Culture Conditions and Handling

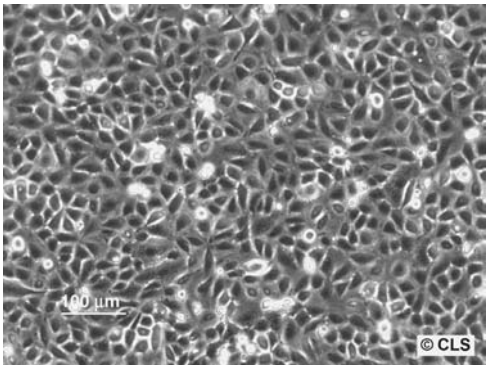
Culture medium:	Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Add fresh 0.025% trypsin/0.02% EDTA for 2–3 min, remove, and allow standing for 5–10 min at 37 °C. Add fresh culture medium, aspirate and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

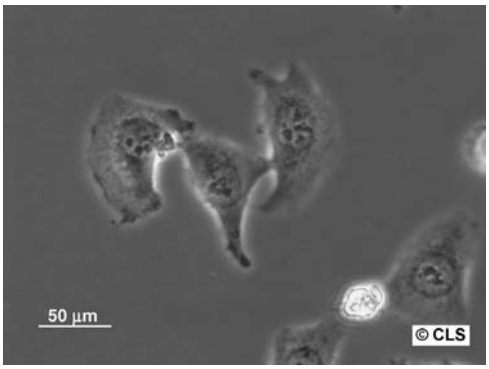
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 13; D13S317: 8, 12; D16S539: 9, 12; D18S51: 12; D21S11: 33.2; D3S1358: 15, 18; D5S818: 11, 12; D7S820:11, 12; D8S1179: 13, 14; FGA: 19, 21; Penta D: 10; Penta E: 12, 13; THO1: 9; TPOX: 8; vWA: 16
Tumorigenic:	Yes, in nude mice
Products:	Cytokeratine 8, 18, Vimentin
ATCC number:	Not available
CLS number:	300292



Chang-Liver, 100× Leica.



Chang-Liver, 100× Leica.



Chang-Liver, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

C

Chang-Liver

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Tissue: Liver, normal
Morphology: Epithelial
Growth properties: Monolayer, cells pile up at high density
Description: Cells of this line contain HeLa marker chromosomes, and were derived via HeLa contamination. The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

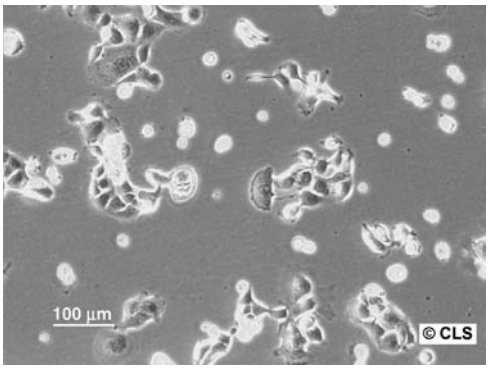
Culture medium: Minimum essential medium Eagle with 2 mM L-glutamine and Earle's BSS adjusted to contain 1.5 g/l sodium bicarbonate, 0.1 mM non-essential amino acids, and 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution. Allow flask to sit at 37 °C until cells detach. Add fresh medium, remove trypsin by centrifugation, add fresh medium, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

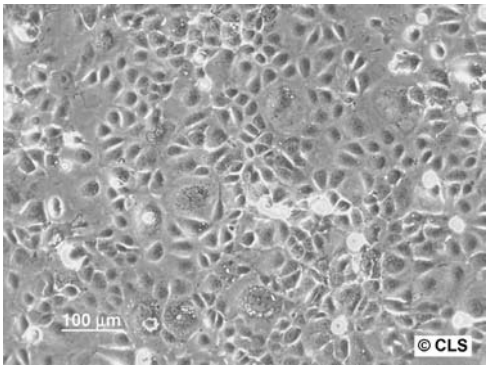
DNA profile (STR): Amelogenin: X; CSF1PO: 10; D13S317: 12, 13.3; D16S539: 9, 10; D18S51: 16; D21S11: 27, 28; D3S1358: 15, 18; D5S818: 12; D7S820: 8, 12; D8S1179: 12, 13; FGA: 21; Penta D: 8, 15; Penta E: 7, 17; THO1: 7; TPOX: 8, 12; vWA: 16, 18
Tumorigenic: Yes, in Syrian hamsters
Isoenzymes: G6PD, A
Reverse transcriptase: Negative
Viruses: Tested MHV (mouse hepatitis virus) negative
Virus susceptibility: Poliovirus 1, 2, 3; adenovirus 3; vesicular stomatitis (Indiana)
Products: Keratin
ATCC number: CCl 13; ECACC No: 88021102
CLS number: Cryovial: 300139

Further Reading

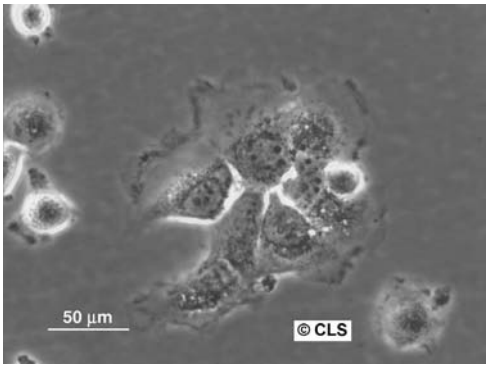
Chang, R.S. (1954) Continuous subcultivation of epithelial-like cells from normal human tissues. *Proc. Soc. Exp. Biol. Med.*, **87**, 440.



CLS-54, 100× Leica.



CLS-54, 100× Leica.



CLS-54, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-54

Origin and General Characteristics

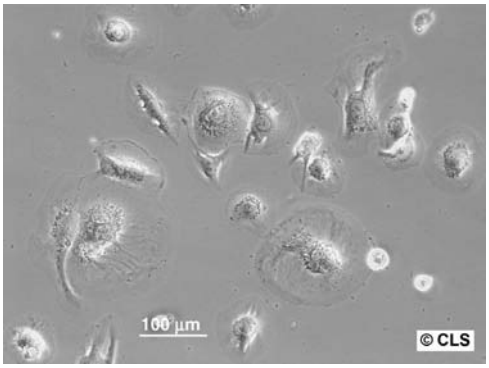
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	65 years
Gender:	Male
Tissue:	Lung
Cell type:	Epithelial; Carcinoma
Growth properties:	Monolayer
Description:	In vitro etablished from the primary lung carcinoma of a 65 year-old man in 1998

Culture Conditions and Handling

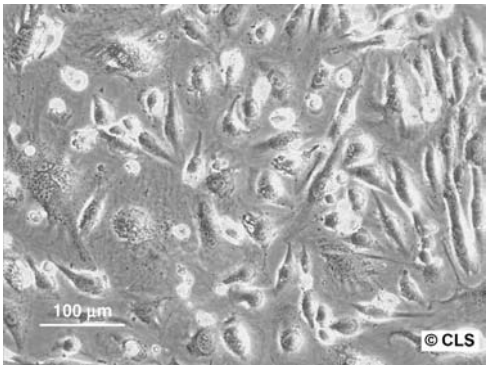
Culture medium:	RPMI 1640, 90%, fetal bovine serum, 10%
Subculture routine:	Remove medium, add fresh 0.025% trypsin, 0.02% EDTA for several minutes, remove trypsin, and let the culture sit at 37 °C for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

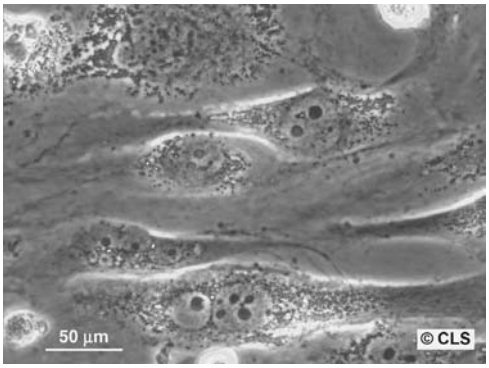
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 11; D16S539: 12, 13; D18S51: 11, 17, 18; D21S11: 30, 31.2; D3S1358: 18; D5S818: 13; D7S820:10, 11; D8S1179: 11; FGA: 20.; Penta D: 9; Penta E: 12, 15; THO1: 6, 9.3; TPOX: 8, 9; vWA: 14, 17
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300227



CLS-117, 100× Leica.



CLS-117, 100× Leica.



CLS-117, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-117

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 47 years
Gender: Female
Tissue: Thyroidea
Morphology: Polymorph cells; fibroblast
Cell type: Sarcoma, thyroid
Growth properties: Monolayer
Description: in vitro established from the primary sarcoma of the thyroid gland of a 47-year-old woman

Culture Conditions and Handling

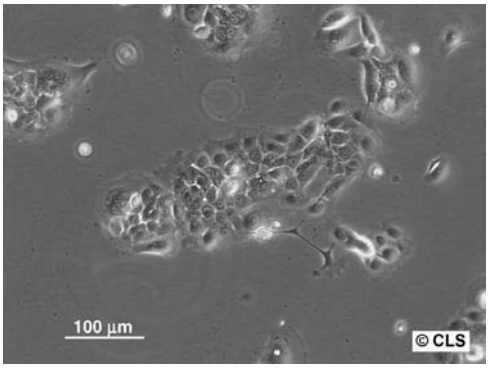
Culture medium: RPMI 1640 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at room temperature (or 37 °C) until the cells detach (about 2–3 min). Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Every three to five days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

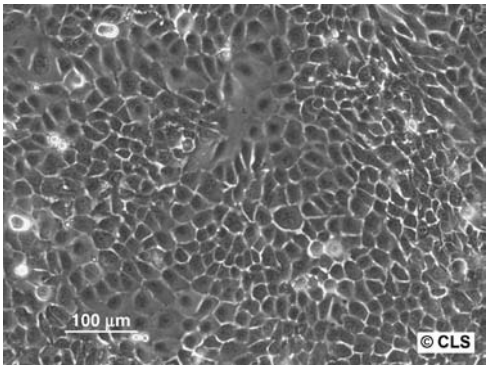
DNA profile (STR): Amelogenin: X; CSF1PO: 13; D13S317: 12; D16S539: 11; D18S51: 11; D21S11: 30; D3S1358: 18; D5S818: 11; D7S820: 11; D8S1179: 15; FGA: 22; Penta D: 10; Penta E: 18; THO1: 6; TPOX: 8; vWA: 14
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300329

Further Reading

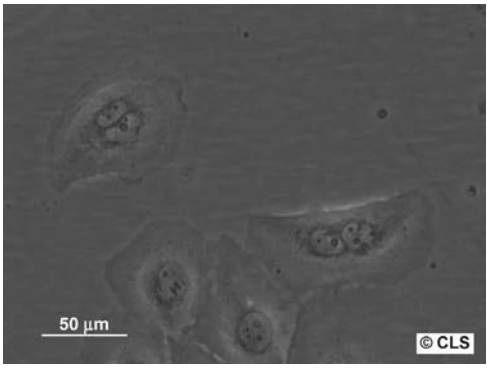
Hilbert, J., Goerttler, K., and Löhrke, H. (1989) Is there an alteration of the DNA index and the cytoskeleton in tumor cell models in comparison with xenotransplantation and in-vitro culturing? Results of 10 human models. *J. Cancer Res. Clin. Oncol.*, **115** (Suppl. 1): S 50.



CLS-354, 100× Leica.



CLS-354, 100× Leica.



CLS-354, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-354

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	51 years
Gender:	Male
Tissue:	Mouth
Morphology:	Epithelial
Cell type:	Squamous epithelial carcinoma
Growth properties:	Monolayer
Description:	Established *in vitro* from the primary squamous carcinoma of a 51-year-old male, 1998

Culture Conditions and Handling

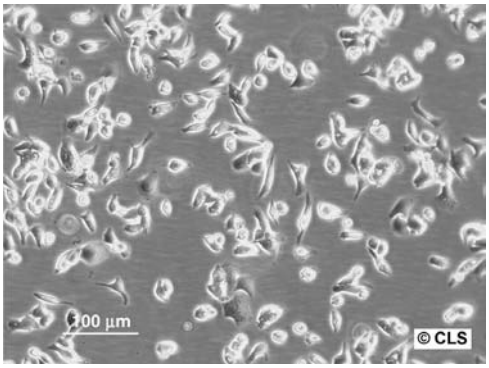
Culture medium:	DMEM: Ham's F12 medium (1:1, vol/vol) supplemented with 2mM L-glutamine and 5–10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA for 2–3 min, remove trypsin and let the culture stand for 5 to stand for 5–10 min at room temperature. Once all the cells have detached, add complete cell culture medium, remove trypsin by centrifuging, resuspend the cells in fresh cell culture medium and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Three times weekly

Special Features of the Cell Line and Recommended Use

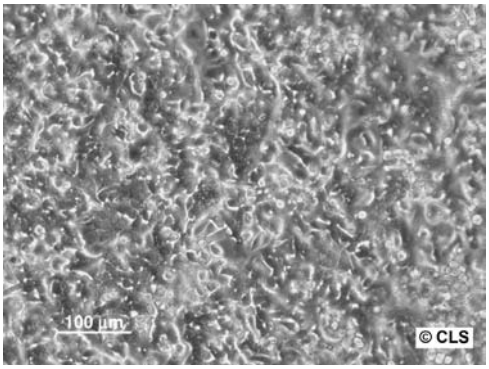
DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 12; D3S1358: 16, 16; D5S818: 9, 12; D7S820: 7, 9; D8S1179: 12, 14; D16S539: 9, 11; D13S317: 9, 13; D18S51: 15, 15; D21S11: 28, 28; FGA: 21, 23; Penta D: 13, 13; Penta E: 10, 14; THO1: 9, 9.3; TPOX: 8, 8; vWA: 15, 17
Tumorigenic:	Yes, in nude mice
Reverse transcriptase:	Negative
Products:	Keratin
ATCC number:	Not available
CLS number:	300152

Further Reading

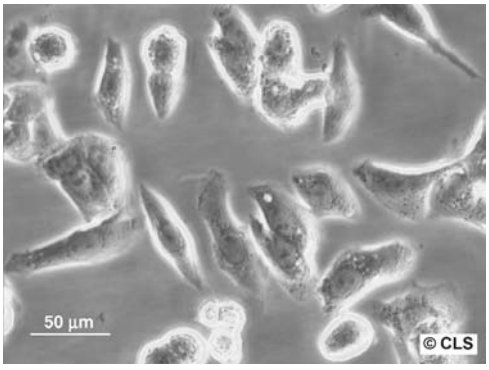
Kubler, A.C., Reuther, T., Staff, C., Haase, T., Flechtenmacher, C., Benner, A., Scheer, M., and Zillmann, U. (2001) Clinical effectiveness of m-THPC-PEG in a new xenogenic animal tumor model for human squamous epithelial carcinomas. (Article in German). *Mund Kiefer Gesichtschir*, **5** (2), 105–113.



CLS-439, 100× Leica.



CLS-439, 100× Leica.



CLS-439, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-439

Origin and General Characteristics

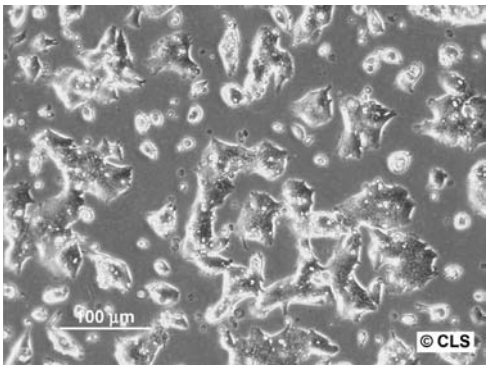
Organism: *Homo sapiens* (human)
Ethnicity: European
Gender: Male
Age: 61 years
Tissue: Bladder (urinary)
Morphology: Epithelial
Growth properties: Monolayer
Description: Established from the primary bladder carcinoma of a 61-year-old male, 1998

Culture Conditions and Handling

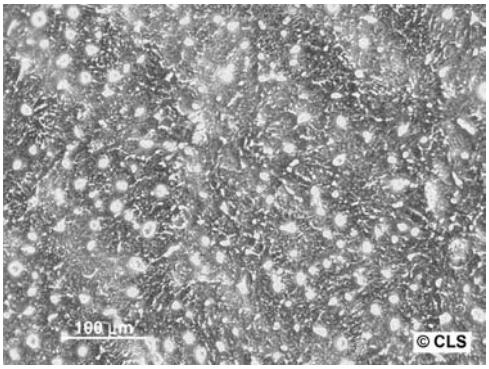
Culture medium: McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every six to eight days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 11; D16S539: 10, 13; D18S51: 14; D21S11: 29, 31; D3S1358: 16; D5S818: 11; D7S820:10, 11; D8S1179: 11, 13; FGA: 20; Penta D: 9, 12; Penta E: 12, 16; THO1: 7; TPOX: 9, 10; vWA: 17
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300150



Colo-60H, 100× Leica.



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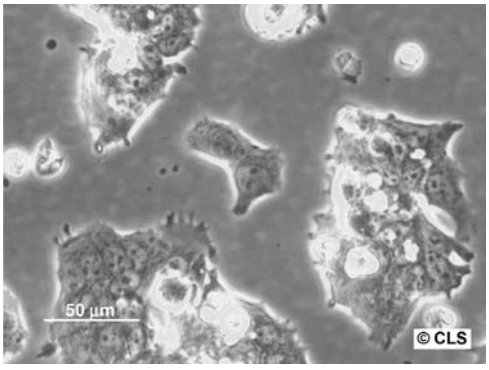


Colo-60H, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colo-60H

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Gender: Male
Age: 73 years
Tissue: Colon transversum adenocarcinoma
Morphology: Epithelial
Cell type: Untreated colon adenocarcinoma

Culture Conditions and Handling

Culture medium: DMEM: Ham's F12 medium supplemented with L-glutamine and 5% fetal bovine serum

Subculture routine: Remove medium and rinse with PBS free of calcium and magnesium. Add Accutase solution and incubate at 37 °C for 10 minutes. Collect the cells and dispense into new flasks. Subculture at about 90% confluence

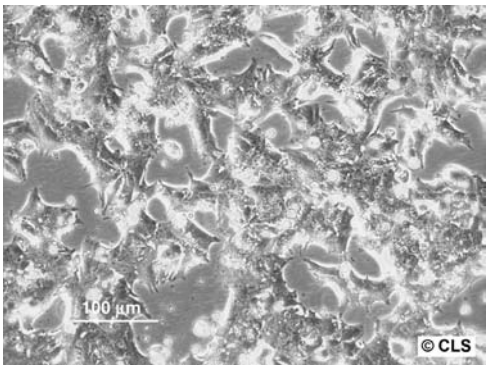
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

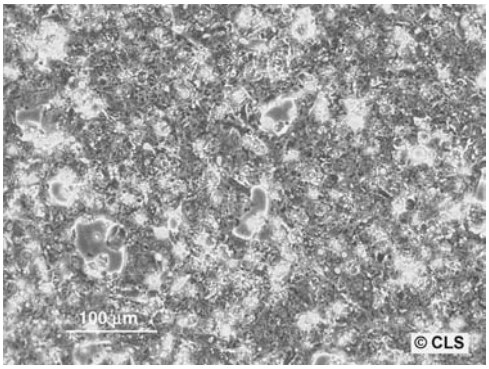
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 15; D13S317: 11; D16S539: 9, 13; D18S51: 13, 15; D21S11: 29, 33.2; D3S1358: 15; D5S818: 9, 16; D7S820: 7.3, 10; D8S1179: 11; FGA: 21, 24; Penta D: 14; Penta E: 11, 13; THO1: 6, 9.3; TPOX: 7, 10; vWA: 15, 16

ATCC number: Not available

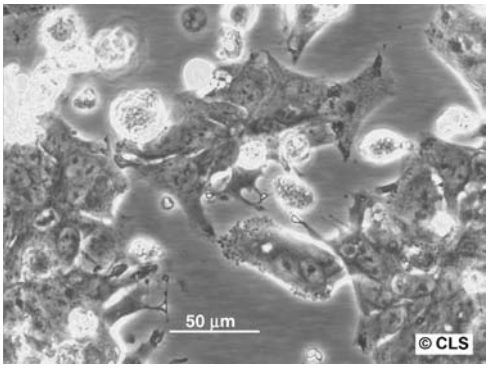
CLs number: 300456



Colo-94H, 100× Leica.



Colo-94H, 100× Leica.



Colo-94H, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colo-94H

Origin and General Characteristics

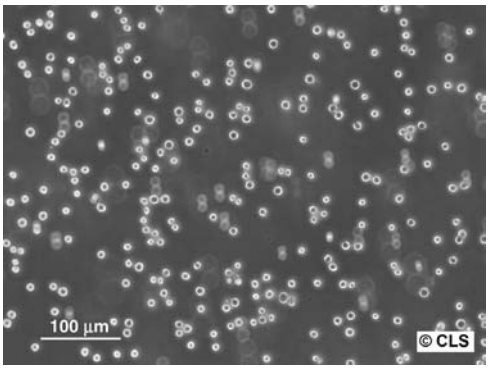
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	70 years
Gender:	Male
Tissue:	Adenocarcinoma, colorectal; colon, ascendes
Morphology:	Epithelial
Growth properties:	monolayer
Description:	Established from the primary adenocarcinoma of the colon of a 70 year-old male, Cell Lines Service

Culture Conditions and Handling

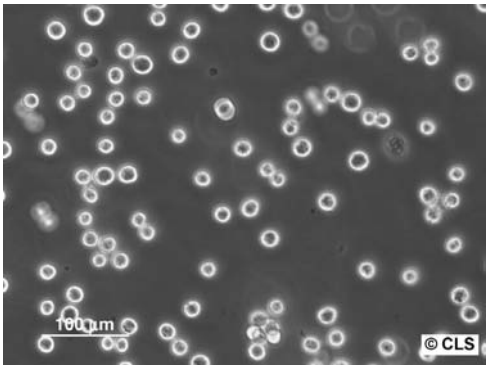
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS with non-essential amino acids, 90%, fetal bovine serum, 10%
Subculture routine:	Remove medium, add fresh 0.25% trypsin, 0.02% EDTA for several minutes, remove trypsin, and let the culture sit at 37 °C for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 8 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

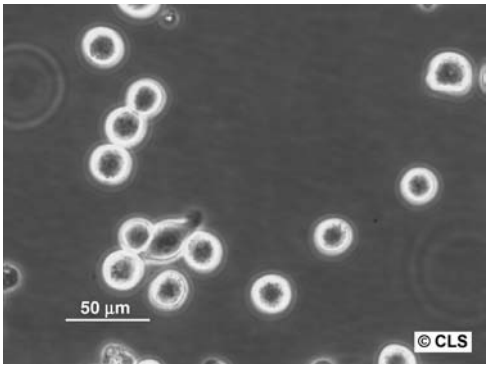
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 14; D13S317: 11; D16S539: 13; D18S51: 18; D21S11: 27, 28; D3S1358: 15, 17; D5S818: 12; D7S820: 8; D8S1179: 12; FGA: 21; Penta D: 12, 13; Penta E: 17; THO1: 7, 9.3; TPOX: 8; vWA: 15, 19
Tumorigenic:	Yes, in nude mice
Reverse transcriptase:	Negative
Products:	Cytokeratine 8, 18, 19
ATCC number:	Not available
CLS number:	300161



Colo-205, 100× Leica.



Colo-205, 200× Leica.



Colo-205, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colo-205

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	70 years
Gender:	Male
Tissue:	Colon (metastatic site: ascites)
Morphology:	Spherical, leukocyte-like
Cell type:	Colorectal adenocarcinoma; Dukes' type D
Growth properties:	Cells grow loosely attached and in suspension
Description:	The cells are CSAp negative (CSAp-), positive for keratin by immunoperoxidase staining they express a 36000 Dalton cell surface glycoprotein related to the GA733-2 tumor associated antigen

Culture Conditions and Handling

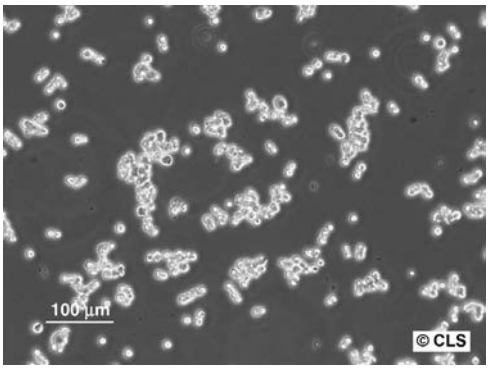
Culture medium:	DMEM:Ham's F12 (1 : 1 mixture) medium supplemented with L-glutamine and 5% fetal bovine serum.
Subculture routine:	Shake flask, pour one-half of the medium into a new flask and add fresh medium to both flasks. Cells remaining attached may be removed using a standard trypsin protocol
Split ratio:	Subcultivation ratios of 1 : 2 to 1 : 10 are possible when all cells are pooled (suspended cells plus cells recovered using trypsin)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

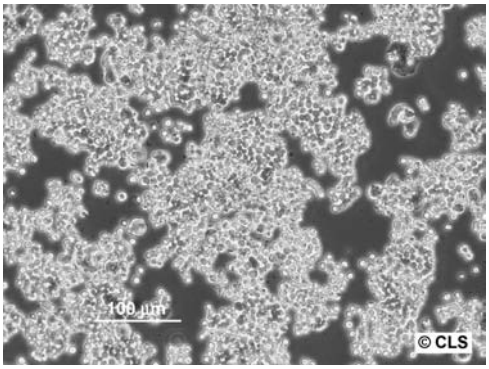
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D13S317: 10, 12; D16S539: 12, 13; D18S51: 18; D21S11: 30.2, 33.2; D3S1358: 16; D5S818: 10, 13; D7S820: 9, 10; D8S1179: 9, 14; FGA: 21, 23; Penta D: 9, 11; Penta E: 13, 15; THO1: 8, 9; TPOX: 11; vWA: 15
Tumorigenic:	Yes, in nude mice
Isoenzymes:	G6PD, B; PGM1, 1–2; PGM3, 1–2; 6PGD, A; ES-D, 1–2, PEP-D, 1
Reverse transcriptase:	Negative
Products:	carcinoembryonic antigen (CEA) 1.5–4.1 ng/10^6 cells/10 days; keratin; interleukin 10 (IL-10, interleukin-10)
ATCC number:	CCl-222
CLS number:	300380

Further Reading

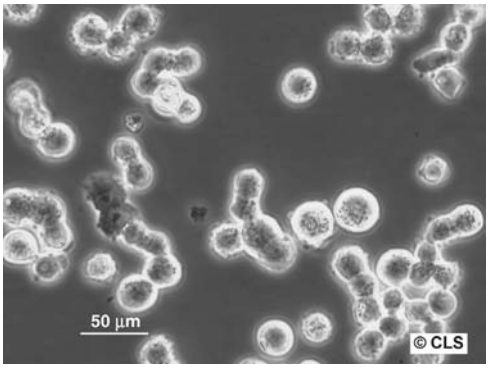
Semple, T.U. *et al.* (1978) Tumor and lymphoid cell lines from a patient with carcinoma of the colon for a cytotoxicity model. *Cancer Res.*, **38**, 1345–1355.



Colo-320DM, 100× Leica.



Colo-320DM, 100× Leica.



Colo-320DM, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colo-320DM

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	55 years
Gender:	Female
Tissue:	Colorectal; colon
Morphology:	Rounded and refractile
Cell type:	Adenocarcinoma

Culture Conditions and Handling

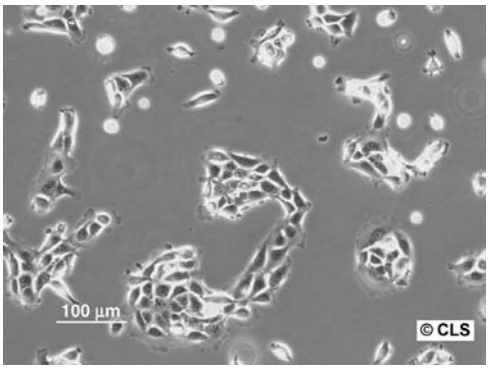
Culture medium:	Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium and magnesium. Add Accutase solution and incubate at 37 °C for 10 minutes. Collect the cells and dispense into new flasks. Subculture at about 90% confluence
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

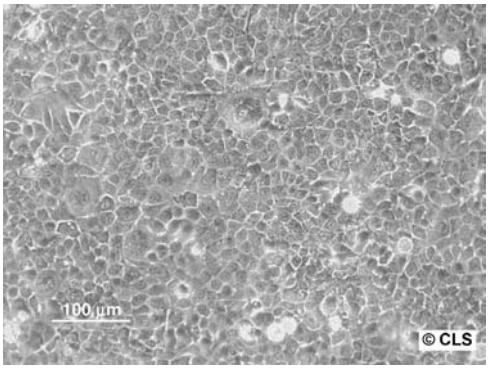
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 11; D13S317: 11; D16S539: 11, 12; D18S51: 15; D21S11: 33.2; D3S1358: 17; D5S818: 12; D7S820: 9, 12; D8S1179: 13; FGA: 20; Penta D: 9, 12; Penta E: 11; THO1: 9; TPOX: 8, 9; vWA: 15, 18
Tumorigenic:	Yes, in nude mice
Isoenzymes:	PGM1,1; PGM3, 2; G6PD, B; PEP-D, 1; 6PGD, A; ES-D, 1
Products:	Serotonin; norepinephrine; epinephrine; adrenocorticotropic hormone (ACTH); parathyroid hormone
ATCC number:	CCL-220
CLS number:	300153

Further Reading

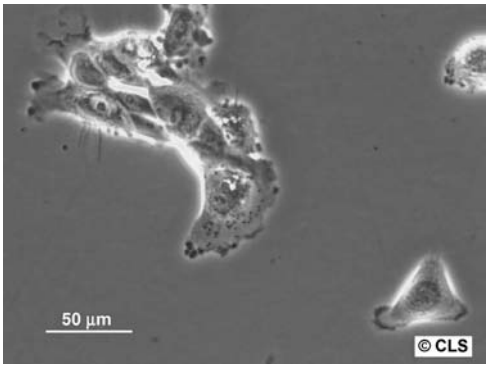
Quin, L.A. *et al.* (1979) Cell lines from human colon carcinoma with unusual cell products, double minutes, and homogeneously staining regions. *Cancer Res.*, **39**, 4914–4924.



COLO-680N, 100× Leica.



COLO-680N, 100× Leica.



COLO-680N, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

COLO-680N

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Black
Age: 57 years
Gender: Female
Tissue: Esophagus
Morphology: Epitheloid
Cell type: Esophageal squamous cell carcinoma
Growth properties: Monolayer

Culture Conditions and Handling

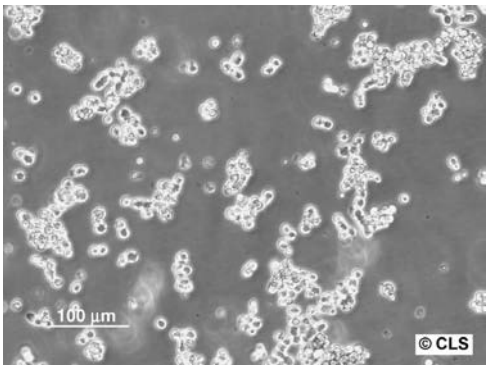
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA and incubate at 37 °C until the cells detach. Add fresh medium, collect the cells, and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

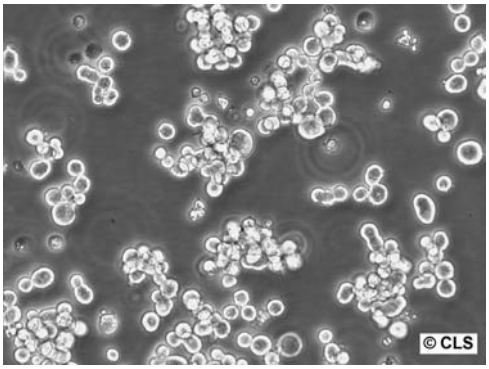
DNA profile (STR): Amelogenin: X; CSF1PO: 11, 12; D13S317: 13; D16S539: 11, 12; D18S51: 19; D21S11: 27; D3S1358: 15; D5S818: 11; D7S820: 10, 12; D8S1179: 14, 15; FGA: 18.2; Penta D: 12; Penta E: 7,8; THO1: 8; TPOX: 6; vWA: 17, 18
Immunology: Cells express BMP-6 (bone morphogenetic protein) in standard cell cultivation conditions.
ATCC number: Not available
CLS number: 300464

Further Reading

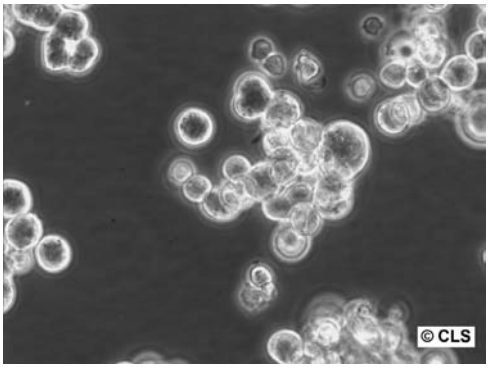
Raida, M., Sarbia, M., Clement, J.H., Adam, S., Gabbert, H.E., and Hoffken, K. (1999) Expression, regulation and clinical significance of bone morphogenetic protein 6 in esophageal squamous-cell carcinoma. *Int. J. Cancer*, **83** (1), 38–44.



Colo-824, 100× Leica.



Colo-824, 200× Nikon.



Colo-824, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colo-824

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Female
Age:	52 years
Morphology:	Epithelial
Tissue:	Metastatis of a female breast cancer patient. (pleural effusion)
Cell type:	Mammary gland carcinoma
Growth properties:	Monolayer/suspension
Description:	The cells do not tolerate DMSO; upon thawing, DMSO has to be removed by centrifugation

Culture Conditions and Handling

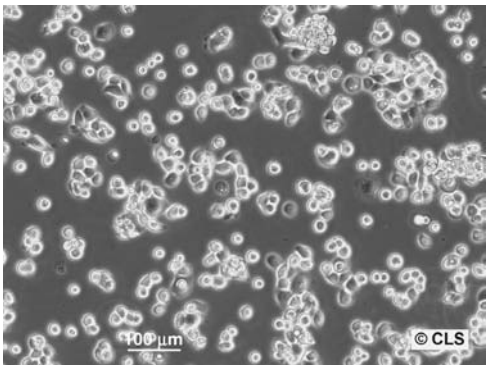
Culture medium:	RPMI-1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Collect the non-adherent cells and combine with the slightly adherent cells being knocked off the bottom of the cell culture vessel. Seed out at about $5 \times 10^4/cm^2$
Split ratio:	A ratio of 1 : 4 is recommended
Fluid renewal:	Every two to three days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

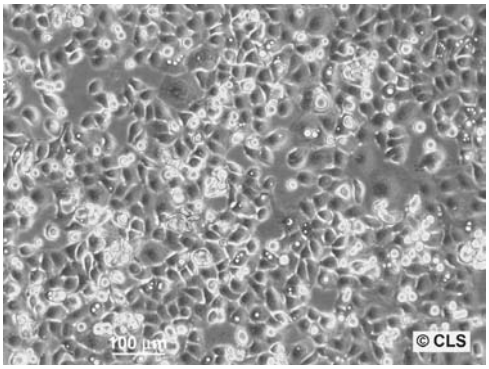
DNA profile (STR):	Amelogenin: X,; CSF1PO: 10, 12; D13S317: 11, 12, 13; D16S539: 13; D18S51: 15, 19; D21S11: 28; D3S1358: 16, 17; D5S818: 12; D7S820: 8, 11; D8S1179: 12, 14; FGA: 22; Penta D: 5, 10; Penta E: 7; THO1: 7, 9; TPOX: 6, 11; vWA: 16
Tumorigenic:	Yes, in nude mice
CLS number:	300463

Further Reading

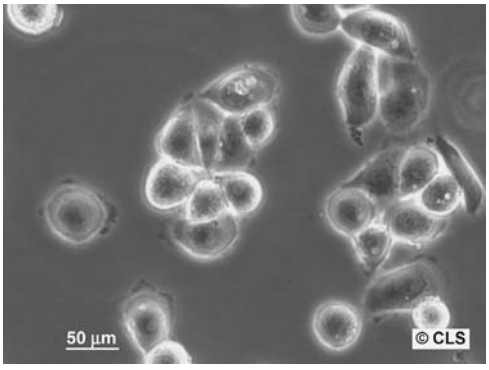
Savelyeva, L., Claas, A., An, H., Weber, R.G., Lichter, P., and Schwab, M. (1999) Retention of polysomy at 9p23-24 during karyotypic evolution in human breast cancer cell line COLO 824. *Genes Chromosomes Cancer,* **24** (1), 87–93, PMID: 9892114.



DAN-G, 100× Leica.



DAN-G, 100× Leica.



DAN-G, 400× Leica.

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DAN-G

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	68 years
Tissue:	Pancreas
Cell type:	Carcinaoma
Morphology:	Epithelial
Description:	The line was derived from nude mouse xenografts initiated with cells from the tumor of a patient with cancer of the pancreas

Culture Conditions and Handling

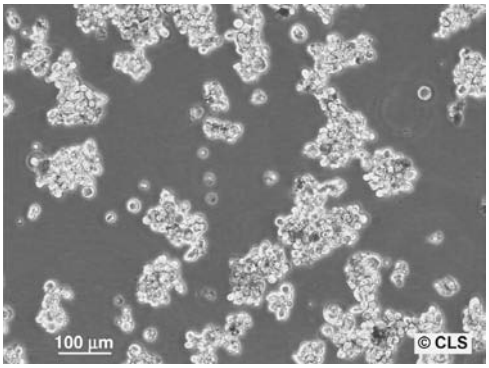
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every 4–6 days
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	About 33 h
Tumorigenic:	Yes, in nude mice
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

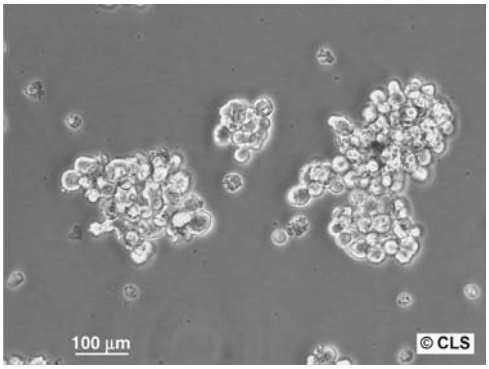
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 13; D13S317: 8; D16S539: 8, 11; D18S51: 16; D21S11: 29, 31.2; D3S1358: 16; D5S818: 12, 13; D7S820: 10, 13; D8S1179: 10, 11; FGA: 20; Penta D: 9, 13; Penta E: 7; THO1: 9.3; TPOX: 10; vWA: 16, 18
ATCC number:	DSZM: ACC249
CLS number:	300162

Further Reading

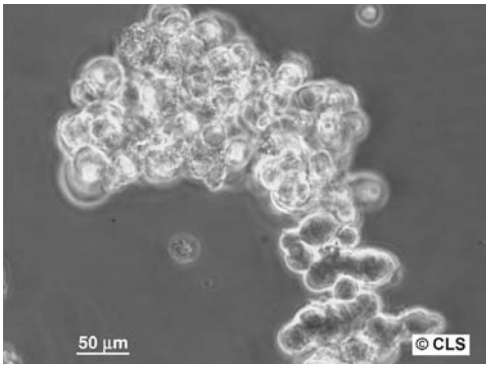
Chu, M.Y., Naguib, F.N., Iltzsch, M.H., el Kouni, M.H., Chu, S.H., Cha, S., and Calabresi, P. (1984) Potentiation of 5-fluoro-2′-deoxyuridine antineoplastic activity by the uridine phosphorylase inhibitors benzylacyclouridine and benzyloxybenzylacyclouridine. *Cancer Res.*, **44** (5), 1852–1856.



DMS-79, 100× Leica.



DMS-79, 200× Leica.



DMS-79, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

DMS-79

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	65 years
Tissue:	Lung
Cell type:	Small cell lung carcinoma
Growth properties:	Aggregates in suspension
Description:	The line was established from cells in the pleural fluid of a patient with small cell carcinoma of the lung. The patient had previously been treated with cytoxan, vincristine, methotrexate, and radiation therapy. The cells express HLA class I and class II antigens

Culture Conditions and Handling

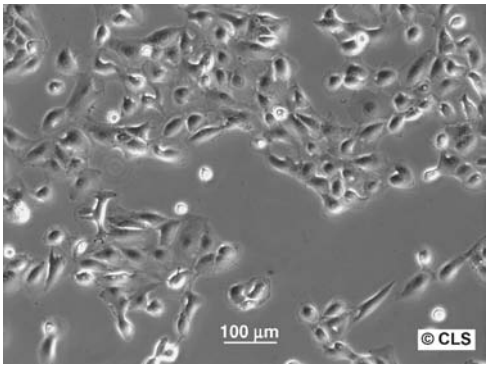
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine, 4.5 g/l glucose, 1 mM sodium pyruvate, 10 mM Hepes and 10% fetal bovine serum
Subculture routine:	Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Cell counts are approximate since the cells grow in aggregates. Subculture by transferring one part of the suspension into new flasks with fresh cell culture medium
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

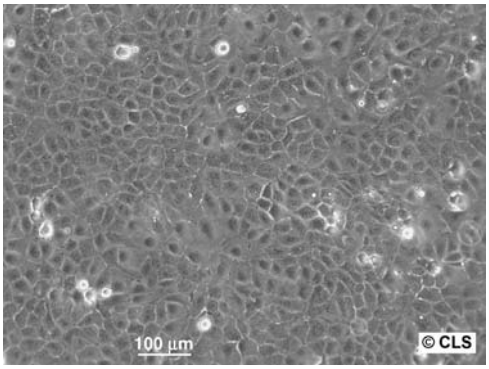
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10; D13S317: 11; D16S539: 12; D18S51: 14, 17; D21S11: 30;D3S1358: 18; D5S818: 10; D7S820: 9, 11; D8S1179: 12, 14; FGA: 21; Penta D: 11, 13; Penta E: 7; THO1: 8; TPOX: 8; vWA: 18
Tumorigenic:	Yes, in nude mice
Oncogene:	c-myc +, N-myc +, c-raf-1 +, Ha-ras +, Ki-ras +, N-ras +, v-fes −, v-fms −
Antigen expression:	Leu 7; My23; Class 1 HLA; Class 2 HLA
Receptors expressed:	Epidermal growth factor (EGF)
Products:	Adrenocorticotropin (adrenocorticotropic hormone, ACTH); bombesin; calcitonin; corticotropin; beta endorphin; 17 beta estradiol; lipotropin; oxytocin – neurophysin (OT-NP); parathormone; somatostatin-like immunoreactivity (SRIF)
ATCC number:	Not available
CLS number:	300164

Further Reading

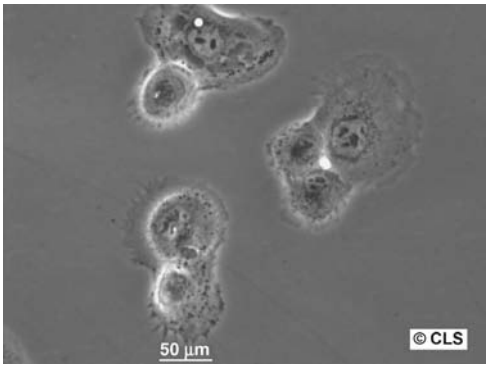
Pettengill, O.S. *et al.* (1980) Animal model for small cell carcinoma of the lung. Effect of immunosuppression and sex of mouse on tumor growth in nude athymic mice. *Exp. Cell Biol*, **48**, 279–297, *Lung Cancer*, **4**, 155–161 (1988).



DU-145, 100× Leica.



DU-145, 100× Leica.



DU-145, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

DU-145

Origin and General Characteristics

Organism:	Homo sapiens (human)
Ethnicity:	Caucasian
Age:	69 years
Gender:	Male
Tissue:	Prostate
Morphology:	Epithelial
Cell type:	Carcinoma; from metastatic site: brain
Growth properties:	Monolayer
Description:	DU 145 was isolated by K.R. Stone *et al.* from a lesion in the brain of a patient with metastatic carcinoma of the prostate and a 3 year history of lymphocytic leukemia

Culture Conditions and Handling

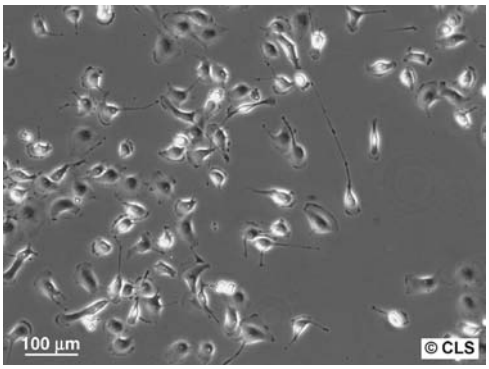
Culture medium:	Minimum essential medium Eagle with Earle's BSS supplemented with 2 mM L-glutamine, 0.1 mM non-essential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium and magnesium. Add Accutase solution and incubate at 37 °C for 10 minutes. Collect the cells and dispense into new flasks. Subculture at about 90% confluence
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

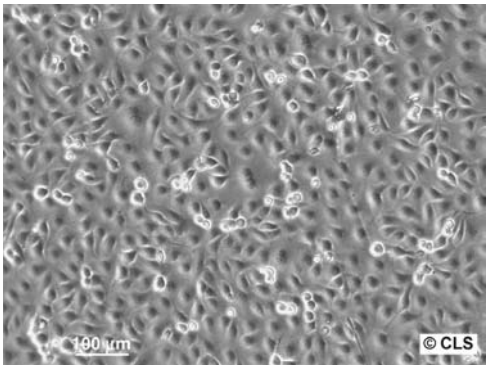
Karyotype:	(P75) hypotriploid to tetraploid with abnormalities including breaks, dicentrics, minutes, and large telocentric marker
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 11; D3S1358: 16; D5S818: 10, 13; D7S820: 7, 10, 11, 12; D8S1179: 13, 14; D13S317: 12, 13, 14; D16S539: 11, 13; D18S51: 12, 13; D21S11: 30, 33, 34; FGA: 22, 23; Penta D: 9, 13; Penta E: 12, 14; THO1: 7; TPOX: 11; vWA: 17, 18, 19
Tumorigenic:	Yes, in nude mice; forms adenocarcinoma (grade II) consistent with prostatic primary
Antigen expression:	Blood type O; Rh+
Isoenzymes:	Me-2, 1-2; PGM3, 2; PGM1, 1; ES-D, 1; AK-1, 1; G6PD, B; GLO-1, 2; Phenotype Frequency Product: 0.0041
ATCC number:	HTB-81
CLS number:	300168

Further Reading

Mickey, D.D., Stone, K.R., Wunderli, H., Mickey, G.H., Vollmer, R.T., and Paulson, D.F. (1977) Heterotransplantation of a human prostatic adenocarcinoma cell line in nude mice. *Cancer Res.*, **37**, 4049–4058.



ECV-304, 100× Leica.



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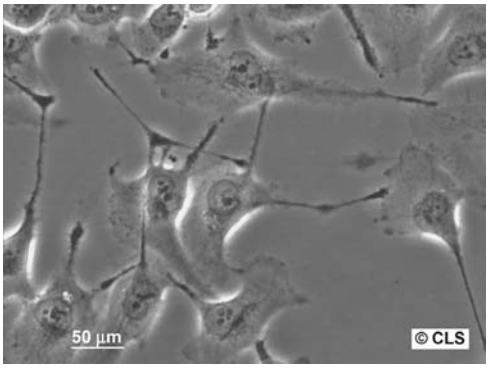


ECV-304, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

ECV-304

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Tissue: Urinary bladder; carcinoma
Morphology: Epithelial
Growth properties: Adherent
Description: DNA profiling studies, conducted at ATCC, revealed that STR patterns of the endothelial line ECV-304 and the human bladder line T24 were very similar, suggesting that ECV-304 was a derivative of T24. Furthermore, ATCC karyotypes of the two lines show two shared-marker chromosomes. Combined, these results show that ECV-304 is indeed a derivative of T24, a line that was developed years earlier

Culture Conditions and Handling

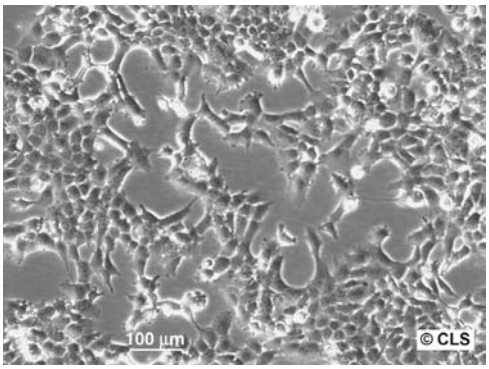
Culture medium: Medium 199 supplemented with glutamine, Hepes, Penicillin/Streptomycine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA (versene) solution. Add fresh 0.25% trypsin/0.02% EDTA solution, rinse and remove trypsin. Allow the flask to sit at 37 °C until the cells detach. Add serum-containing medium, resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 6 to 1 : 10 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

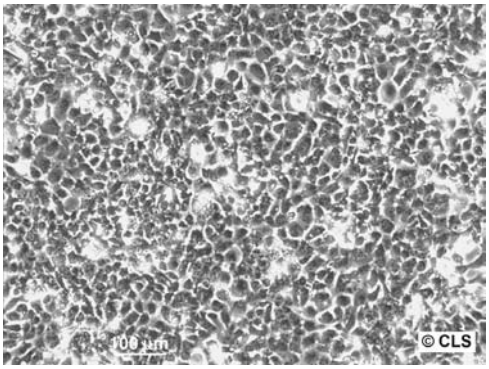
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 9; D18S51: 16, 18; D21S11: 29, 29; D3S1358: 16, 16; D5S818: 10; D7S820: 10, 11; D8S1179: 14, 14; FGA: 17, 22; Penta D: 11, 15; Penta E: 7, 10; THO1:6; TPOX: 8, 11; vWA: 17
Tumorigenic: Yes, in BALB/c nu/nu mice
Biomarkers: Weibel–Palade bodies; tubule formation on Matrigel
Antigen expression: Factor VIII
ATCC number: Not available
CLS number: 300452

Further Reading

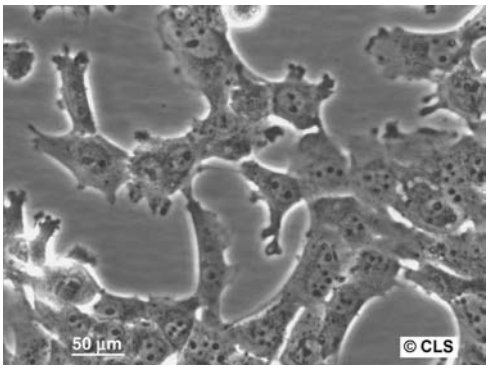
Takahashi, K. *et al.* (1990) Spontaneous transformation and immortalization of human endothelial cells. *In Vitro Cell. Dev. Biol.*, **26**, 265–274.



FAMPAC, 100× Leica.



FAMPAC, 100× Leica.



FAMPAC, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

FAMPAC (PA-CLS-13)

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	European
Age:	43 years
Gender:	Female
Tissue:	Pancreas
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Adherent epitheloid cells growing in monolayers
Description:	Established from the primary pancreas adenocarcinoma of a 43- year-old female in 1995, Dr. Schmidt, H. Löhrke

Culture Conditions and Handling

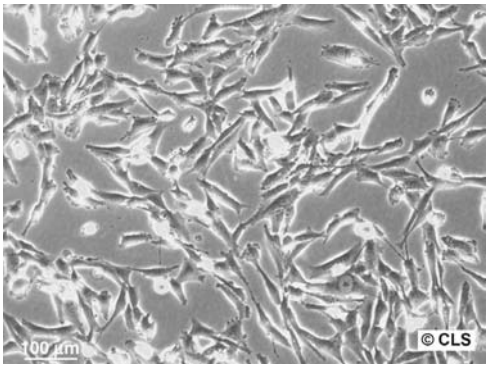
Culture medium:	DMEM: Ham's F12 (1 : 1) medium supplemented with 5% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin, and let the culture sit at 37 °C until the cells detach (max. five minutes). Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

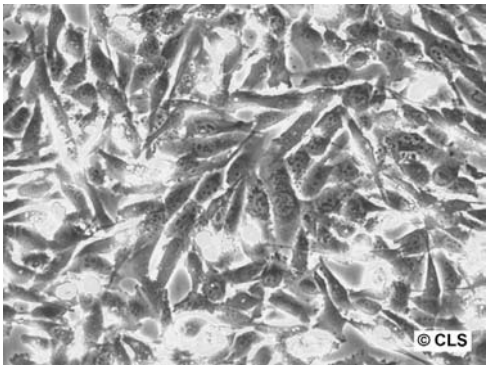
Karyotype:	Confirmed human
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 8; D16S539: 14; D18S51: 15; D21S11: 32.2; D3S1358: 16, 17; D5S818: 10,11; D7S820: 11; D8S1179: 10, 12; FGA: 22; Penta D: 11; Penta E: 12,13; THO1:9; TPOX: 8; vWA: 15 (CLS · Cell Lines Service, 2011)
Tumorigenic:	Yes, in nude mice, adenocarcinoma
ATCC number:	Not available
CLS number:	300309

Further Reading

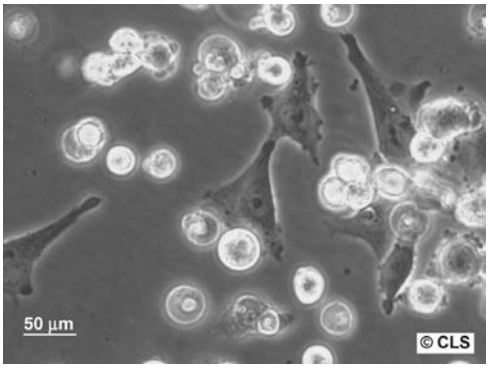
Eisold, S. *et al*. (2004) Characterization of FAMPAC, a newly identified human pancreatic carcinoma cell line with a hereditary background. *Cancer,* **100** (9), 1978–1986.



GCT, 100× Leica.



GCT, 200× Leica.



GCT, 400× Leica.

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GCT

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Gender: Male
Age: 29 years
Tissue: Histiocytoma, fibrous; from metastatic site: lung
Morphology: Epithelial
Growth properties: Monolayer
Description: The line produces CSA for human granulocyte precursors and EEA for erythroid precursor. Medium conditioned by this line can be used as a source of prostaglandin E and plasminogen activator

Culture Conditions and Handling

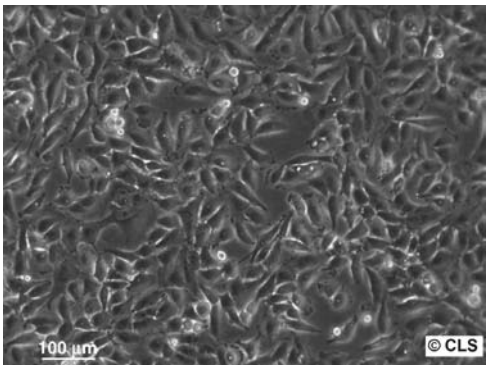
Culture medium: McCoy's 5a medium supplemented with glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin, and incubate at 37 °C until the cells detach. Add medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

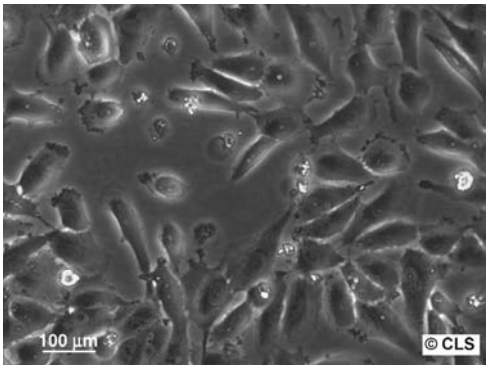
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 11, 12; D16S539: 9; D18S51: 17, 19; D21S11: 28; D3S1358: 16, 17; D5S818: 13, 15; D7S820: 11, 12; D8S1179: 11, 13; FGA: 21; Penta D: 12; Penta E: 12, 13; THO1: 8, 9.3; TPOX: 8, 9; vWA: 16, 18
Products: Colony stimulating activity (CSA); erythroid enhancing activity (EEA); prostaglandin E; plasminogen activator
ATCC number: TIB-223
CLS number: 300155

Further Reading

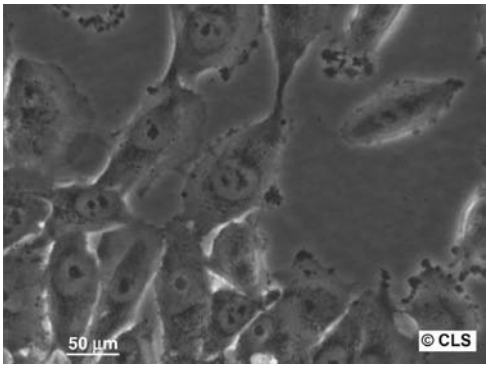
Di Persio, J.F. *et al.* (1978) Human cell lines that elaborate colony-stimulating activity for the marrow cells of man and other species. *Blood*, **51**, 507–519.



H4, 100× Leica.



H4, 200× Leica.



H4, 400× Leica.

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H4

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 37 years
Gender: Male
Tissue: Brain
Morphology: Epithelial
Cell type: Glioma
Growth properties: Monolayer

Culture Conditions and Handling

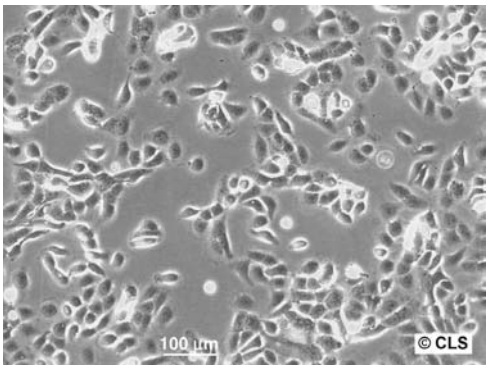
Culture medium: Dulbecco's modified Eagle's medium supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 10 to 1 : 15 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

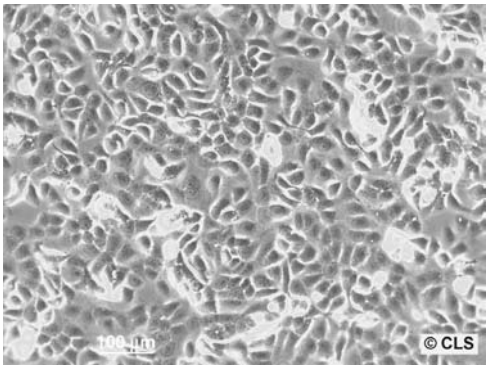
Karyotype: Modal number = 75; range 45 = 80; Y chromosome present
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 12; D16S539: 11, 12; D18S51: 14, 16; D21S11: 30, 31; D3S1358: 17, 18; D5S818: 10, 12; D7S820: 8, 11; D8S1179: 14; FGA: 19, 25; Penta D: 10, 12; Penta E: 5, 12; THO1: 7, 9; TPOX: 8, 11; vWA: 14, 18
Tumorigenic: No
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1; ES-D, 1; Me-2, 0; AK-1, 1; GLO-1, 2; Phenotype Frequency Product: 0.0452
ATCC number: HTB-148
CLS number: 300184

Further Reading

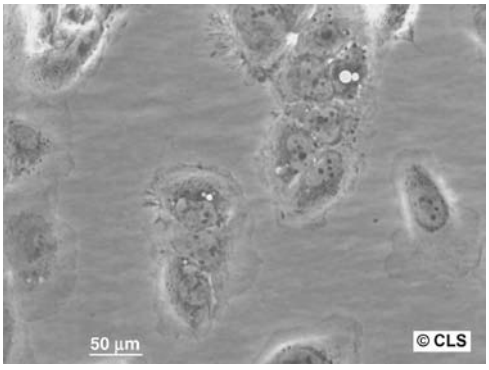
Arnstein, P., Taylor, D.O., Nelson-Rees, W.A., Huebner, R.J., and Lennette, E.H. (1974) Propagation of human tumors in antithymocyte serum-treated mice. *J. Natl. Cancer Inst.*, **52**, 71–84.



HB-CLS-1, 100× Leica.



HB-CLS-1, 100× Leica.



HB-CLS-1, 400× Leica.

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HB-CLS-1

Origin and General Characteristics

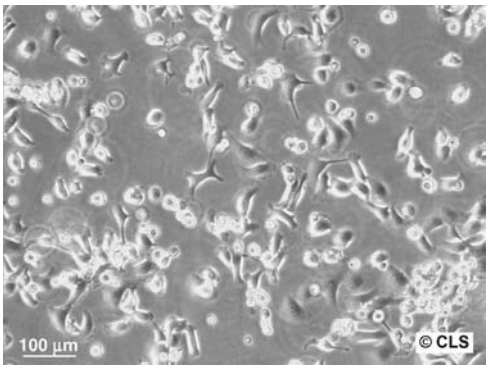
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	62 years
Gender:	Male
Tissue:	Urinary bladder, carcinoma, GIII;
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	Established from the primary bladder carcinoma grading III of a 62-year-old male

Culture Conditions and Handling

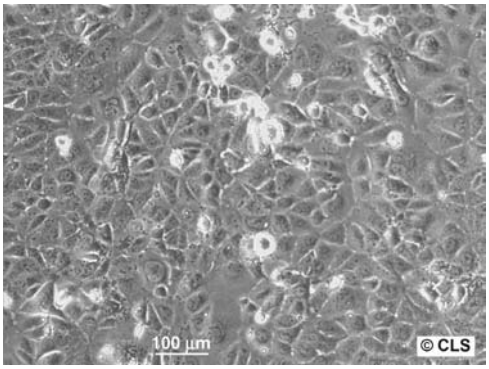
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 12; D13S317: 12, 13; D16S539: 8; D18S51: 17, 19; D21S11: 29; D3S1358: 14; D5S818: 11; D7S820: 10, 11; D8S1179: 12, 14; FGA: 19; Penta D: 11, 12; Penta E: 10; THO1:6; TPOX: 8,10; vWA: 15
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300190



HB-CLS-2, 100× Leica.



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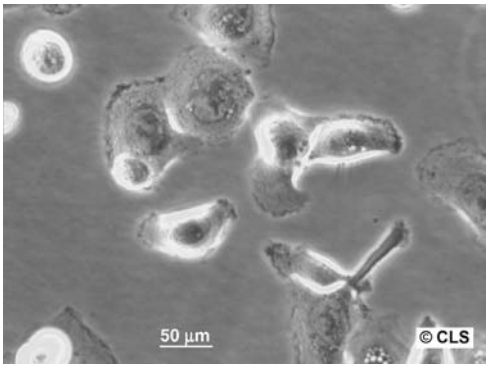

HB-CLS-2, 00× Leica.

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HB-CLS-2

Origin and General Characteristics

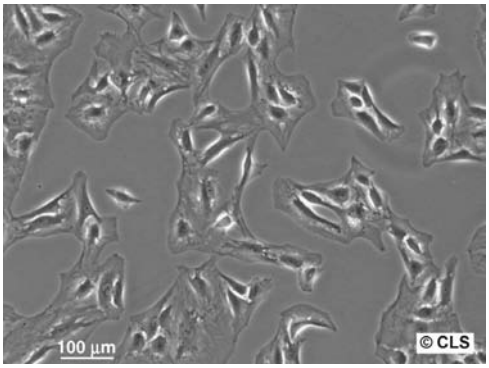
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	50 years
Tissue:	Bladder (urinary), carcinoma, GIII.
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	Established from the primary bladder carcinoma grading III of a 50-year-old male

Culture Conditions and Handling

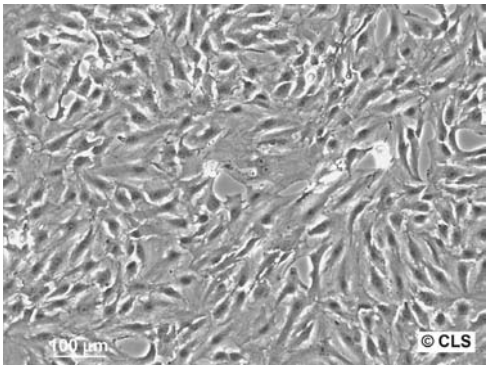
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

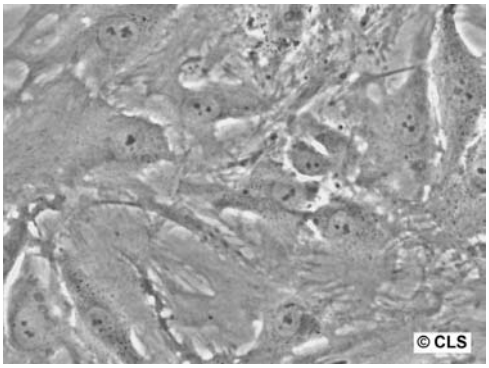
Tumorigenic:	Yes, in nude mice
DNA profile (STR):	Amelogenin: X,Y; CSF1PO: 7, 10; D3S1358: 16; D8S1179: 13; D5S818:10, 12; D7S820: 8, 9; D13S317:11, 12; D16S539:12; D18S51: 15, 17; D21S11: 32.2, 35.2; Penta D: 11, 13; Penta E: 13; FGA: 21, 23; TH01:8, 10; TPOX:11; vWA:15, 18
ATCC number:	Not available
CLS number:	300191



HBL-52, 100× Leica.



HBL-52, 100× Leica.



HBL-52, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HBL-52

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 47 years
Gender: Female
Tissue: Brain
Cell type: Meningioma
Growth properties: Monolayer
Description: The cell line was originally taken from a transitional meningioma grade I localized at the optic canal

Culture Conditions and Handling

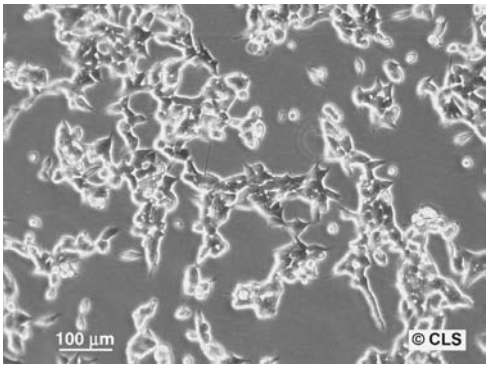
Culture medium: DMEM: Ham's F12 (1 : 1 mixture) supplemented with 2 mM L-glutamine and 10% fetal bovine serum may be used as an alternative
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Rinse with 0.025% trypsin/0.02% EDTA solution, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every three to five days
Split ratio: A ratio of 1 : 2 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

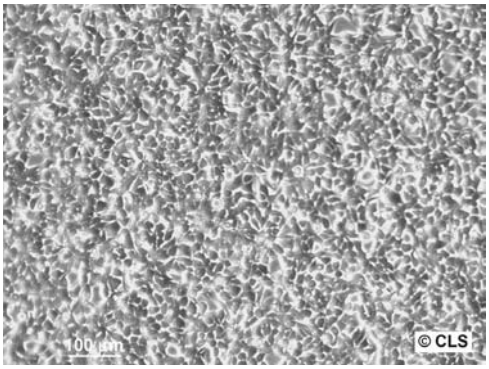
DNA profile (STR): Amelogenin: X, X; CSF1PO: 10, 13; D13S317: 11, 12; D16S539: 11, 13; D18S51: 15, 16; D21S11: 30, 31; D3S1358: 15, 15; D5S818: 12, 13; D7S820: 10, 11; D8S1179: 13, 13; FGA: 23, 26; Penta D: 9, 10; Penta E: 11, 12; THO1: 6, 9.3; TPOX: 8, 8; vWA: 16, 20
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300188

Further Reading

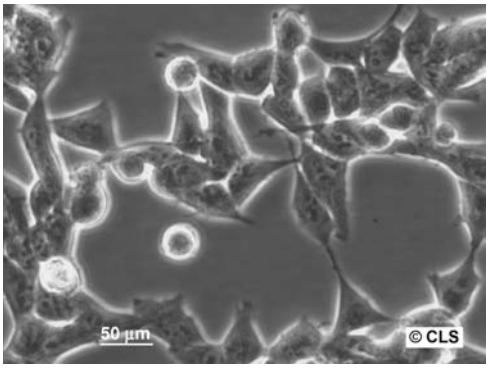
Akat, K., Mennel, H.-D., Kremer, P., Gassler, N., Bleck, C.K.E., and Kartenbeck, J. (2003) Molecular characterization of desmosomes in meningiomas and arachnoidal tissue. *Acta Neuropathol.*, **106**, 337–347.



HEK-293, 100× Leica.



HEK-293, 100× Leica.



HEK-293, 400× Leica.

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HEK-293

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Synonym(s): 293
Age: Fetus
Tissue: Kidney (transformed with adenovirus 5 DNA)
Morphology: Epithelial
Cell type: Embryonal kidney
Growth properties: Monolayer
Description: The cells contain transforming Adenovirus 5 DNA from both the left end of the viral genome. According to the GenTSV §5 Abs. 2 i.V.m. Anhang Teil B, Teil A II, and the statement of the ZKBS (Central committee for Biological Safety, Germany), the cell line 293 is categorized to Biosafety level 1. The 293 cell line is in accordance with an established human cell line, which contains parts of a viral genome but does not release infectious virus particles

Culture Conditions and Handling

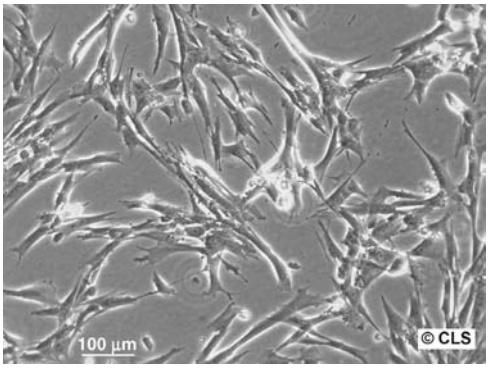
Culture medium: DMEM: Ham's F12 medium (1 : 1 mixture) supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

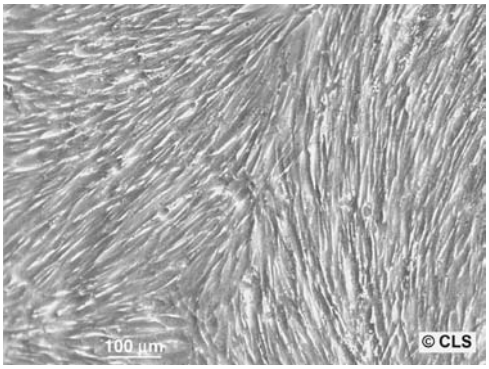
Karyotype: 2n = 46
DNA profile (STR): Amelogenin: X; CSF1PO: 11, 12; D13S317: 12, 14; D16S539: 9, 9; D18S51: 18; D21S11: 28, 30.2; D3S1358: 15, 17; D5S818: 8, 9; D7S820: 11, 12; D8S1179: 12, 14; FGA: 23; Penta D: 9, 10; Penta E: 7, 15; TH01: 7, 9.3; TPOX: 11; vWA: 16, 19
Receptors expressed: vitronectin
Applications: Transfection
ATCC number: CRl-1573
CLS number: 300192

Further Reading

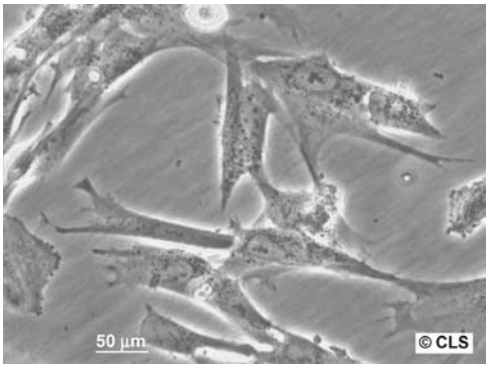
Graham, F.L., Smiley, J., Russell, W.C., and Naim, R. (1977) Characteristics of a human cell line transformed by DNA from human adenovirus type 5. *J. Gen. Virol.*, **36**, 59–74.



HEL-299, 100× Leica.



HEL-299, 100× Leica.



HEL-299, 400× Leica.

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HEL-299

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Black
Age: Embryo
Gender: Male
Tissue: Lung
Morphology: Fibroblast
Growth properties: Monolayer, adherent
Description: The capacity of this cell line to propagate in culture is limited. Senescence of the cells will start after about ten passages. M2 muscarinic receptor expression is down-regulated following protein-kinase C stimulation

Culture Conditions and Handling

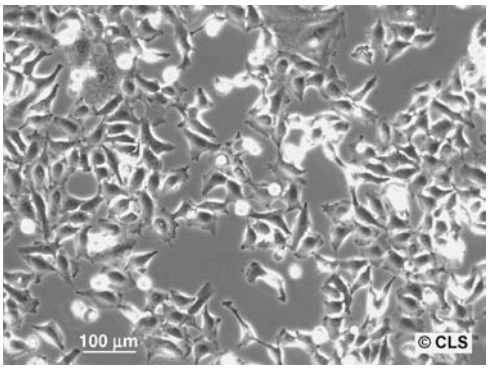
Culture medium: Minimum essential medium Eagle (Earl) supplemented with L-glutamine, 0.1 mM non-essential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add freshly prepared 0.025% trypsin/0.02% EDTA, incubate at 37 °C until the cells detach. Add medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

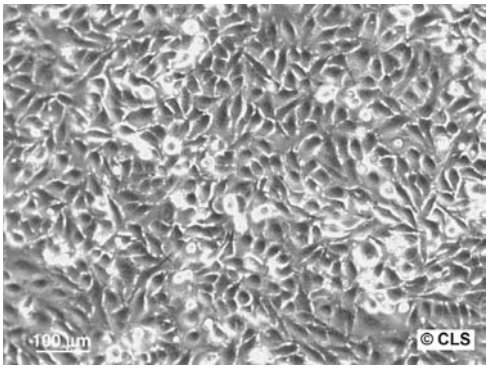
Karyotype: Normal human male; diploid, stable
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 7, 10; D3S1358: 16; D5S818: 11, 13; D7S820: 8, 11; D8S1179: 14, 15; D13S317: 11, 12; D16S539: 10, 11; D18S51: 14, 17; D21S11: 28, 31.6; FGA: 24, 25, Penta D: 2.2, 9; Penta E: 5, 12; THO1: 7; TPOX: 8, 12; vWA: 16
Receptors expressed: m2 muscarinic receptor
Isoenzymes: G6PD, A
Reverse transcriptase: Negative
Virus susceptibility: Vesicular stomatitis (Indiana); poliovirus 1
CLS number: 300193

Further Reading

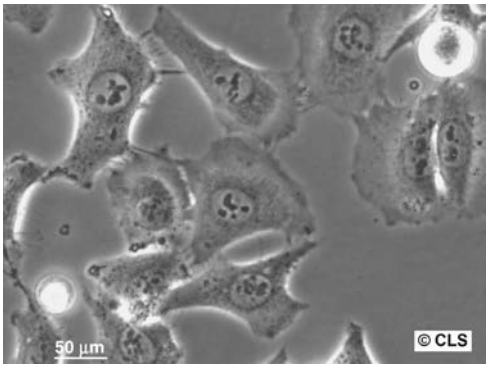
Peterson, W.D. Jr. *et al.* (1968) Glucose-6-phosphate dehydrogenase isoenzymes in human cell cultures determined by sucrose-agar gel and cellulose acetate zymograms. *Proc. Soc. Exp. Biol. Med.*, **128**, 772–776.



HeLa, 100× Leica.



HeLa, 100× Leica.



HeLa, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HeLa

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Black
Age:	31 years
Gender:	Female
Tissue:	Cervix
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Monolayer
Description:	HeLa cells have been reported to contain human papilloma virus 18 (HPV-18) sequences. P53 expression was reported to be low, and normal levels of pRB (retinoblastoma suppressor) are found. The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

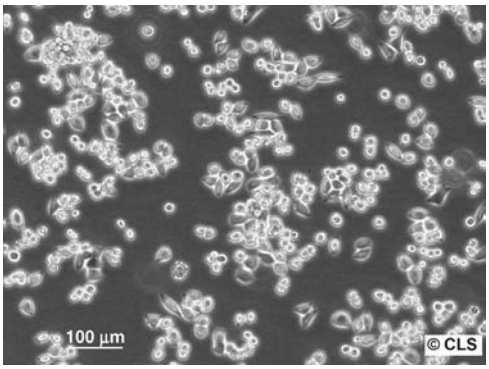
Culture medium:	Eagles's MEM with Earle's BSS supplemented with 2 mM L-glutamine, 0.1 mM non-essential amino acids, 1.0 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Rinse the cells with fresh EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA and incubate at 37 °C until the cells detach. Add fresh culture medium, centrifuge to remove trypsin and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	BSL 1, according to recommendations of the ZKBS (http://apps2.bvl.bund.de/cells)

Special Features of the Cell Line and Recommended Use

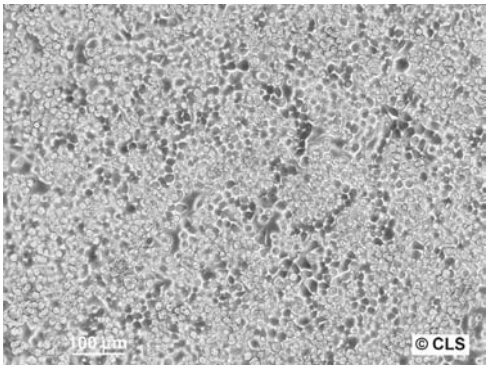
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 9, 10; D13S317: 13, 13.3; D16S539: 9, 10; D18S51: 16; D21S11: 27; D3S1358: 15, 18; D5S818: 11, 12; D7S820: 8, 12; D8S1179: 12, 13; FGA: 18, 21; Penta D: 8; Penta E: 7, 17; THO1: 7; TPOX: 8, 12; vWA: 16, 18
Isoenzymes:	G6PD, A
Reverse transcriptase:	Negative
Applications:	Transfection host
Products:	Keratin; lysophosphatidylcholine (lyso-PC) induces AP-1 activity and c-jun N-terminal kinase activity (JNK1) by a protein kinase C-independent pathway
ATCC number:	CCL-2
CLS number:	300194

Further Reading

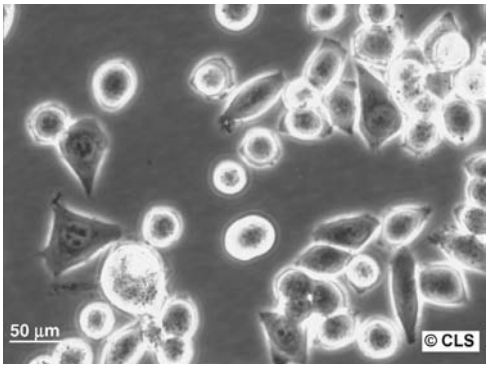
Gey, G.O., Coffman, W.D., and Kubicek, M.T. (1952) Tissue culture studies of the proliferative capacity of cervical carcinoma and normal epithelium. *Cancer Res.*, **12**, 264–265.



Hela-S3, 100× Leica.



Hela-S3, 100× Leica.



Hela-S3, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HeLa-S3

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Black
Gender: Female
Age: 31 years
Morphology: Epithelial
Tissue: Cervix
Cell type: Adenocarcinoma
Description: The HeLa-S3 cell line is a subclone of the HeLa cell line, as described by Puck TT and Fisher HW in 1956. This line can be adapted to grow in suspension. HeLa cells have been reported to contain human papilloma virus 18 (HPV-18) sequences

Culture Conditions and Handling

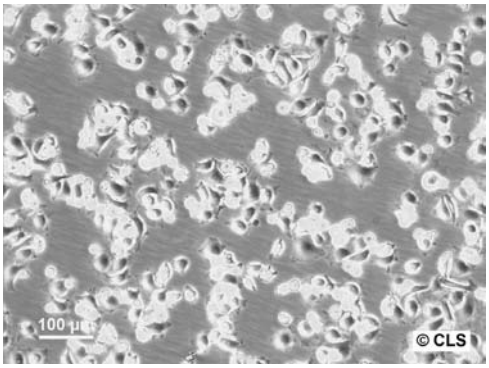
Culture medium: DMEM:Ham's F12 mixture (1 : 1) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove culture media and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh culture media, centrifuge to remove trypsin, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 10 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: BSL 1, according to recommendations of the ZKBS (http://apps2.bvl.bund.de/cells)

Special Features of the Cell Line and Recommended Use

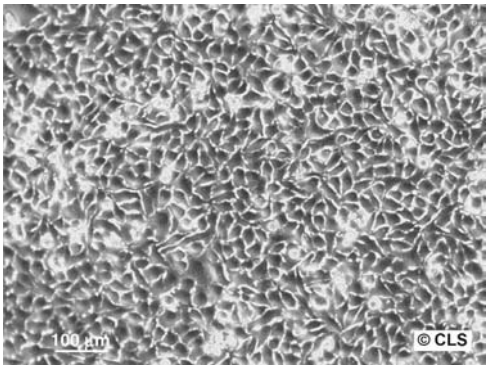
DNA profile (STR): Amelogenin: X; CSF1PO: 9, 10; D13S317: 13.3, 13.3; D16S539: 9, 10; D18S51: 16; D21S11: 27, 28; D3S1358: 15, 18; D5S818: 11, 12; D7S820: 8, 12; D8S1179: 12, 13; FGA: 18, 21; Penta D: 8, 15; Penta E: 7, 17; THO1: 7; TPOX: 8, 12; vWA: 16, 18
HeLa Markers: Yes
Isoenzymes: G6PD, A
Reverse transcriptase: Negative
Virus susceptibility: Poliovirus 1, 2, 3; vesicular stomatitis (Indiana); encephalomyocarditis; adenovirus 5
Products: Keratin
ATCC number: CCl-2.2
CLS number: 300384

Further Reading

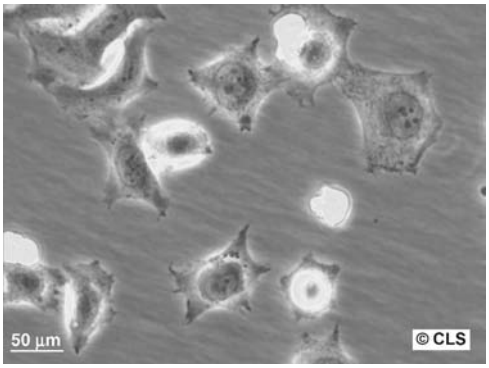
Puck, T.T. and Marcus, P.I. (1955) *Proc. Natl. Acad. Sci. USA*, **41**, 432–437.



Hep-2, 100× Leica.



Hep-2, 100× Leica.



Hep-2, 400× Leica.

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Hep-2

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Gender: Male
Tissue: Larynx
Cell type: Epidermoid carcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: The Hep-2 cell line has been described to originate from tumours which were produced in irradiated-cortisonised weanling rats after injection of epidermoid carcinoma tissue isolated from the larynx of a 56 year old male. STR (DNA)-profiling has revealed that the HEp-2 cell line is almost identical to the HeLa cell line. The cells are positive for keratin by immunoperoxidase staining.

Culture Conditions and Handling

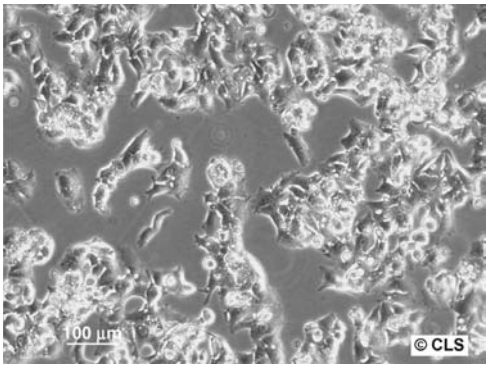
Culture medium: Minimum essential medium Eagle with Earle's BSS supplemented with 2 mM L-glutamine, 0.1 mM non-essential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin/0.02% EDTA solution, rinse and remove trypsin. Allow flask to sit at room temperature (or at 37 °C) until cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 10 is recommended
Fluid renewal: Two to three times weekly

Special Features of the Cell Line and Recommended Use

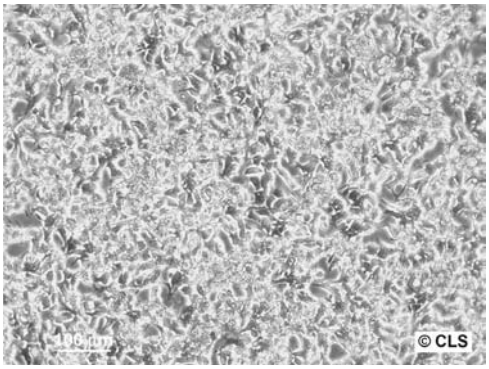
DNA profile (STR): Amelogenin: X; CSF1PO: 9, 10; D13S317: 12, 13.3; D16S539: 9, 10; D18S51: 16; D21S11: 27, 28; D3S1358: 15, 18; D5S818: 11, 12; D7S820: 8, 12; D8S1179: 12, 13; FGA: 18, 21; Penta D: 8, 15; Penta E: 7, 17; THO1: 7; TPOX: 8, 12; vWA: 16, 18
Biosafety level: 1
HeLa markers: Yes
Isoenzymes: G6PD, A
Reverse transcriptase: Negative
Products: Keratin
ATCC number: CCL-23
CLS number: 300397

Further Reading

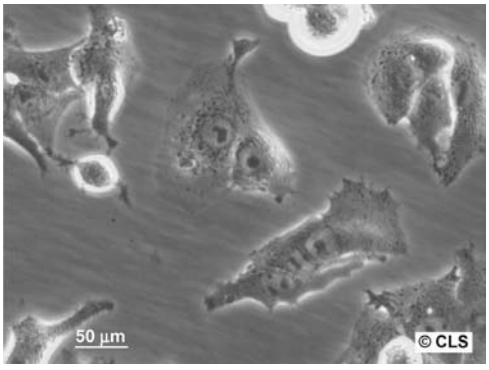
Toolan, H. (1954) Transplantable human neoplasms maintained in cortisone-treated laboratory animals: H.S. No. 1; H.Ep. No.1; H.Ep. No. 2; H.Ep. No. 3; and H.Emb.Rh. No. 1. *Cancer Res.*, **14**, 660–666.



Hep-G2, 100× Leica.



Hep-G2, 100× Leica.



Hep-G2, 400× Leica.

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Hep-G2

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	15 years
Tissue:	Liver
Cell type:	Hepatoblastoma (hepatocellular carcinoma)
Morphology:	Epithelial
Growth properties:	monolayer
Description:	Hep-G2 cells express 3-hydroxy-3-methylglutaryl-CoA reductase and hepatic triglyceride lipase activities. They demonstrate decreased expression of apoA-I mRNA and increased expression of catalase mRNA in response to gramoxone (oxidative stress). There is no evidence of a Hepatitis B virus genome

Culture Conditions and Handling

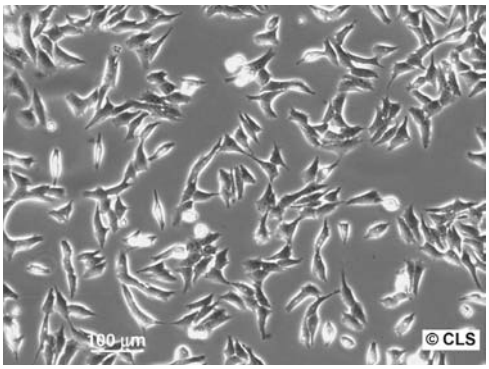
Culture medium:	Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA solution and allow the flask to sit at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Twice weekly
Doubling time:	Approx. 48 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

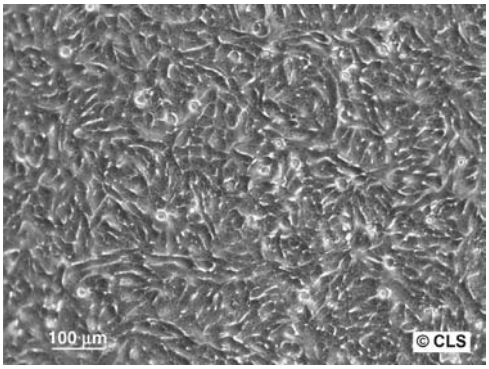
Karyotype:	Modal number = 55 (range = 50–60); has a rearranged chromosome 1
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 11; D13S317: 9, 13; D16S539: 12, 13; D18S51: 13, 14; D21S11: 29, 31; D3S1358: 15, 16; D5S818: 11, 13; D7S820: 10; D8S1179: 15, 16/17; FGA: 22, 25; Penta D: 9, 13; Penta E: 15, 20; THO1: 9; TPOX: 8,9; vWA: 17
Tumorigenic:	No
Receptors expressed:	Insulin; insulin-like growth factor II (IGF II)
Products:	Albumin; alpha-fetoprotein (alpha fetoprotein); alpha1 acid glycoprotein (alpha-1 acid glycoprotein); alpha1 antitrypsin (alpha-1-antitrypsin); alpha1 antichymotrypsin; (alpha-1-antichymotrypsin); alpha2 HS glycoprotein (alpha-2-HS- glycoprotein); alpha2 macroglobulin (alpha-2-macroglobulin); beta lipoprotein (beta-lipoprotein); ceruloplasmin; C4 and C3 activator; fibrinogen; haptoglobin; plasminogen; retinol binding protein (retinol-binding protein); transferrin
ATCC number:	HB-8065
CLS number:	300198

Further Reading

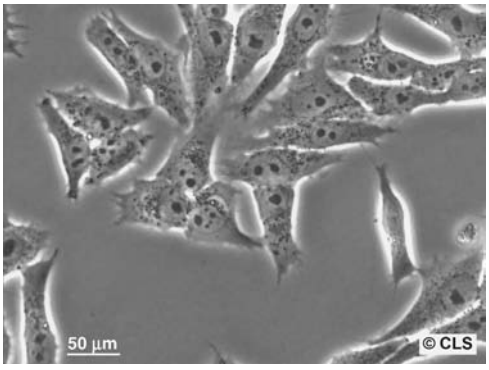
Aden, D.P. *et al.* (1979) Controlled synthesis of HBsAg in a differentiated human liver carcinoma-derived cell line. *Nature*, **282**, 615–616.



HGC-27, 100× Leica.



HGC-27, 100× Leica.



HGC-27, 400× Leica.

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HGC-27

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Tissue: Stomach
Morphology: Epithelial; polygonal, or short spindle-shaped
Cell type: Gastric carcinoma
Growth properties: Monolayer
Description: The HGC-27 cell line was established by culture of the metastatic lymph node from a gastric cancer patient diagnosed histological as undifferentiated carcinoma

Culture Conditions and Handling

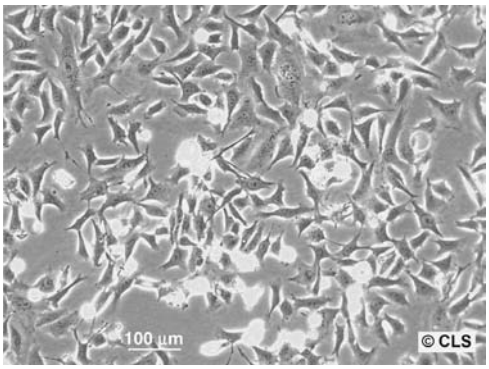
Culture medium: DMEM:F12 (1 : 1 mixture) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: split confluent cultures 1 : 3 to 1 : 6 that is, seeding at 2–4 × 10 000 cells cm^2 using trypsin/EDTA
Fluid renewal: Two to three times weekly
Doubling time: 17 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

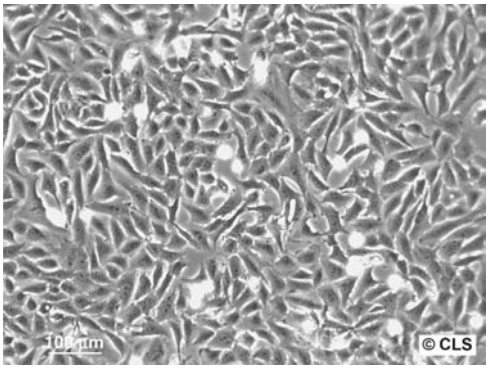
DNA profile (STR): Amelogenin: X, X; CSF1PO: 12; D13S317: 10, 11; D16S539: 10, 11; D18S51: 16, 17; D21S11: 30, 33, 34; D3S1358: 17; D5S818: 12; D7S820: 11, 12, 13; D8S1179: 7, 11, 16; FGA: 22; Penta D: 9, 13; Penta E: 18; THO1: 9; TPOX: 8; vWA: 14
Tumorigenic: Yes
Modal number: Mode of 109 and 110 chromosomes
ATCC number: Not available
CLS number: 300436

Further Reading

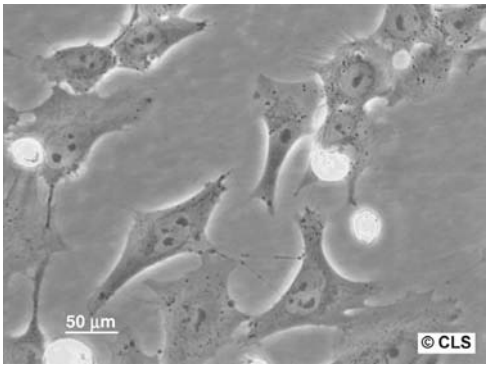
Akagi, T. and Kimoto, T. (1976) Human cell line (HGC-27) derived from the metastatic lymph node of gastric cancer. *Acta Med. Okayama*, **30** (3), 215–219.



HOS, 100× Leica.



HOS, 100× Leica.



HOS, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HOS

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 13 years
Gender: Female
Tissue: Bone
Morphology: A mixture of fibroblasts and epithelial-like cells
Cell type: Sarcoma, osteogenic
Growth properties: Monolayer
Description: HOS cells exhibit a flat morphology, low saturation density, low plating efficiency in soft agar and are sensitive to chemical and viral transformation. The cells express alkaline phosphatase under basal conditions

Culture Conditions and Handling

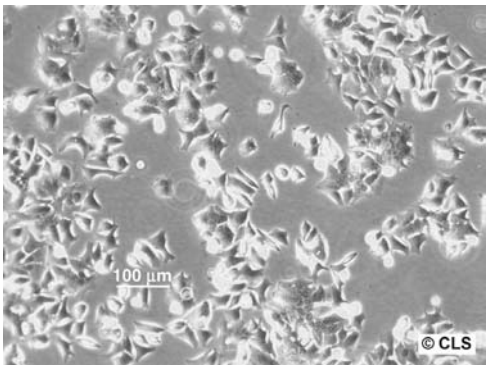
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1 mM non-essential amino acids (NEA) and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin solution for 2–4 min at 37 °C. Stop the enyme activity by adding fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

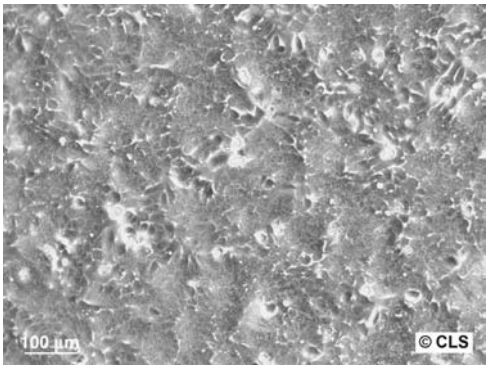
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 10, 13; D18S51: 14; D21S11: 31.2; D3S1358: 15; D5S818: 13; D7S820: 11, 12; D8S1179: 14; FGA: 24; Penta D: 9, 10; Penta E: 7, 12; THO1: 6; TPOX: 8, 11; vWA: 18
Isoenzymes: G6PD, B
ATCC number: CRL-1543
CLS number: 300449

Further Reading

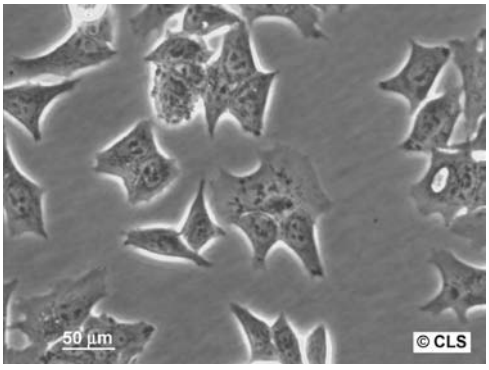
McAllister, R.M., Gardner, M.B., Greene, A.E., Bradt, C., Nichols, W.W., and Landing, B.H. (1971) Cultivation *in vitro* of cells derived from a human osteosarcoma. *Cancer*, **27**, 397–402.



HRT-18 (HCT-8), 100× Leica.



HRT-18 (HCT-8), 100× Leica.



HRT-18 (HCT-8), 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HRT-18 (HCT-8)

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 67 years
Gender: Male
Tissue: Colon
Morphology: Epithelial
Cell type: Colorectal adenocarcinoma, ileocecal
Growth properties: Monolayer
Description: The HCT-8 line is identical to the HRT-18 cell line. The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

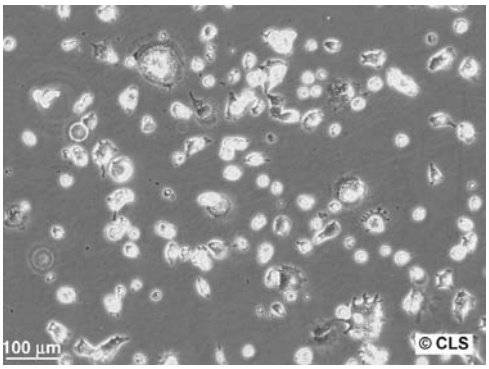
Culture medium: DMEM:Ham's F12 medium (1 : 1 mixture) supplemented with 2 mM L-glutamine and 5% fetal bovine serum
Subculture routine: Remove culture medium and rinse twice with 0.025% trypsin/0.02% EDTA in Hanks' BSS. Incubate with trypsin/EDTA solution for 10 to 15 min at 37 °C. Disperse the cells in fresh medium, remove trypsin by centrifugation, resuspend cells in fresh medium, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

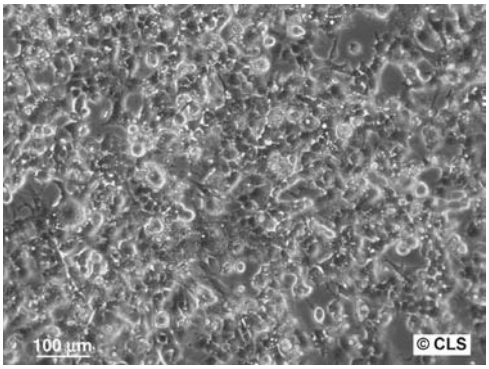
DNA profile (STR): Amelogenin: X, y; CSF1PO: 12; D13S317: 8, 11; D16S539: 12, 13; D18S51: 11, 17; D21S11: 29, 32.2; D3S1358: 17; D5S818: 13; D7S820: 10, 12; D8S1179: 15; FGA: 22; Penta D: 9, 14; Penta E: 7, 14; THO1: 7, 9.3; TPOX: 8, 11; vWA: 18, 19
Tumorigenic: Yes, in nude mice
Immunology: AK-1, 1; ES-D, 1–2; GLO-1, 2; G6PD, B; PGM1, 1; PGM3, 1; Me-2, 1
Reverse transcriptase: Negative
Products: carcinoembryonic antigen (CEA) 0.5 ng/10 exp6 cells/10 days; alkaline phosphatase; keratin
ATCC number: Not available
CLS number: 300210

Further Reading

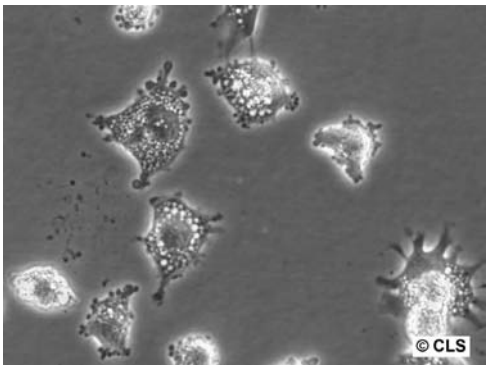
Tompkins, W.A. *et al.* (1974) Cultural and antigenic properties of newly established cell strains derived from adenocarcinomas of the human colon and rectum. *J. Natl. Cancer Inst.*, **52**, 1101–1110.



HS1-CLS, 100× Leica.



HS1-CLS, 100× Leica.



HS1-CLS, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HS1-CLS

Origin and General Characteristics

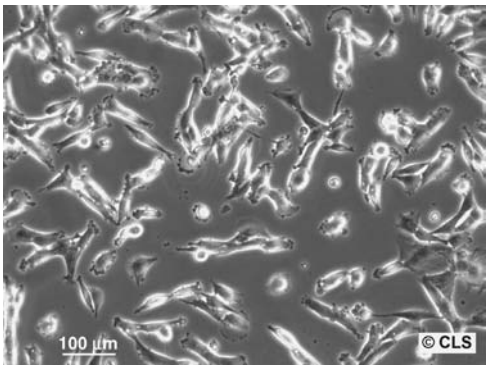
Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Sarcoma
Morphology: Fibroblast
Growth properties: Monolayer
Description: In vitro established from the primary sarcoma

Culture Conditions and Handling

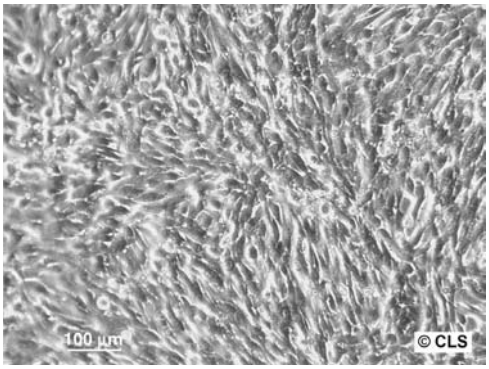
Culture medium: DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse using PBS without calcium / magnesium. Add Accutase and incubate at 37 °C for 10 min. Dislodge the cells and dispense into new flasks already containing fresh cell culture medium
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

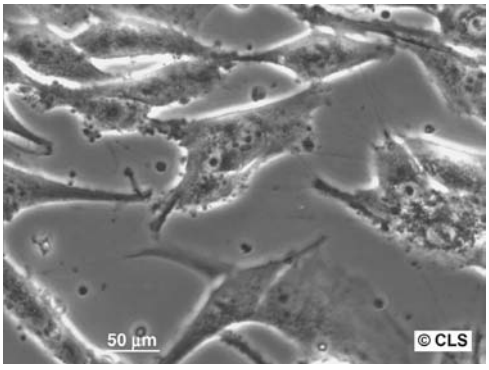
DNA profile (STR): Amelogenin: X,Y; CSF1PO: 11, 13; D13S317: 12; D16S539: 14; D18S51: 12, 14; D21S11: 28, 32; D3S1358: 17, 18; D5S818: 13, 16; D7S820: 11; D8S1179: 12, 13, 14; FGA: 21, 22; Penta D: 9; Penta E: 11, 13; THO1: 7; TPOX: 9; vWA: 17, 18
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300212



HS-683, 100× Leica.



HS-683, 100× Leica.



HS-683, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HS-683

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	76 years
Gender:	Male
Tissue:	Brain
Morphology:	Fibroblast
Cell type:	Glioma
Growth properties:	Monolayer
Description:	Hs 683 cells were isolated from explant cultures of a glioma taken from the left temporal lobe of a 76-year-old male Caucasian. Microvilli but no desmosomes were observed

Culture Conditions and Handling

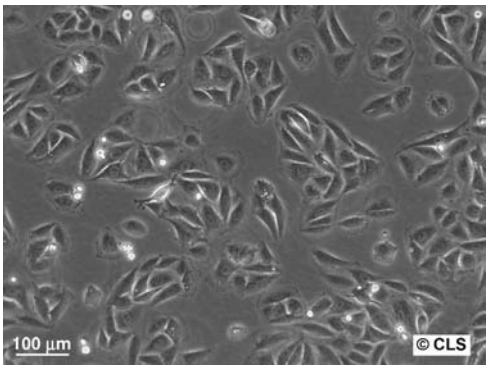
Culture medium:	Dulbecco's modified Eagle's medium (4.5 g/l glucose) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks
Split ratio:	A ratio of 1 : 4 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

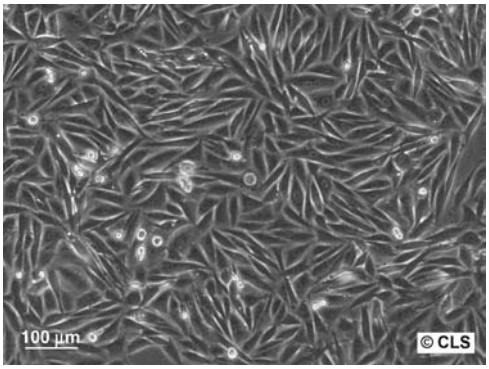
Karyotype:	(P15) hypotetraploid with mode = 88; range = 44 to 97; Y chromosomes present
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 9, 13; D13S317: 8, 12; D16S539: 9, 10; D18S51: 12, 14; D21S11: 27, 33.2; D3S1358: 14, 16; D5S818: 11, 12; D7S820: 11; D8S1179: 12, 13; FGA: 21.2, 22; Penta D: 13, 14; Penta E: 13, 15; THO1: 6, 8; TPOX: 8, 11; vWA: 18, 20
Tumorigenic:	No
Isoenzymes:	G6PD, B; PGM1, 1; PGM3, 1-2; ES-D, 1; Me-2, 2; AK-1, 1; GLO-1, 2; Phenotype Frequency Product: 0.0029
ATCC number:	HTB-138
CLS number:	300213

Further Reading

Owens, R.B. *et al.* (1976) Epithelial cell cultures from normal and cancerous human tissues. *J. Natl. Cancer Inst.*, **56**, 843–849.



HS-695T, 100× Leica.



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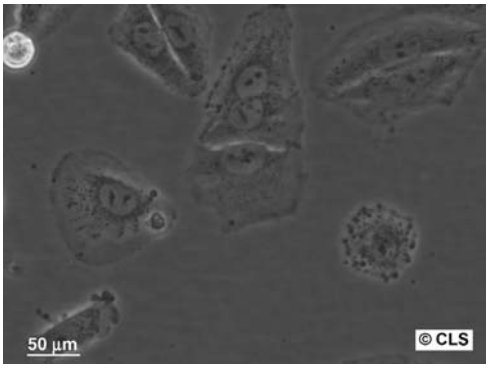

HS-695T, 400× Leica.

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HS-695T

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 26 years
Gender: Male
Morphology: Epithelial
Cell type: Amelanotic melanoma
Tissue: Skin (from metastatic site: lymph node)

Culture Conditions and Handling

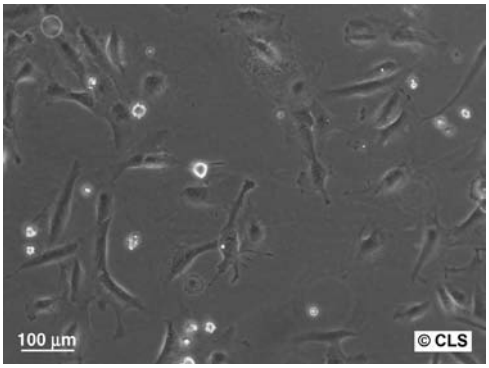
Growth Properties: Monolayer
Culture medium: Minimum essential medium (Eagle) in Earle's BSS with nonessential amino acids and sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin, 0.02% EDTA solution for 1–2 min, remove trypsin and let the culture sit at room temperature for 5 to 10 min. Add fresh medium, aspirate and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

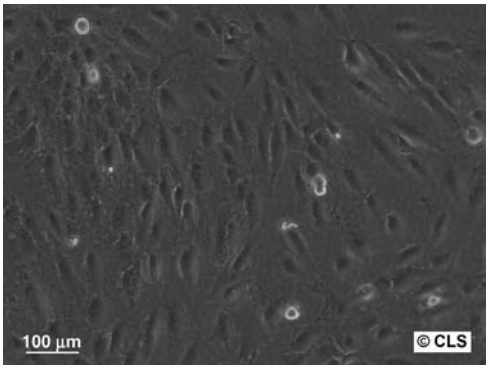
Karyotype: (P19–40) mode = 52; Y chromosome present
DNA profile (STR): Amelogenin: X,Y; CSF1PO: 11; D3S1358: 15; D5S818: 9; D7S820: 9,10; D8S1179: 13,15; D13S317: 12; D16S539: 9,13; D18S51: 18; D21S11: 29; FGA: 21,24; Penta D: 9/12; Penta E: 18,5; THO1: 6; TPOX: 8; vWA: 18
Tumorigenic: Yes, in immunosuppressed mice
Isoenzymes: G6PD, B; PGM1, 1; PGM3, 1; ES-D, 1; Me-2, 0; AK-1, 1; GLO-1, 1; Phenotype Frequency Product: 0.0427
ATCC number: HTB-137
CLS number: 300211

Further Reading

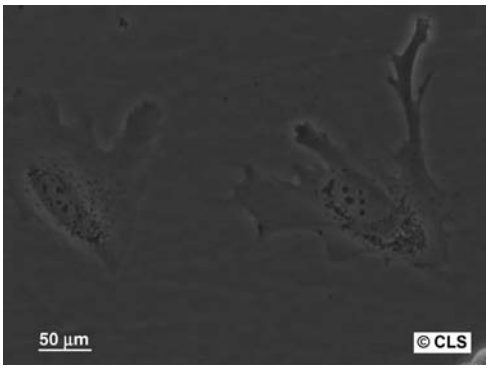
Creasey, A.A. *et al.* (1979) Biological properties of human melanoma cells in culture. *In Vitro*, **15**, 342–350.



HS-729, 100× Leica.



HS-729, 100× Leica.



HS-729, 400× Leica.

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HS-729

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	74 years
Tissue:	Soft tissue
Cell type:	Rhabdomyosarcoma
Morphology:	Fibroblast
Growth properties:	Monolayer

Culture Conditions and Handling

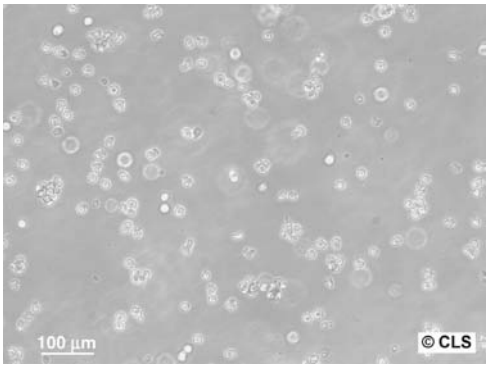
Culture medium:	Dulbecco's modified Eagle's medium supplemented with L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin and let the culture sit at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, resuspend in fresh cell culture media, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

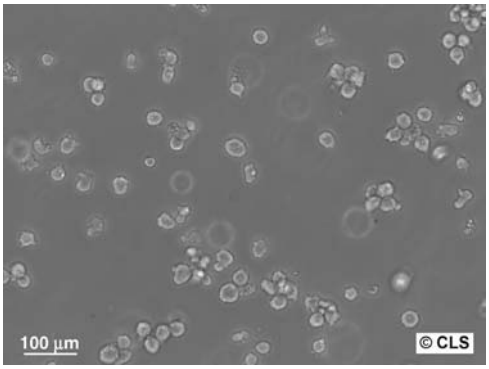
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10; D13S317: 11; D16S539: 11; D5S818: 11, 12 D7S820: 8, 9; TH01: 6, 9.3; TPOX:11; vWA: 16, 17; D3S1358: 17; D21S11: 28, 31.2; D18S51: 12 Penta E: 7, 12; Penta D: 9, 14; D8S1179: 10, 14; FGA: 19, 20
Isoenzymes:	G6PD, B
ATCC number:	HTB-153
CLS number:	300443

Further Reading

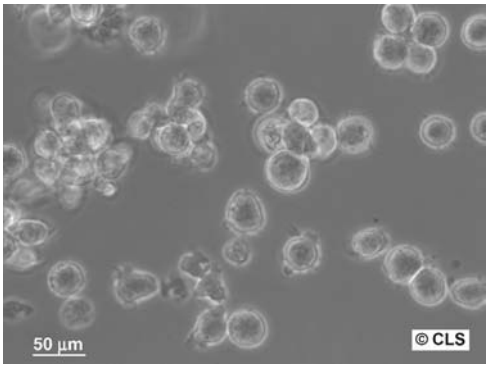
Shabahang, M., Buffan, A.E., Nolla, J.M., Schumaker, L.M., Brenner, R.V., Buras, R.R., Nauta, R.J., and Evans, S.R. (1996) The effect of 1, 25-dihydroxyvitamin D3 on the growth of soft-tissue sarcoma cells as mediated by the vitamin D receptor. *Ann. Surg. Oncol.*, **3** (2), 144–149.



HSB, 100× Leica.



HSB, 200× Leica.



HSB, 400× Leica.

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HSB

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Synonym(s): CCRF-HSB-2; HSB-2
Ethnicity: Caucasian
Age: 11.5 years
Gender: Male
Tissue: Blood, peripheral
Morphology: Lymphoblast
Cell type: T-lymphoblast; acute lymphoblastic leukemia
Growth properties: Suspension
Description: Derived from the same buffy coat preparation as CCL-120 (CCRF-SB) by serially transplanting into newborn syrian hamsters

Culture Conditions and Handling

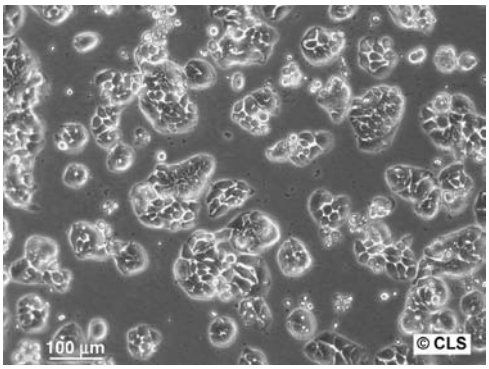
Culture medium: Iscove's modified Dulbecco's medium supplemented with L-glutamine and 10% fetal bovine serum. Alternatively, RPMI 1640 medium supplemented with L-glutamine and 10% fetal bovine serum may be used
Subculture routine: Remove medium and rinse using PBS without calcium/magnesium. Add Accutase and incubate at 37 °C for 10 min. Dislodge the cells and dispense into new flasks already containing fresh cell culture medium
Fluid renewal: Add fresh medium (10 to 20% by volume) every three to four days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

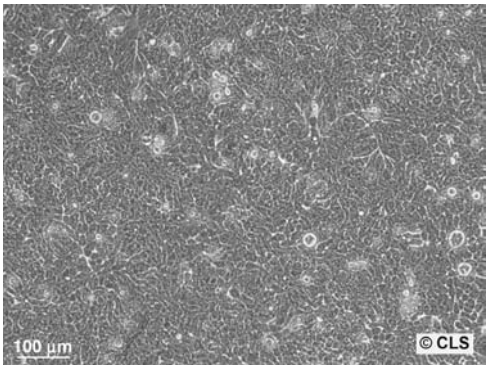
DNA profile (STR): Amelogenin: X; CSF1PO: 8, 12; D13S317: 10, 12; D16S539: 9, 13, 14; D18S51: 9, 13, 14; D21S11: 28, 29; D3S1358: 15, 16; D5S818: 11, 12; D7S820: 10, 14; D8S1179: 9, 15; FGA: 22, 23, 24; Penta D: 9, 9; Penta E: 6, 13; THO1: 8, 10; TPOX: 8, 8; vWA: 18, 19, 20
Tumorigenic: Yes, in nude mice
Antigen expression: HLA A1, A2, B12, B17, Cw2; CD5 (78%), CD7 (96%)
Isoenzymes: G6PD, B
Reverse transcriptase: Negative
ATCC number: Not available
CLS number: 300214

Further Reading

Anderson, M.D. (1967) Hospital and Tumor Inst. Monograph., 21, *Proc. Am. Assoc. Cancer Res.*, **8**, 1.



HT-29, 100× Leica.



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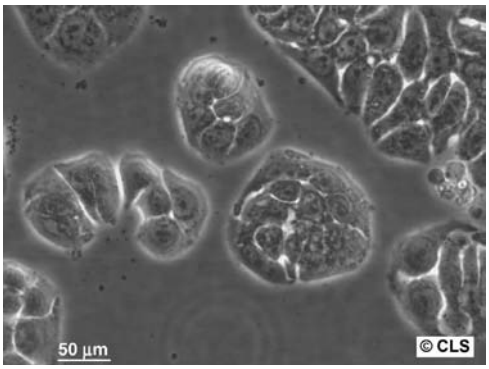

HT-29, 400× Leica.

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HT-29

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Female
Age:	44 years
Tissue:	Colon
Cell type:	Adenocarcinoma, colorectal
Morphology:	Epithelial
Growth properties:	Adherent

Culture Conditions and Handling

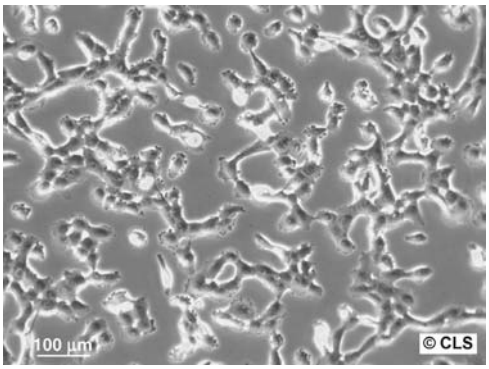
Culture medium:	DMEM medium supplemented with 4 mM glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin solution/0.02% EDTA and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, aspirate and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal:	Two to three times per week
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

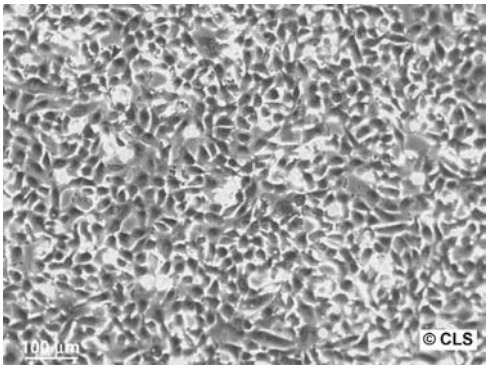
DNA Profile (STR):	Amelogenin: X, X; CSF1PO: 11, 12; D3S1358: 15, 17; D5S818: 11, 12; D7S820: 10; D8S1179: 10; D13S317: 11, 11; D16S539: 11, 12; D18S51: 13; D21S11: 29, 30; FGA: 20, 22; Penta D: 11, 13; Penta E: 14, 16; THO1: 6, 9; TPOX: 8, 9; vWA: 17, 19
Tumorigenic:	Yes, in nude mice
Oncogene:	myc +; ras +; myb +; fos +; sis +; p53 +; abl −; ros −; src−
Antigen expression:	Blood type A; Rh +; HLA A1, A3, B12, B17, Cw5
Immunology:	CD4-; cell surface expression of galactose ceramide (a possible alternative receptor for HIV)
Receptors expressed:	Urokinase receptor(u-PAR); vitamin D (moderate expression)
Isoenzymes:	Me-2, 1; PGM3, 1-2; PGM1, 1-2; ES-D, 1; AK-1, 1; GLO-1, 1-2; G6PD, B
Virus susceptibility:	Human immunodeficiency virus (HIV, LAV)
Products:	Secretory component of IgA; carcinoembryonic antigen (CEA); transforming growth factor beta binding protein; mucin; The p53 antigen is overproduced
ATCC number:	HTB-38
CLS number:	300215

Further Reading

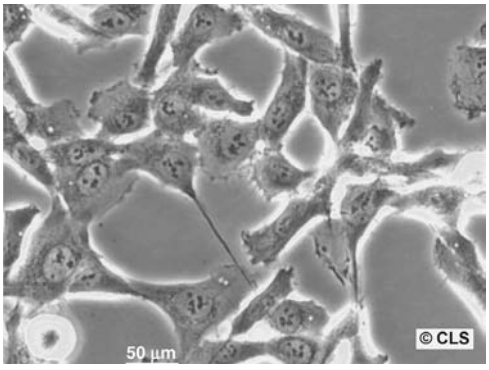
Fogh, J. (ed.) (1975) *Human Tumor Cells In Vitro*, Plenum Press, New York, pp. 115–159.



HT-1080, 100× Leica.



HT-1080, 100× Leica.



HT-1080, 400× Leica.

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HT-1080

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	35 years
Gender:	Male
Morphology:	Epithelial
Cell type:	Fibrosarcoma
Growth properties:	Monolayer
Description:	The cells contain an activated N-ras oncogene.

Culture Conditions and Handling

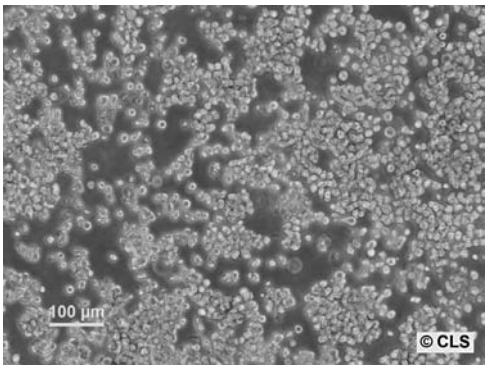
Culture medium:	Minimum Essential Medium supplemented with L-Glutamin, sodium pyruvate, NEAA and 10% fetal bovine serum
Subculture routine:	Remove culture medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin, 0.02% EDTA solution and remove. Allow flask to sit at 37 °C until the cells detach. Add fresh medium, aspirate, and dispense into new flasks.
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

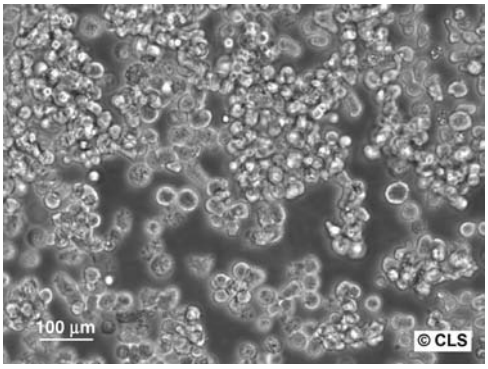
Karyotype:	Modal number: 2n = 46, pseudodiploid
DNA Profile (STR):	Amelogenin: X, Y; CSF1PO: 12; D13S317: 12, 14; D16S539: 9, 12; D18S51: 12, 18; D21S11: 28, 30; D3S1358: 16; D5S818: 11, 13; D7S820: 9, 10; D8S1179: 13, 14; FGA: 22, 25; Penta D: 9, 12; Penta E: 5, 15; THO1: 6; TPOX: 8; vWA: 14, 19
Tumorigenic:	Yes, in immunosuppressed mice
Oncogene:	ras+
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
Virus susceptibility:	Poliovirus 1; vesicular stomatitis (Indiana); RD114; feline leukemia virus (FeLV)
ATCC number:	HTB-40
CLS number:	300216

Further Reading

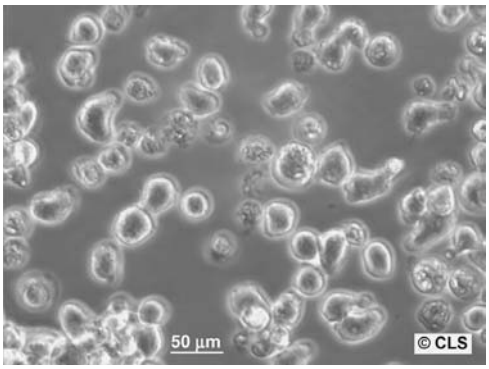
Rasheed, S. *et al.* (1974) Characterization of a newly derived human sarcoma cell line (HT-1080). *Cancer,* **33**, 1027–1033.



HuT-78, 100× Nikon.



HuT-78, 200× Nikon.



HuT-78, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

HuT-78

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	53 years
Tissue:	Blood (cutaneous lymphoma)
Cell-type:	T lymphocyte
Morphology:	Lymphoblast
Growth properties:	Suspension
Description:	Derived from the peripheral blood of a patient with Sézary syndrome. The line has the properties of a mature human T cell with helper/inducer activity. The growth rate is stimulated by IL-2. TNF alpha is an autocrine growth factor for Hut-78

Culture Conditions and Handling

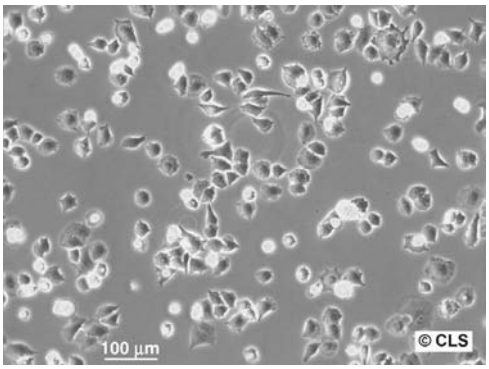
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Start cultures at 1×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Subculture by pipetting aliquots into new cell culture flasks containing the appropriate amount of cell culture media
Freeze medium:	CM-1 (CLS · Cell Lines Service)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

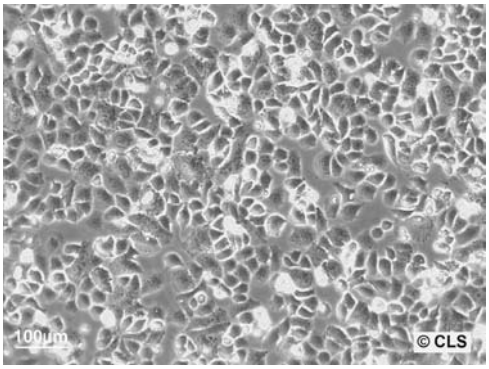
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 8, 12; D16S539: 11, 12; D18S51: 18; D21S11: 30; D3S1358: 15, 16; D5S818: 11, 12; D7S820: 8, 11; D8S1179: 12, 14; FGA: 21, 25; Penta D: 9; Penta E: 13, 15; THO1: 8, 9; TPOX: 8, 9; vWA: 14, 15
Antigen expression:	CD4
Receptors expressed:	interleukin-2 (interleukin 2, IL-2)
Products:	interleukin-2 (interleukin 2, IL-2); tumor necrosis factor alpha (TNF alpha)
ATCC number:	TIB 161
CLS number:	300338

Further Reading

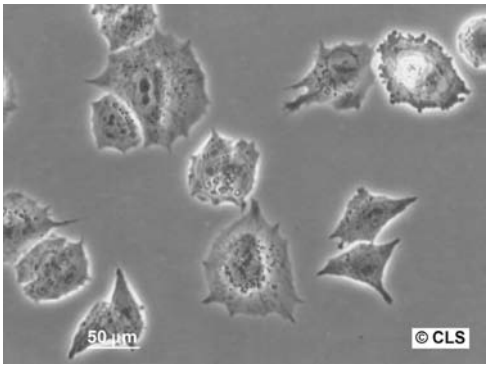
Gazdar, A.F. *et al.* (1980) Mitogen requirements for the *in vitro* propagation of cutaneous T-cell lymphomas. *Blood*, **55**, 409–417.



HuTu-80, 100× Leica.



HuTu-80, 100× Leica.



HuTu-80, 400× Leica.

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HuTu-80

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	53 year
Tissue:	Duodenum
Cell type:	Adenocarcinoma
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The cells express receptors for bombesin at up to 6000 sites per cell

Culture Conditions and Handling

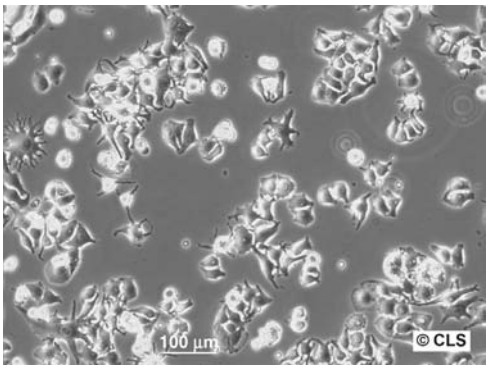
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with L-glutamine, 1% nonessential amino acids, sodium pyruvate, Hepes and 10% fetal bovine serum
Subculture routine:	Remove culture medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin, 0.02% EDTA solution and remove. Incubate at 37 °C until the cells detach. Add medium containing serum, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

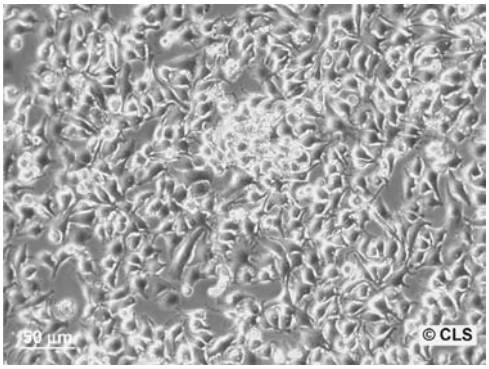
DNA profile (STR):	Amelogenin: X,Y; CSF1PO: 11, 13; D13S317: 8, 11; D16S539: 10, 11; D18S51: 14, 17; D21S11: 31, 32.2; D3S1358: 15, 17; D5S818: 12, 13; D7S820: 9, 11; D8S1179: 15; FGA: 21, 23; Penta D: 2.2; Penta E: 12, 18; THO1: 7; TPOX: 9, 11; vWA: 16, 18
Tumorigenic:	Yes, in nude mice; forms well differentiated papillary adenocarcinoma, (grade I)
Antigen expression:	Blood type B; Rh+
Receptors expressed:	Bombesin
Isoenzymes:	PGM3, 1-2; PGM1, 1-2; ES-D, 1; Me-2, 2; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0017
ATCC number:	HTB-40
CLS number:	300218

Further Reading

Schmidt, M. *et al.* (1977) Gastrointestinal cancer studies in the human to nude mouse heterotransplant system. *Gastroenterology*, **72**, 829–837.



IGR-1, 100× Leica.



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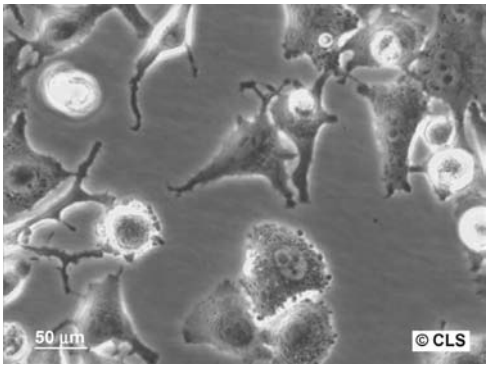

IGR-1, 400× Leica.

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IGR-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Gender:	Male
Age:	42 yr
Tissue:	Skin
Morphology:	Polygonal
Cell type:	Malignant melanoma
Growth properties:	Monolayer
Description:	The IGR-1 cell line has been established from the metastatic melanoma in a growing lymph node

Culture Conditions and Handling

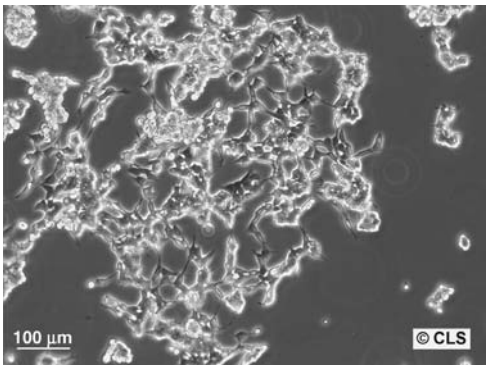
Culture medium:	DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine:	Remove culture medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin, 0.02% EDTA solution. Incubate at 37 °C until the cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Culture Conditions and Handling

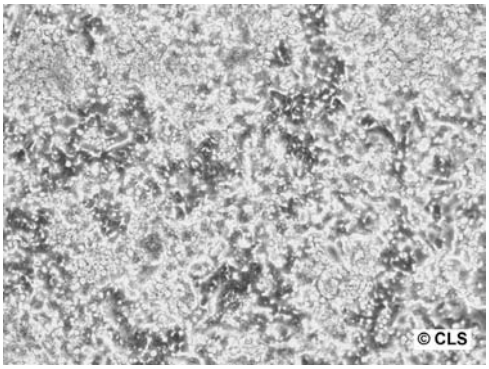
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10; D13S317: 13; D16S539: 11, 13; D18S51: 16; D21S11: 32.2; D3S1358: 14, 17; D5S818: 10, 11; D7S820: 10, 11; D8S1179: 10; FGA: 23, 24; Penta D: 10; Penta E: 7, 11; THO1: 7, 9.3; TPOX: 8; vWA: 17, 18
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300219

Further Reading

Aubert C *et al.* (1980) Tumorigenicity of human malignant melanocytes in nude mice in relation to their differentiation in vitro. *J. Natl. Cancer Inst.*, **64**, 1029–40.



IMR-32, 100× Leica.



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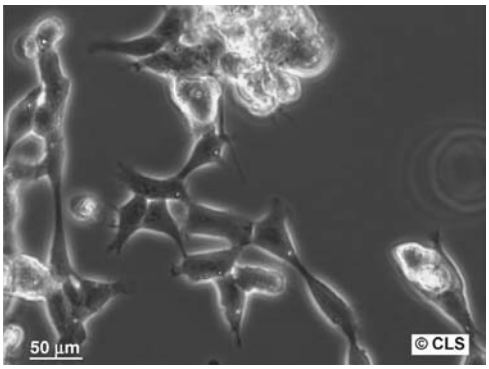

IMR-32, 400× Leica.

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IMR-32

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	13 months
Gender:	Male
Tissue:	Brain
Morphology:	Fibroblast
Cell type:	Neuroblastoma; neuroblast, fibroblast
Growth properties:	Monolayer
Description:	There are two cell types present. A small neuroblast-like cell is predominant, and the other one is a large hyaline fibroblast. This cell line can be propagated to >80 serial subcultures

Culture Conditions and Handling

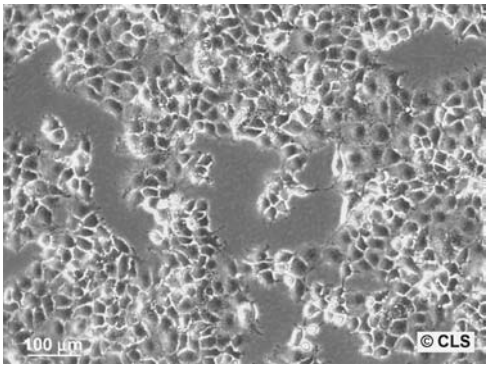
Culture medium:	Minimum essential medium Eagle (Earle) supplemented with L-glutamine, 1% non-essential amino acids, 1.0 mM sodium pyruvate and 10% heat-inactivated fetal bovine serum Alternatively, DMEM:Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum may be used.
Subculture routine:	Remove culture medium and rinse with PBS without calcium/magnesium. Add Accutase solution and incubate at 37 °C until the cells detach (10 minutes). Collect the cells and dispense into new flasks. A standard trypsin protocol may be used as well
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Every two to three days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

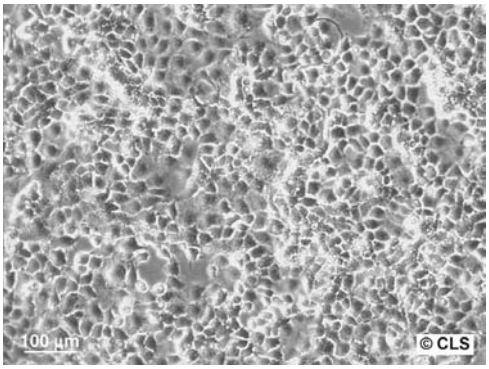
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 9, 9; D16S539: 8, 10; D18S51: 12, 15; D21S11: 30, 31; D3S1358: 16, 16; D5S818: 11, 12; D7S820: 9, 10; D8S1179: 13, 13; FGA: 21, 24; Penta D: 11, 12; Penta E: 7, 15; THO1: 7, 9.3; TPOX: 11, 11; vWA: 15, 15
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
Virus resistance:	Echovirus 11
Virus susceptibility:	Vesicular stomatitis (Indiana); herpes simplex; vaccinia; coxsackievirus B3; poliovirus 3 (poorly)
ATCC number:	CCL-127
CLS number:	300148

Further Reading

Tumilowicz, J.J. *et al.* (1970) Definition of a continuous human cell line derived from neuroblastoma. *Cancer Res.*, **30**, 2110–2118



JAR, 100× Leica.



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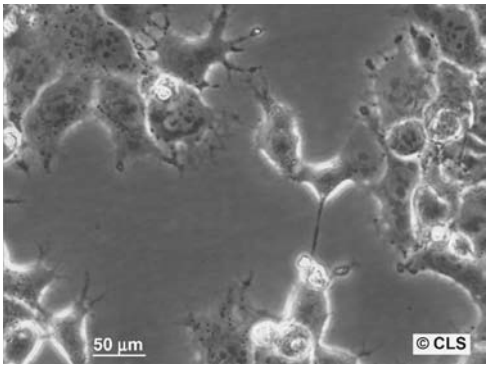

JAR, 400× Leica.

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JAR

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 24 years
Gender: Female
Tissue: Placenta
Morphology: Epithelial
Cell type: Choriocarcinoma
Growth properties: Monolayer
Description: The JAR line was established by R.A. Pattillo and associates directly from a trophoblastic tumor of the placenta. The JAR cell line exhibits an extremely complex Karyotype. Pseudotriploid to hypertriploid human cell line, modal chromosome number of 68. Only one normal X chromosome can be detected

Culture Conditions and Handling

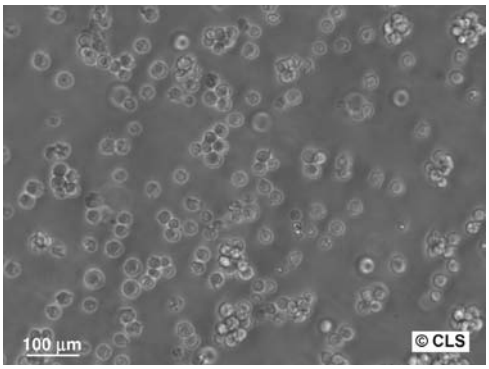
Culture medium: Medium 199 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin/0.02% EDTA in Earle's BSS without Ca^{2+} and Mg^{2+} for 5 min, disperse the cells with a curved Pasteur pipette and centrifuge at 800 rpm for 3 min. Remove trypsin, add fresh medium, resuspend the pellet and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

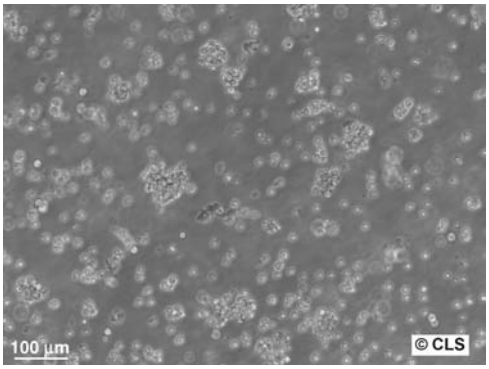
DNA profile (STR): Amelogenin: X/Y; CSF1PO: 7, 10; D13S317: 11; D16S539: 9, 10; D18S51: 13, 17; D21S11: 30; D3S1358: 14; D5S818: 10, 11; D7S820: 10, 11; D8S1179: 14, 16; FGA: 22; Penta D: 9, 11; Penta E: 10, 12; THO1: 6, 7; TPOX: 8, 11; vWA: 16, 18
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1-2; ES-D, 2; AK-1, 1; GLO-1, 1
Products: Estrogen; progesterone; human chorionic gonadotropin (hCG); human chorionic somatomammotropin (placental lactogen); hCG production averages 22.5 ng/ml after reculturing
ATCC number: HTB-144
CLS number: 300221

Further Reading

Pattillo, R.A. *et al.* (1971) The JAR cell line – continous human multihormone production and controls. *In Vitro*, **6**, 398–399.



Jurkat E6.1, 100× Leica.



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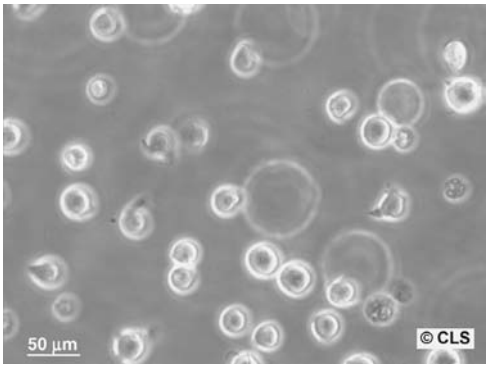

Jurkat E6.1, 400× Leica.

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Jurkat E6.1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Gender: Male
Tissue: Blood
Morphology: Lymphoblast
Cell type: T lymphocyte, acute T cell leukemia
Growth properties: Suspension
Description: This is the clone E6.1 of the Jurkat-FHCRC cell line. The cells produce large amounts of IL-2 after stimulation with phorbol esters and either lectins or monoclonal antibodies against the T3 antigen (both types of stimulants are needed to induce IL-2 production).

Culture Conditions and Handling

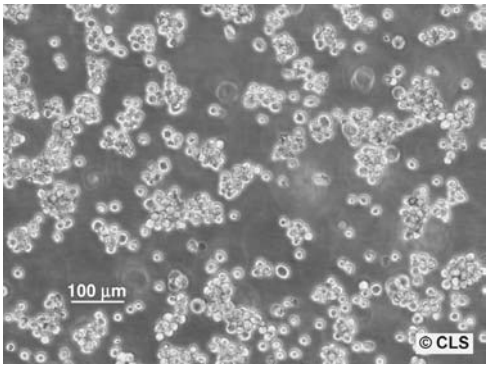
Culture medium: RPMI 1640 medium supplemented with L-glutamine, 4.5 g/l glucose, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Start cultures at 1×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Do not allow the cell concentration to exceed 1×10^6 cells/ml
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

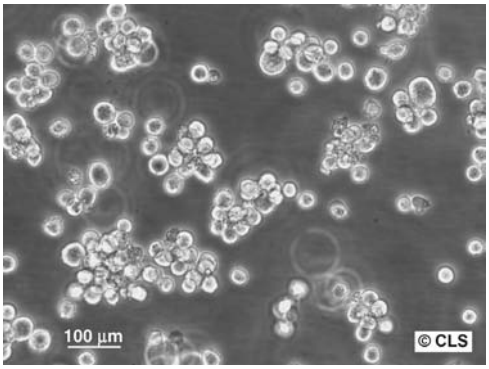
Karyotype: Modal number = 46; range = 41 to 47; the karyotype is 46,XY,-2,-18, del(2)(p21p23), del(18)(p11.2)
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 8, 12; D16S539: 11; D18S51: 13, 21; D21S11: 31.2, 33.2; D3S1358: 15, 15; D5S818: 9; D7S820: 8, 10; D8S1179: 13, 14; FGA: 20, 21; Penta D: 11, 13; Penta E: 10, 12; THO1: 6, 9.3; TPOX: 8, 10; vWA: 18
Antigen expression: CD3
Products: Interleukin-2 (interleukin 2, IL-2); gamma interferon
ATCC number: TIB 152
CLS number: 300223

Further Reading

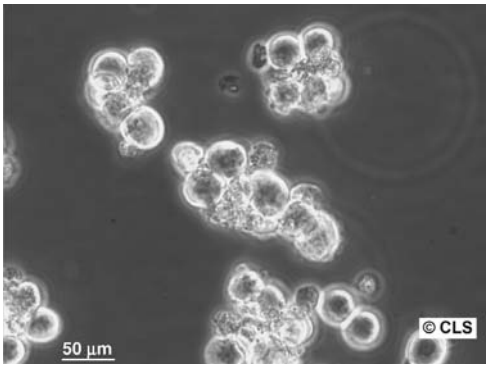
Gillis, S. and Watson, J. (1980) Biochemical and biological characterization of lymphocyte regulatory molecules. V. Identification of an interleukin 2-producing human leukemia T cell line. *J. Exp. Med.*, **152**, 1709–1719.



K-562, 100× Leica.



K-562, 200× Leica.



K-562, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

K-562

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Age:	53 year
Gender:	Female
Tissue:	Bone marrow
Morphology:	lymphoblast
Cell type:	Chronic myelogenous leukemia
Growth properties:	Suspension
Description:	The cells spontaneously differentiate into precursors of the erythroid, granulocytic and monocytic series. The line is EBNA negative

Culture Conditions and Handling

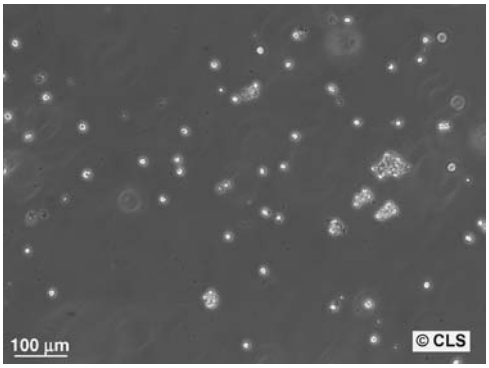
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Start new cultures at 1×10^5 viable cells/ml. Subculture when the cell concentration has reached 1×10^6 cells/ml. Prepare dilutions by transferring an appropriate volume of cell suspension into new flasks containing fresh cell culture medium
Fluid renewal:	Every 2 to 3 d
Biosafety level:	2

Special Features of the Cell Line and Recommended Use

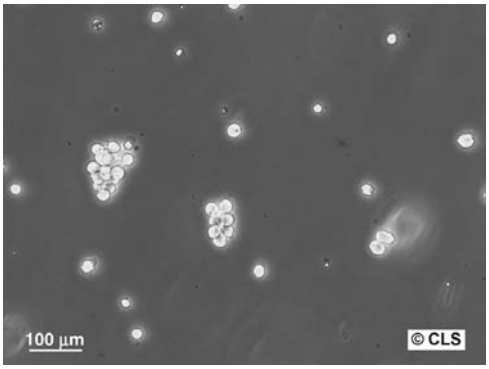
DNA profile (STR):	Amelogenin: X; CSF1PO: 9, 10; D13S317: 8; D16S539: 11, 12; D18S51: 15; D21S11: 29, 30; D3S1358: 16; D5S818: 11, 12; D7S820: 9, 11; D8S1179: 12; FGA: 21, 24; Penta D: 9, 13; Penta E: 5, 14; THO1: 9.3; TPOX: 8, 9; vWA: 16
Tumorigenic:	Yes, in nude mice
Antigen expression:	CD7 (25%)
Isoenzymes:	G6PD, B; AK-1, 1; ES-D, 1; GLO-1, 2; PGM1, 0; PGM3, 1; Me-2, 0
Reverse transcriptase:	Negative
Viruses:	Tested positive for SMRV (Squirrel Monkey RetroVirus) by PCR
ATCC number:	CCL 243
CLS number:	300224

Further Reading

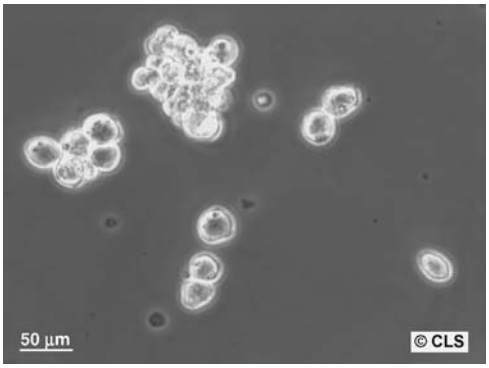
Lozzio, C.B. and Lozzio, B.B. (1975) Human chronic myelogenous leukemia cell-line with positive Philadelphia chromosome. *Blood*, **45**, 321–334.



Kasumi-1, 100× Leica.



Kasumi-1, 200× Leica.



Kasumi-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Kasumi-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Japanese
Age: 7 year
Gender: Male
Tissue: Blood
Morphology: Round cells showing marked variations in both size and nuclear cytoplasmic ratio.
Cell type: Myeloblast (AML-acute myeloid leukemia)
Growth properties: Suspension
Description: The Kasumi-1 cell line was derived from the peripheral blood of a 7-year-old Japanese boy with AML (FAB M2) in relapse after bone marrow transplantation. Kasumi-1 cells have the characteristics of myeloid and macrophage lineages; they differentiate into macrophage-like cells when cultured with TPA

Culture Conditions and Handling

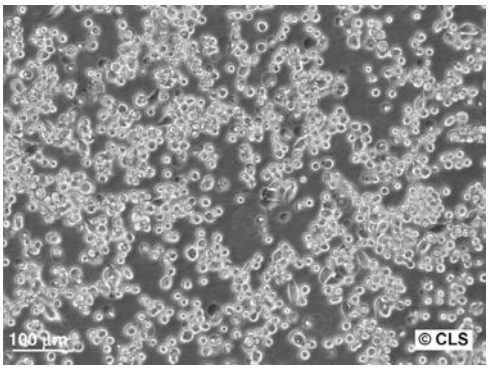
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10–20% fetal bovine serum
Subculture routine: Start cultures at 3×10^5 cells/ml and split 24 h later. Subculture the cells in transferring one part of cell suspension into new cell culture flasks already containing an appropriate volume of fresh cell culture medium. Maintain at a cell density between 1×10^5 and 6×10^5 cells/ml. Viability may drop when the cell density exceeds $1–2 \times 10^6$ cells/ml
Split ratio: A ratio of about 1 : 2 to 1 : 3 is recommended.
Fluid renewal: Add fresh medium (20 to 30% by volume) every two to three days
Doubling time: 40 to 45 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

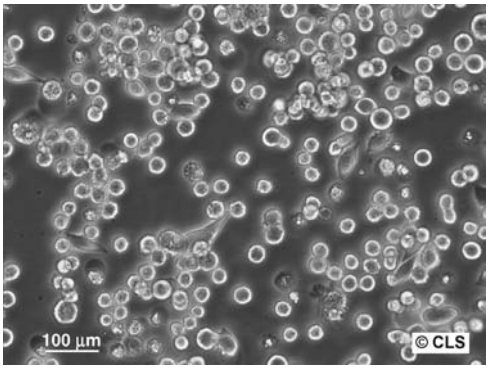
Karyotype: t(8;21) chromosome translocation
DNA profile (STR): Amelogenin: X; CSF1PO: 10, 12; D13S317: 11, 13; D16S539: 9, 12; D18S51: 15, 16; D21S11: 30, 31; D3S1358: 15, 17; D5S818: 9, 11; D7S820: 8, 11; D8S1179: 13, 14; FGA: 22, 24; Penta D: 12; Penta E: 11; TH01: 6, 9; TPOX: 8, 9; vWA: 14
Immunology: CD4+ (37.1%, coexpressed with CD34 and CD33), CD13 + (OKM13), CD15 + (LeuM1), CD33 +, CD34 + (MY10), CD38 + (OKT10, 50.1%), CD71 + (Nu-TERf), HLA-DR + (OKDR).
ATCC number: CRL-2724
CLS number: 300226

Further Reading

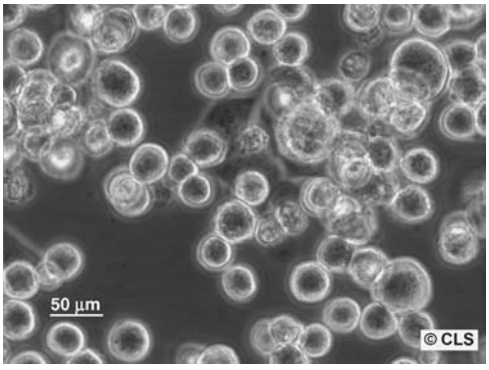
Asou, H. *et al.* (1991) Establishment of a human acute myeloid leukemia cell line (Kasumi-1) with 8;21 chromosome translocation. *Blood*, **77**, 2031–2036.



KATO-III, 100× Leica.



KATO-III, 200× Leica.



KATO-III, 400× Leica.

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KATO-III

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Asian
Age:	55 years
Gender:	male
Tissue:	Stomach (pleural effusion). From metastatic site: supraclavicular and axillary lymph nodes and Douglas cul-de-sac
Morphology:	Spherical
Cell type:	Gastric carcinoma
Growth properties:	Suspension/monolayer upon long-term cultivation

Culture Conditions and Handling

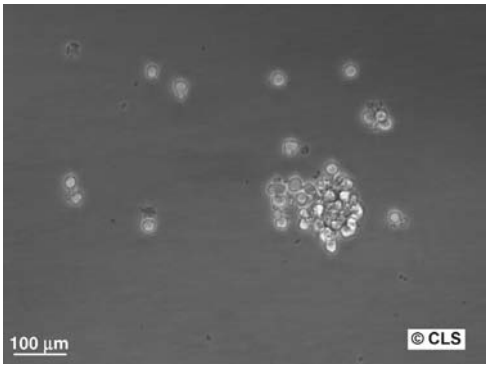
Culture medium:	Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Subculture by diluting aliquots in new flasks containing fresh medium. Collect adherent cells following short-terms incubation with Accutase
Split ratio:	A ratio of 1 : 2 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	36 h
Karyotype:	The stemline chromosome number is hypotetraploid with the 2S component occurring at 6.2%. Nine markers were common to most S metaphases, four markers were less frequent. One (occasionally 2 copies) homogenous staining region (HSR) (t(11;HSR) was present in all metaphases examined, but no double minutes (DM) were detected
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

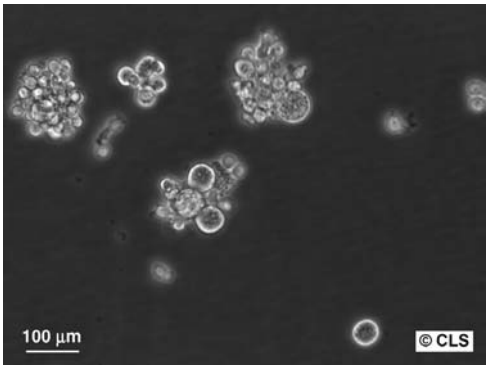
DNA profile (STR):	Amelogenin: X; CSF1PO: 7, 11; D13S317: 8, 12; D16S539: 10, 12; D18S51: 12, 12; D21S11: 30, 31; D3S1358: 15, 16; D5S818: 10, 11; D7S820: 8, 12; D8S1179: 13, 14; FGA: 23, 24; Penta D: 13, 14; Penta E: 13, 18, 19; THO1: 7, 9; TPOX: 11, 11; vWA: 14, 16
Tumorigenic:	Yes; in cheek pouches of anti thymocyte serum treated hamsters; not tumorigenic in nude mice
Antigen expression:	Blood type B; Rh+
Isoenzymes:	PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0742
ATCC number:	HTB 103
CLS number:	300381

Further Reading

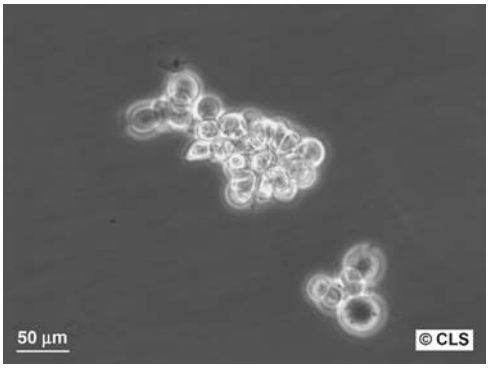
Sekiguchi, M. *et al.* (1978) Establishment of cultured cell lines derived from a human gastric carcinoma. *Jpn. J. Exp. Med.*, **48**, 61–68.



KG-1A, 100× Leica.



KG-1A, 200× Leica.



KG-1A, 400× Leica.

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KG-1A

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	59 year
Gender:	Male
Tissue:	Bone marrow
Morphology:	Myeloblast
Cell type:	Acute myelogenous leukemia
Growth properties:	Suspension
Description:	The KG-1A cell line is derived from the KG-1 cell line and is almost identical. They do not spontaneously differentiate to granulocyte and macrophage like cells, do not express DR and do not respond to colony stimulating factor (CSF). The line is EBNA negative

Culture Conditions and Handling

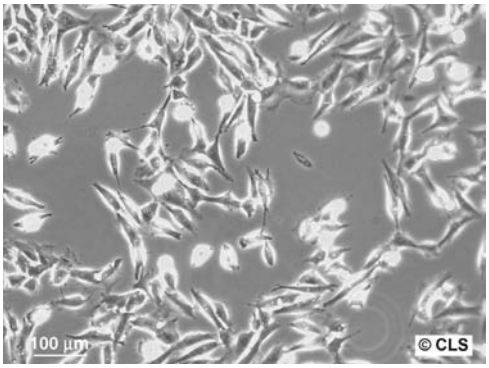
Culture medium:	Iscove's modified Dulbecco's medium supplemented with L-glutamine and 10–20% fetal bovine serum
Subculture routine:	Subculture by centrifugation with a 1 : 2 division of the cell pellet. Optimal cell density is no less than 1 × 10 exp5 cells/ml and no more than 1 × 10 exp6 cells/ml.
Split ratio:	A ratio of 1 : 2 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

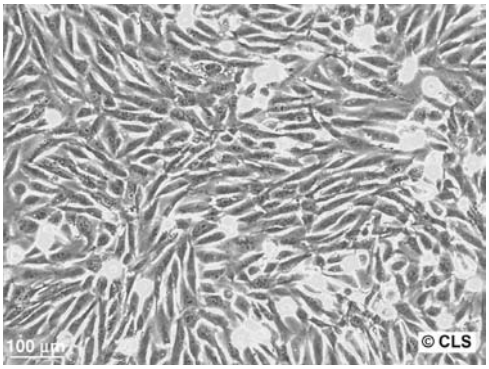
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 7; D13S317: 11, 12; D16S539: 11, 11; D18S51: 10.2, 18; D21S11: 28, 29; D3S1358: 15, 16; D5S818: 13; D7S820: 8, 10; D8S1179: 13, 14; FGA: 22; Penta D: 8, 9; Penta E: 7, 13; THO1: 7, 8; TPOX: 7, 9; vWA: 14, 19
Antigen expression:	HLA A30, A31, B35, Cw4
Isoenzymes:	G6PD, B; PGM1, 1-2; PGM3, 0; ES-D, 1; Me-2, 1; AK-1, 0; GLO-1, 2
Reverse transcriptase:	Negative
ATCC number:	CCL-246.1
CLS number:	300234

Further Reading

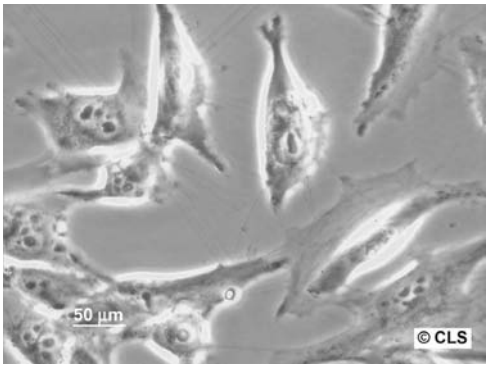
Koeffler, H.P. *et al.* (1980) An undifferentiated variant derived from the human acute myelogenous leukemia cell line (KG-1). *Blood*, **56**, 265–273.



KHOS-240S, 100× Leica.



KHOS-240S, 100× Leica.



KHOS-240S, 400× Leica.

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KHOS-240S

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 13 year
Gender: Female
Tissue: Bone
Morphology: Fibroblast
Cell type: Osteosarcoma; osteogenic
Growth properties: Monolayer
Description: The growth properties of KHOS-240S are similar to HOS (TE-85). The KHOS-240S does not represent a rescuable Kirsten murine sarcoma virus genome

Culture Conditions and Handling

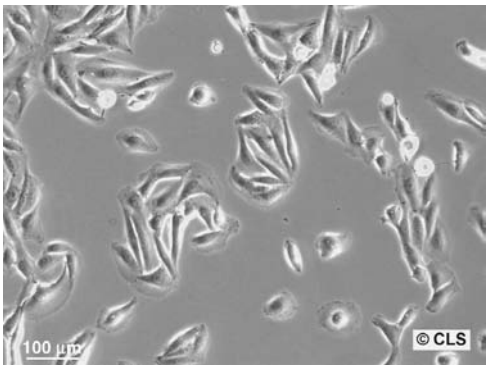
Culture medium: Minimum essential medium (Eagle) in Earle's BSS with nonessential amino acids, 90%; fetal bovine serum, 10%
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

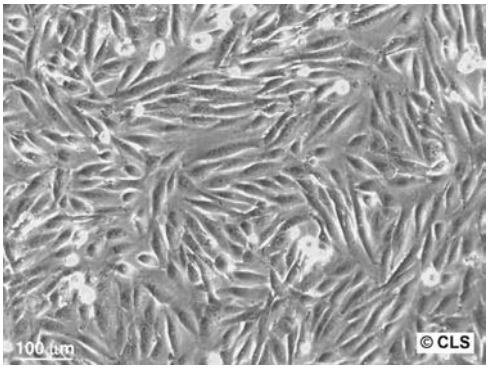
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 10, 13; D18S51: 14, 17; D21S11: 31.2, 32.2; D3S1358: 15; D5S818: 13; D7S820: 11, 12; D8S1179: 11, 14; FGA: 24; Penta D: 9, 10; Penta E: 7, 12; THO1: 6; TPOX: 11; vWA: 18
Tumorigenic: No
ATCC number: CRL-1545
CLS number: 300433

Further Reading

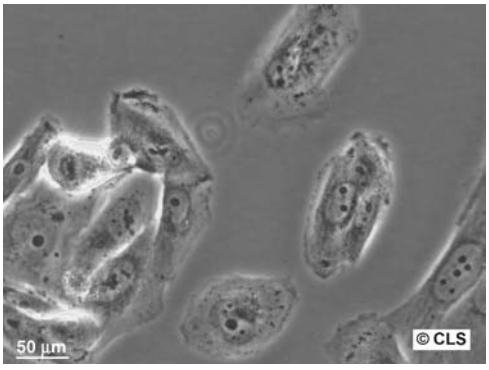
Cho, H.Y. *et al.* (1976) Revertants of human cells transformed by murine sarcoma virus. *Science*, **194**, 951–953.



KHOS-312H, 100× Leica.



KHOS-312H, 100× Leica.



KHOS-312H, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

KHOS-312H

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	13 years
Gender:	Bone
Tissue:	Female
Cell type:	Sarcoma, osteogenic
Growth properties:	Monolayer
Description:	The growth properties of KHOS-312H are similar to HOS (TE-85)

Culture Conditions and Handling

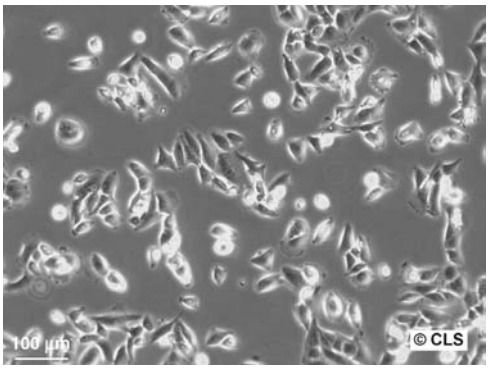
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with glutamine, 1% non-essential amino acids and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free pf calcium and magnesium. Add fresh 0.025% trypsin/0.02% EDTA solution, and incubate at 37 °C until cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks. Subculture at about 80–90% confluence
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

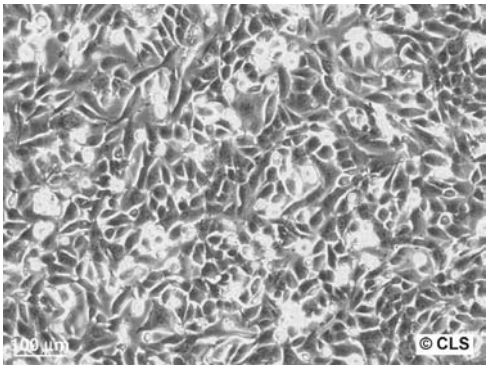
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 10, 13; D18S51: 14, 17; D21S11: 31.2, 32.2; D3S1358: 15; D5S818: 13; D7S820: 11, 12; D8S1179: 11, 14; FGA: 24; Penta D: 9, 10; Penta E: 7, 12; THO1: 6; TPOX: 11; vWA: 18
Tumorigenic:	no
ATCC number:	CRL-1546
CLS number:	300447

Further Reading

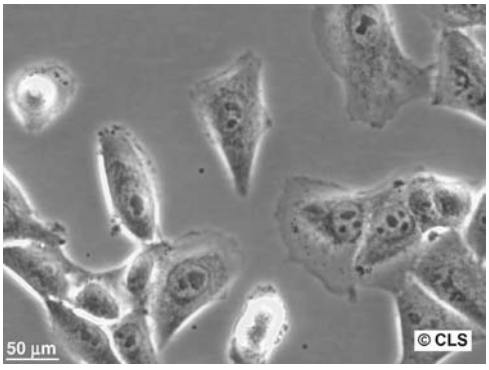
Cho, H.Y. *et al*. (1976) Revertants of human cells transformed by murine sarcoma virus. *Science*, **194**, 951–953.



KHOS-NP, 100× Leica.



KHOS-NP, 100× Leica.



KHOS-NP, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

KHOS-NP

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 13 years
Gender: Female
Tissue: Bone
Morphology: Epithelial
Cell type: Osteosarcoma
Growth properties: Monolayer
Description: This cell line was derived from the HOS cell line (TE-85) by transformation using Kirsten murine sarcoma virus (Ki-MSV). The cells exhibit a high saturation density, a high plating efficiency in soft agar and produce tumors in nude mice. The cells are useful producing MSV pseudotypes with various ecotropic and xenotropic murine leukemia viruses. Cells carry the Ki-MSV genome but do not produce infectious virus particles or viral antigens.

Culture Conditions and Handling

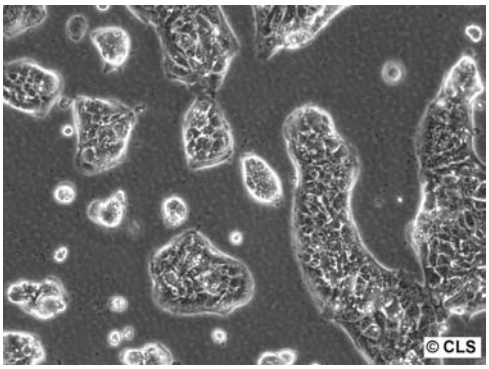
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with non-essential amino acids, L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin solution for 2–3 min, remove trypsin and let the culture sit at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks.
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

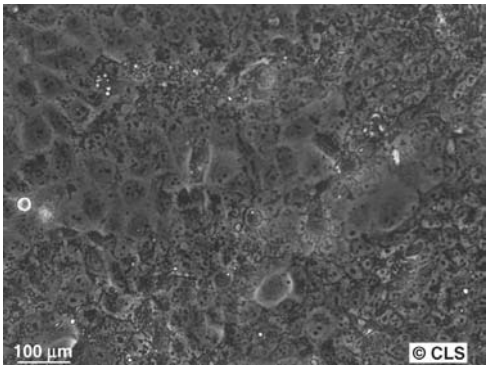
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 10, 13; D18S51: 17; D21S11: 31.2, 32.2; D3S1358: 15; D5S818: 13; D7S820: 11, 12; D8S1179: 11, 14; FGA: 24; Penta D: 9, 10; Penta E: 7, 12; THO1: 6; TPOX: 8, 11; vWA: 18
Tumorigenic: Yes, in nude mice
ATCC number: CRL-1544
CLS number: 300235

Further Reading

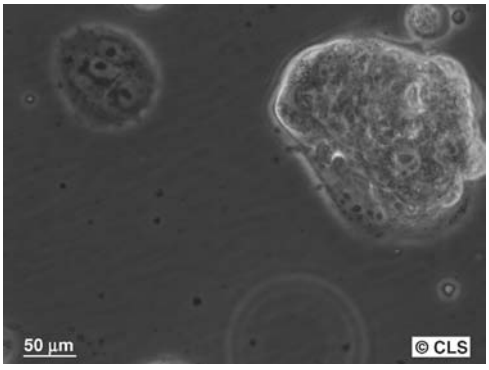
Rhim, J.S. *et al.* (1975) Non-producer human cells induced by murine sarcoma virus. *Int. J. Cancer*, **15**, 23–29.



LCLC-97TM1, 100× Leica.



LCLC-97TM1, 100× Leica.



LCLC-97TM1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

LCLC-97TM1

Origin and General Characteristics

Organism:	*Homo sapiens*
Ethnicity:	Caucasian
Morphology:	Epithelial
Tissue:	Carcinoma, large cell, lung
Growth properties:	Monolayer
Description:	*In vitro* established fro the primary lung large cell carcinoma

Culture Conditions and Handling

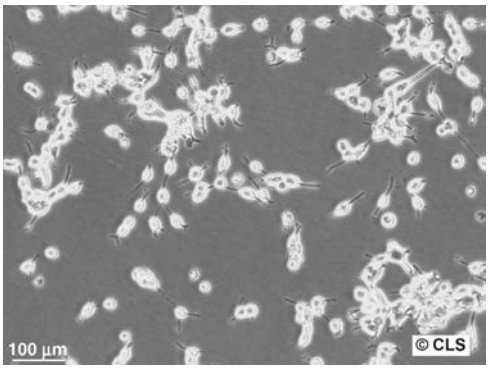
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS with non-essential amino acids, 90%, fetal bovine serum, 10%
Subculture routine:	Remove medium, add fresh 0.025% trypsin, 0.02% EDTA for several minutes, remove trypsin and let the culture sit at 37 °C for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks.
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

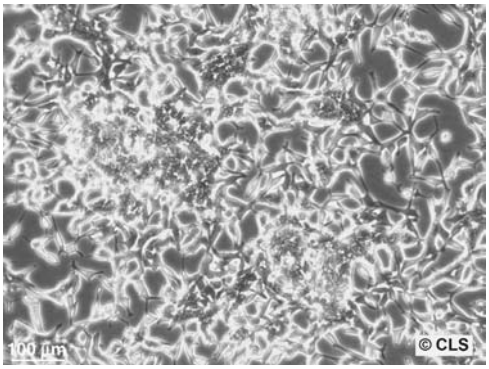
Tumorigenic:	Yes, in nude mice
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 10, 11; D13S317: 11, 13; D16S539: 12, 13; D5S818: 12, 11; D7S820: 10, 11; THO1: 8; TPOX: 8, 11; vWA: 19, 20; D3S1358: 15; D21S11: 27, 30; D18S51: 16; Penta E: 15; Penta D: 12,15; D8S1179: 14; FGA: 23
Reverse transcriptase:	Negative
ATCC number:	Not available
CLS number:	300409

Further Reading

Bepler, G. *et al.* (1988) Characterization of the state of six newly established human non-small-cell lung cancer cell lines. *Differentiation*, **37** (2), 158–171.



LnCaP, 100× Leica.



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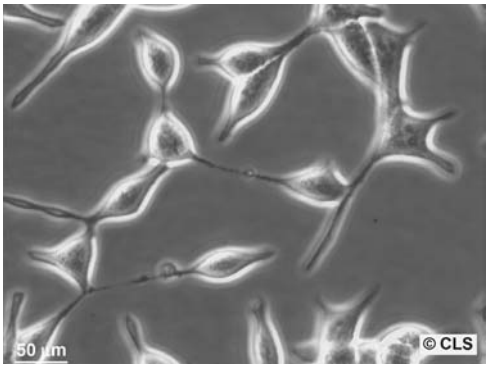


LnCaP, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

LnCaP

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	50 years
Gender:	Male
Tissue:	Prostate (from metastatic site: left supraclavicular lymph node)
Morphology:	Epithelial
Cell type:	Carcinoma
Growth properties:	Clusters; lightly adherent
Description:	This cell line was established from a metastatic lesion of human prostatic adenocarcinoma

Culture Conditions and Handling

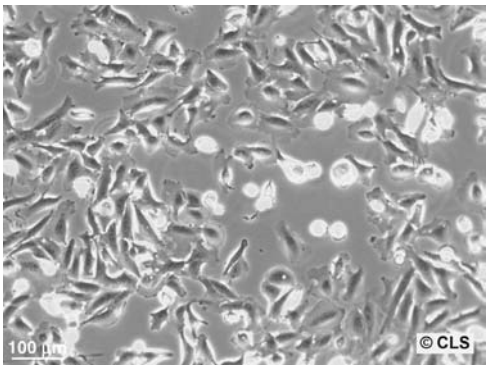
Culture medium:	Minimum Essential medium (Eagle) medium supplemented with 2 mM L-glutamine, 1% NEAA, 1 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse the monolayer with 0.02% EDTA/PBS. Add fresh 0.025% trypsin/0.02% EDTA/PBS solution and incubate until the cells detach. Add complete medium, remove trypsin by centrifugation and dispense into new flasks. Detaching the cells using Accutase, 10 minutes at 37 °C, may be applied
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Twice weekly
Doubling time:	60 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

Karyotype:	Pseudodiploid male; seven marker chromosomes; modal number = 46; range = 33 to 91
DNA Profile (STR):	Amelogenin: X, X; CSF1PO: 10, 11; D13S317: 10, 12; D16S539: 11; D18S51: 11, 12; D21S11: 29, 31.2; D3S1358: 16; D5S818: 11,12; D7S820: 9.1,10.3; D8S1179: 12, 14; FGA: 19, 20; Penta D: 12, 12.4; Penta E: 12, 16; THO1: 9; TPOX: 8,9; vWA: 16, 18
Tumorigenic:	yes, in nude mice
Modal number:	76 to 91
Receptors expressed:	Androgen; estrogen
Products:	Human prostatic acid phosphatase; prostate specific antigen
ATCC number:	CRL-1740
CLS number:	300265

Further Reading

Horoszewicz, J.S. *et al.* (1980) The LNCaP cell line – a new model for studies on human prostatic carcinoma. *Prog. Clin. Biol. Res.*, **37**, 115–132.



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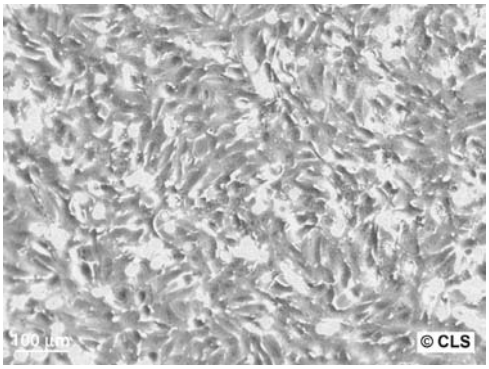

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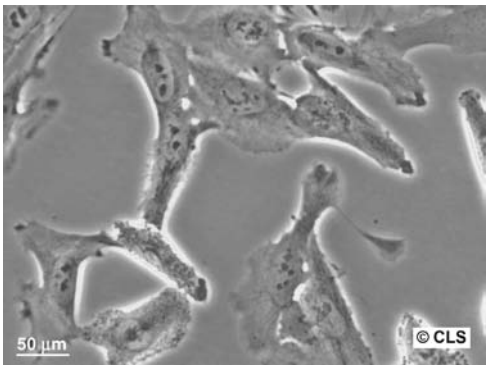


LXF-289, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

LXF-289

Origin and General Characteristics

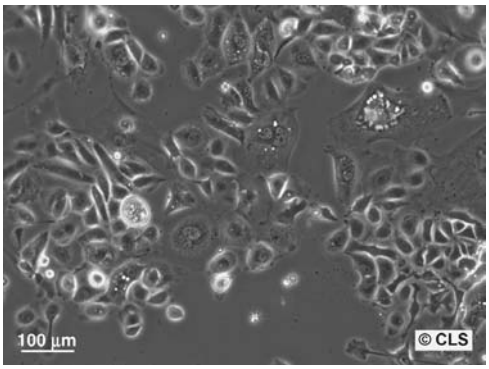
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	62 years
Gender:	Male
Tissue:	Lung
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Monolayer
Description:	*In vitro* established from the primary lung adenocarcinoma of a 62 yr-old male

Culture Conditions and Handling

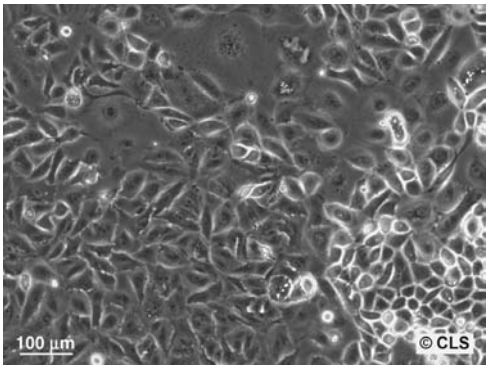
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% non- essential amino acids and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS without calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

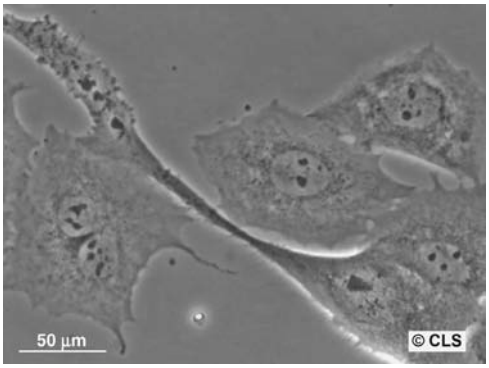
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11; D13S317: 11; D16S539: 9; D18S51: 16, 18; D21S11: 36; D3S1358: 15, 17; D5S818: 11, 12; D7S820: 10, 11; D8S1179: 10, 16; FGA: 22; Penta D: 11; Penta E: 10, 12; THO1: 7, 9; TPOX: 8, 9; vWA: 18, 18
Tumorigenic:	Yes, in nude mice
Immunology:	Cytokeratine 8, 18, positive; Desmoplakin positive; Vimentin positive
Reverse transcriptase:	Negative
ATCC number:	Not available
CLS number:	300269



MA-CLS-2, 100× Leica.



MA-CLS-2, 100× Leica.



MA-CLS-2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MA-CLS-2

Origin and General Characteristics

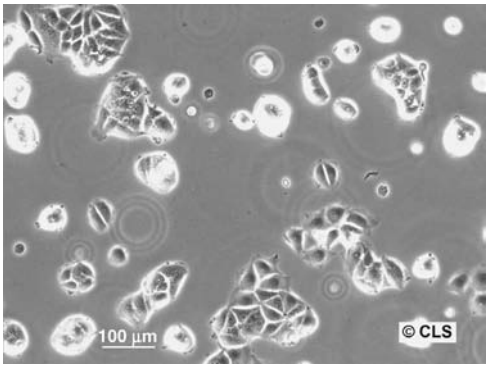
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Female
Age:	47 years
Morphology:	Epithelial
Tissue:	Breast
Cell type:	Mammary gland; carcinoma, metastatic
Growth properties:	Monolayer
Description:	The MA-CLS-2 cell line was established from the pleural effusion of a 47-year-old female in 1998 pT1 NO GII

Culture Conditions and Handling

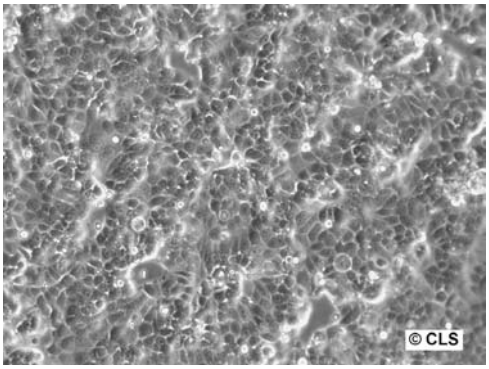
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Collect the cells and dispense into new flasks. A standard trypsinization procedure may be used as well
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X, X; CSF1PO: 11; D13S317: 11; D16S539: 11; D18S51: 15; D21S11: 29; D3S1358: 14, 18; D5S818: 11; D7S820: 8, 9; D8S1179: 13; FGA: 24; Penta D: 9, 13; Penta E: 13; THO1: 7; TPOX: 8; vWA: 17, 18
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300271



MCF-7, 100× Leica.



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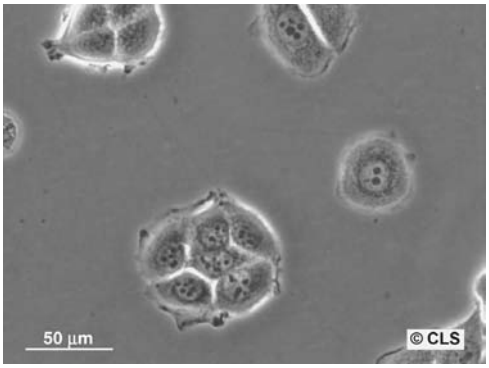


MCF-7, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MCF-7

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	69 years
Gender:	Female
Tissue:	Breast
Morphology:	Epithelial-like
Cell type:	Adenocarcinoma
Growth properties:	Monolayer
Description:	The MCF-7 cell line was established from the pleural effusion of a patient suffering from a breast adenocarcinoma. The MCF-7 line retains several characteristics of differentiated mammary epithelium including the ability to process estradiol via cytoplasmic estrogen receptors and the capability of forming domes.

Culture Conditions and Handling

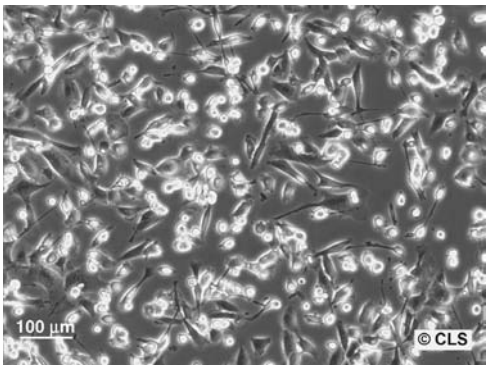
Culture medium:	DMEM:Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

Tumorigenic:	Yes, in nude mice
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 11; D16S539: 11, 12; D18S51: 14; D21S11: 30D5S818: 12; D3S1358: 16D7S820: 8, 9; D8S1179: 10, 14; FGA: 23, 25; Penta D: 12; Penta E: 7, 12; THO1: 6; TPOX: 9, 12; vWA: 14,15
Oncogene:	Wnt7h +; Tx-4
Antigen expression:	Blood type O; Rh+
Receptors expressed:	Wild-type and variant estrogen receptors
Isoenzymes:	PGM3, 1; PGM1, 1-2; ES-D, 1-2; AK-1, 1; GLO-1, 1-2; G6PD, B
Products:	Insulin-like growth factor binding proteins (IGFBP) BP-2; BP-4; BP-5
ATCC number:	HTB 22
CLS number:	300273

Further Reading

Soule, H.D. *et al.* (1973) A human cell line from a pleural effusion derived from a breast carcinoma. *J. Natl. Cancer Inst.*, **51**, 1409–1416.



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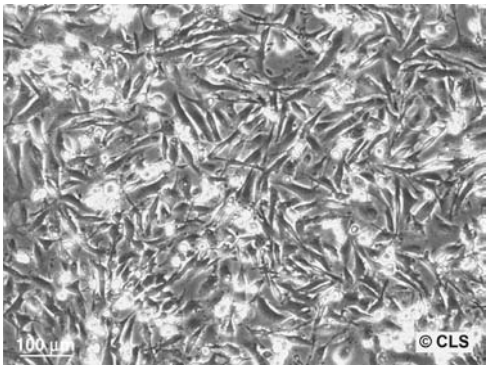

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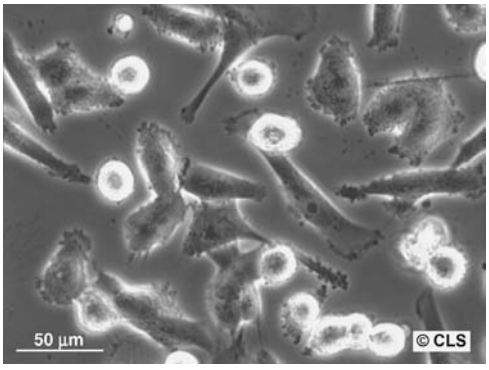

MDA-MB-231, 400× Leica.

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MDA-MB-231

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	51 years
Gender:	Female
Tissue:	Breast (pleural effusion)
Morphology:	Epithelial
Cell type:	Mammary gland adenocarcinoma
Growth properties:	Monolayer

Culture Conditions and Handling

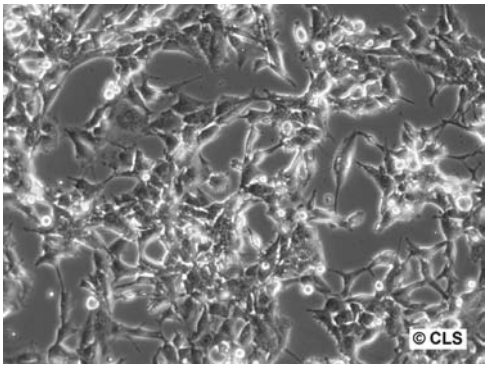
Culture medium:	DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum. Incubate at 37 °C/5% CO_2
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium containing serum, resuspend the cells dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

Karyotype:	Mean chromosome number = 68
DNA profile (STR):	Amelogenin: X; CSF1PO: 12, 13; D13S317: 13; D16S539: 12; D18S51: 11, 16; D21S11: 30, 33.2; D3S1358: 16; D5S818: 12; D7S820: 8, 9; D8S1179: 13; FGA: 22, 23; Penta D: 11, 14; Penta E: 11; TH01: 7, 9.3; TPOX: 8, 9; vWA: 15, 19
Tumorigenic:	Yes, in nude mice as well as in ALS treated BALB/c mice; forms poorly differentiated adenocarcinoma (grade III)
Oncogene:	Wnt3+; wnt7h+
Modal number:	65
Antigen expression:	Blood type O; Rh−
Immunology:	HLA-A2+
Receptors expressed:	Epidermal growth factor (EGF); transforming growth factor alpha (TGF alpha)
Isoenzymes:	Me-2, 1-2; PGM3, 1; PGM1, 1-2; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD B; Phenotype Frequency Product: 0.0229
ATCC number:	HTB-26
CLS number:	300275

Further Reading

Cailleau, R. *et al.* (1974) Breast tumor cell lines from pleural effusions. *J. Natl. Cancer Inst.*, **53**, 661–674.



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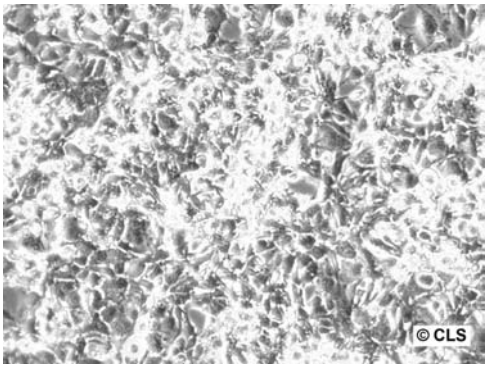

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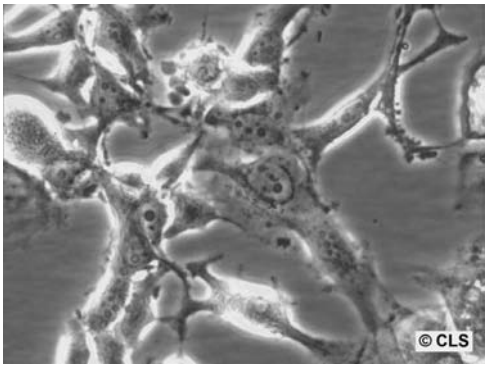

MDA-MB-436, 400× Leica.

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MDA-MB-436

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	43 years
Gender:	Female
Tissue:	Adenocarcinoma; mammary gland; pleural effusion
Morphology:	Pleomorphic with multinucleated component cells
Growth properties:	Monolayer
Description:	The line is pleomorphic and most cells react intensely with anti-tubulin antibody as demonstrated by indirect immunofluorescence staining

Culture Conditions and Handling

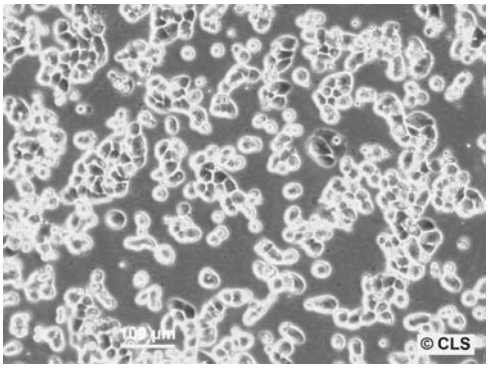
Culture medium:	DMEM:Ham's F12 supplemented with 2 mM L-glutamin and 10% fetal bovine serum. Incubate at 37 °C/5% CO_2
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

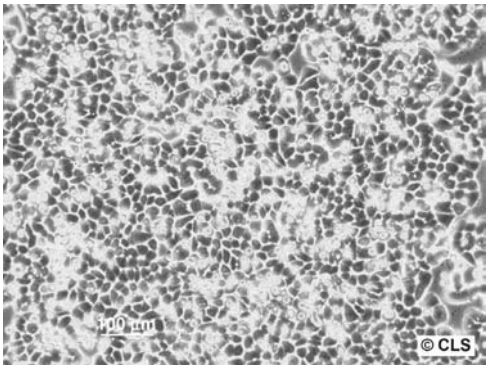
Karyotype:	Modal number = 45
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 12; D13S317: 10; D16S539: 9; D18S51: 12; D21S11: 30, 31.2; D3S1358: 18; D5S818: 13; D7S820: 10; D8S1179: 10, 14; FGA: 24; Penta D: 9; Penta E: 10, 12; TH01: 9.3; TPOX: 8; vWA: 14, 20
Tumorigenic:	No
Isoenzymes:	G6PD, B; PGM1, 1; PGM3, 1; ES-D, 1; Me-2, 1; AK-1, 1; GLO-1, 2; Phenotype Frequency Product: 0.0326
Products:	Tubulin; actin
ATCC number:	HTB-130
CLS number:	300278

Further Reading

Cailleau, R. *et al.* (1978) Long-term human breast carcinoma cell lines of metastatic origin: preliminary characterization. *In Vitro*, **14**, 911–915.



MDA-MB-468, 100× Leica.



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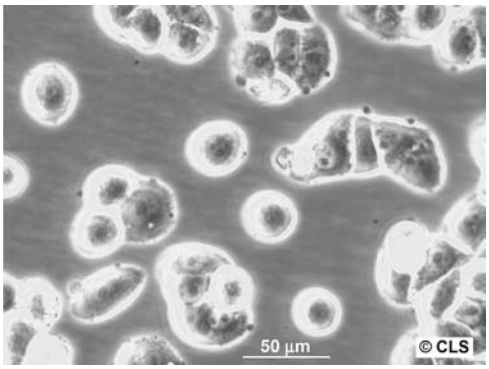

MDA-MB-468, 400× Leica.

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MDA-MB-468

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Black
Age:	51 years
Gender:	Female
Tissue:	Breast (mammary gland)
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Monolayer, adherent
Description:	Although the tissue donor was heterozygous for the G6PD alleles, the cell line consistently showed only the G6PD A phenotype. There is a G → A mutation in codon 273 of the p53 gene resulting in an Arg → His substitution

Culture Conditions and Handling

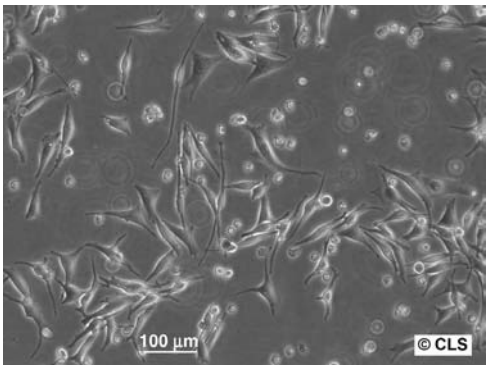
Culture medium:	DMEM:Ham's-F12 medium (1 : 1, vol/vol) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA solution. Add 0.25% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh cell culture medium, resuspend the cells, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

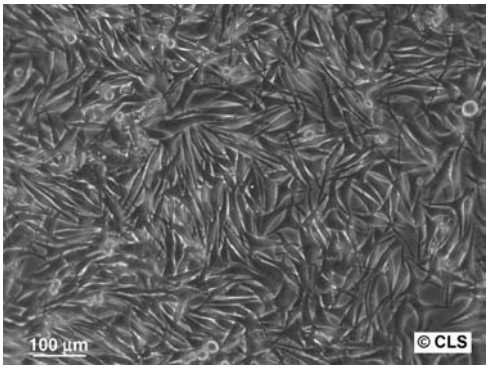
Karyotype:	Predominantly hypodiploid with a minor bimodal component having about 70 chromosomes
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 12; D13S317: 12; D16S539: 9; D5S818: 12; D7S820: 8; TH01: 7; TPOX: 8, 9; vWA: 18; D3S1358: 15; D21S11: 27, 28; D18S51: 17; Penta E: 5; Penta D: 8, 10; D8S1179: 13; FGA: 23
Tumorigenic:	Yes, in nude mice
Antigen expression:	Blood type AB; HLA Aw23, Aw30, B27, Bw35, Cw2, Cw4 (patient)
Immunology:	HLA: Aw23, Aw30; B27, Bw35; Cw2, Cw4
Receptors expressed:	Epidermal growth factor (EGF) receptor is present at 1×10^6 per cell; transforming growth factor alpha (TGF alpha)
Isoenzymes:	G6PD, A; PGM1, 1; PGM3, 2; ES-D, 1; Me-2, 1-2; AK-1, 1; GLO-1, 1-2; Phenotype Frequency Product: 0.0020
ATCC number:	HTB-132
CLS number:	300279

Further Reading

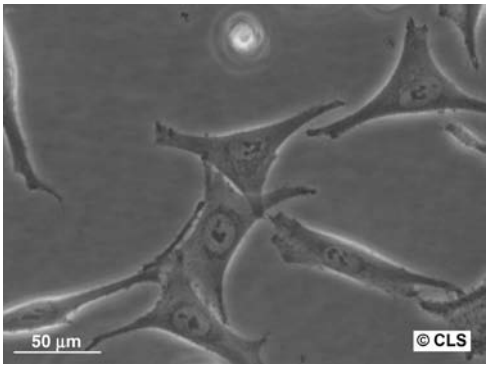
Cailleau, R. *et al.* (1978) Long-term human breast carcinoma cell lines of metastatic origin: preliminary characterization. *In Vitro*, **14**, 911–915.



MEL-CLS-2, 100× Leica.



MEL-CLS-2, 100× Leica.



MEL-CLS-2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MEL-CLS-2

Origin and General Characteristics

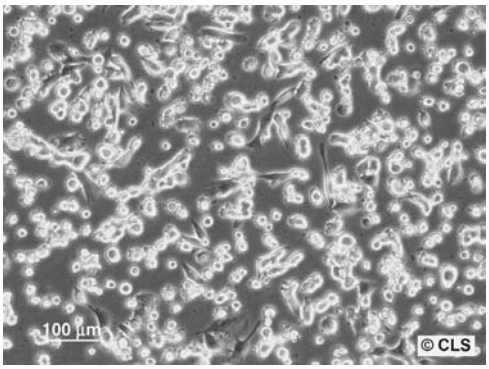
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Tissue:	Skin
Cell type:	Melanotic melanoma
Growth properties:	Monolayer
Description:	*In vitro* established from the primary melanotic melanoma in 1998

Culture Conditions and Handling

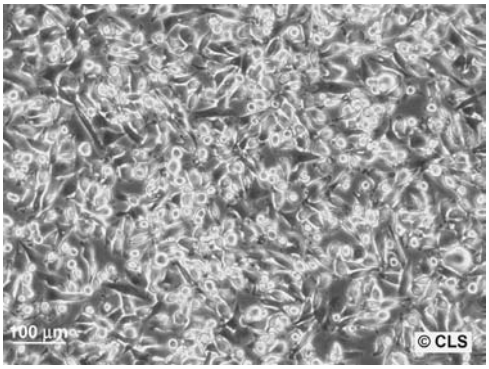
Culture medium:	DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 4 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

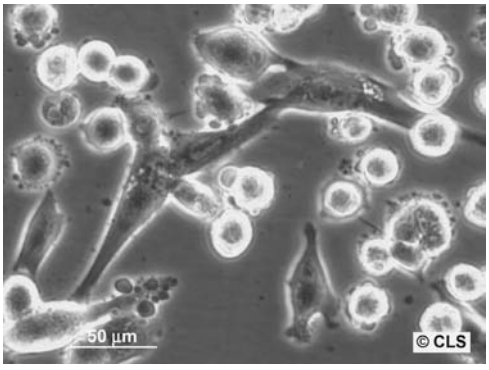
DNA Profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 12; D3S1358: 15; D5S818: 9, 11; D7S820: 7, 10; D8S1179: 15; D13S317: 9, 10; D16S539: 11; D18S51: 12, 17; D21S11: 29, 30; FGA: 23; THO1: 9, 9.3; TPOX: 8, 9; vWA: 15, 17; Penta D: 9, 13; Penta E: 7, 11
Tumorigenic:	Yes, in nude mice
Viruses:	Tested negative for: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B. piliformis
ATCC number:	Not available
CLS number:	300283



MEL-CLS-3, 100× Leica.



MEL-CLS-3, 100× Leica.



MEL-CLS-3, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MEL-CLS-3 (MRI-H-221)

Origin and General Characteristics

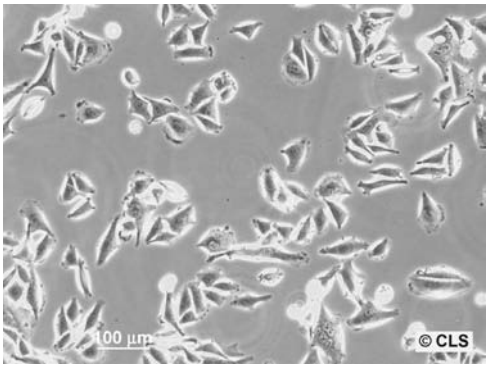
Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Melanoma, amelanotisch
Morphology: Monolayer, adherent
Description: *In vitro* established from the primary amelanotic melanoma

Culture Conditions and Handling

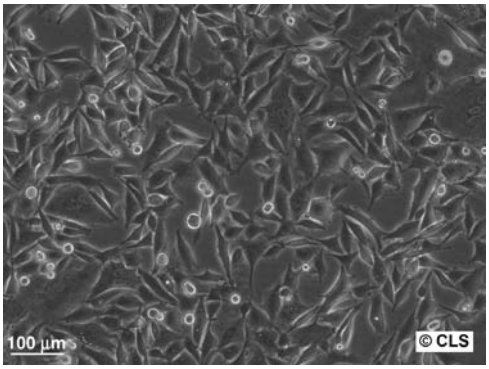
Culture medium: DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

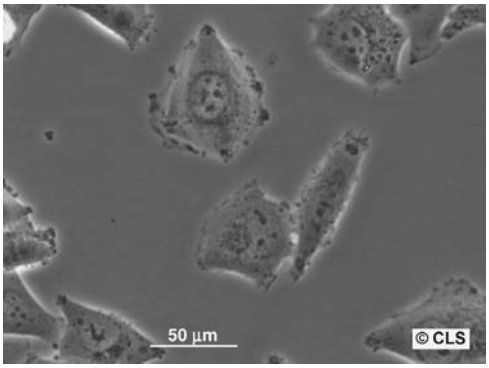
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 10, 11; D3S1358: 16, 18; D5S818: 11, 12; D7S820: 7, 10; D8S1179: 12, 13; D13S317: 11, 13; D16S539: 10, 13; D18S51: 16, 17; D21S11: 28, 31.2; FGA: 21, 25; Penta D: 12, 13; Penta E: 14; TH01: 9.3; TPOX: 8; vWA: 17, 18
Tumorigenic: Yes, in nude mice (Virales Profil: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B.piliformis: negative)
CLS number: 300293



MEL-CLS-4, 100× Leica.



MEL-CLS-4, 100× Leica.



MEL-CLS-4, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MEL-CLS-4

Origin and General Characteristics

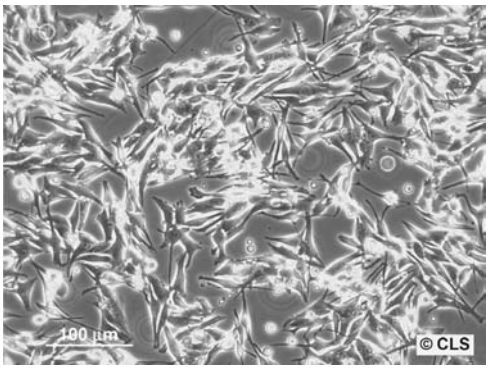
Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Melanosarcoma from metastatic
Growth properties: Monolayer, adherent
Description: *In vitro* established from the metastatic melanosarkoma

Culture Conditions and Handling

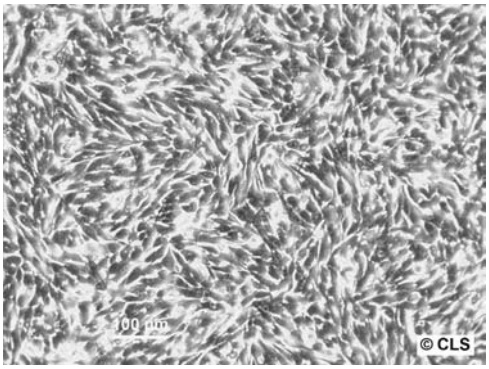
Culture medium: DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

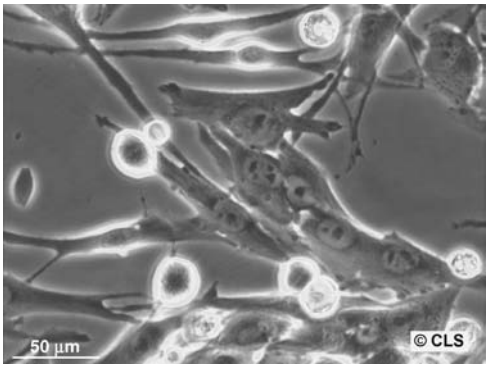
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 12; D16S539: 13; D5S818: 13; D7S820: 10, 11; THO1: 6.9; TPOX: 8, 11; vWA: 17, 18; D3S1358: 15, 18; D21S11: 30; D18S51: 11, 14; Penta E: 7, 19; Penta D: 13; D8S1179: 13, 16; FGA: 19, 23
Tumorigenic: Yes, in nude mice (Virales Profil: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B.piliformis: negative)
ATCC number: Not available
CLS number: 300128



MEWO, 100× Leica.



MEWO, 100× Leica.



MEWO, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MEWO

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Skin
Cell type: Malignant melanoma
Morphology: Fibroblast
Growth properties: Adherent
Description: Product melanin, derived from a human melanoma by Prof. C. Grose (1978). The cells support the growth of varicella-zoster virus (VZV) isolates at 36 °C although growth is optimal at 32 °C

Culture Conditions and Handling

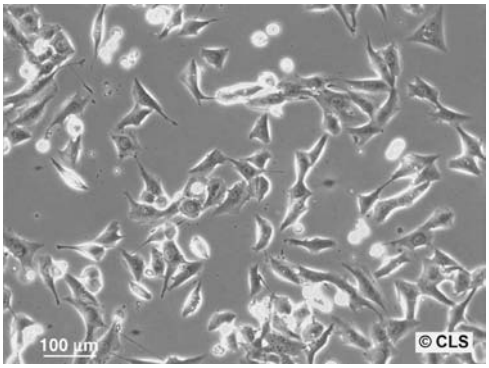
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

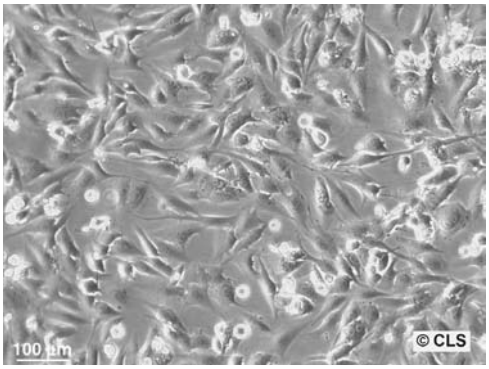
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 12; D13S317: 8, 9; D16S539: 10, 12; D18S51: 14, 17; D21S11: 30, 32.2; D3S1358: 17; D5S818: 12, 13; D7S820: 10, 12; D8S1179: 13, 15; FGA: 22; Penta D: 10; Penta E: 5; THO1: 7, 9; TPOX: 8, 10; vWA: 15
Tumorigenic: Yes, in nude mice; forms malignant melanoma
Applications: Virus studies
ATCC number: HTB-65
CLS number: 300285

Further Reading

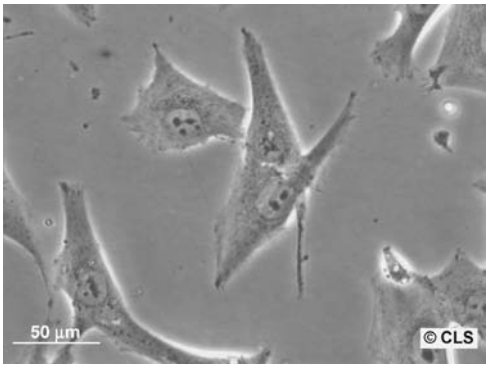
Grose, C. and Brunell, P.A. (1978) Varicella-zoster virus: isolation and propagation in human melanoma cells at 36 and 32 °C. *Infect. Immun.*, **19** (1), 199–203.



MG-63, 100× Leica.



MG-63, 100× Leica.



MG-63, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MG-63

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	14 years
Tissue:	Bone
Cell type:	Osteosarcoma
Morphology:	Fibroblast
Growth properties:	Monolayer
Description:	High levels of interferon production can be induced using polyinosinic–polycytidylic acid, cycloheximide, and actinomycin D

Culture Conditions and Handling

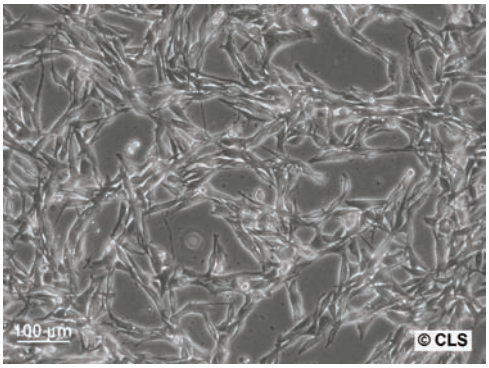
Culture medium:	DMEM: Ham's F12 medium (1 : 1 mixture) supplemented with 2 mM L-glutamine and 5% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) solution for 2–3 min, remove trypsin, and let the culture sit at room temperature until the cells detach. Add fresh medium, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

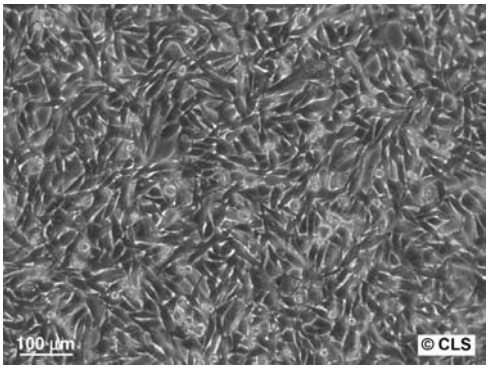
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 11; D16S539: 11; D18S51: 13; D21S11: 28, 29; D3S1358: 15, 17; D5S818: 11, 12; D7S820: 10; D8S1179: 11, 15; FGA: 20, 21; Penta D: 11, 13; Penta E: 12; THO1: 9.3; TPOX: 8, 11; vWA: 16, 19
Receptors expressed:	Transforming growth factor beta (TGF beta, type I and type II)
Products:	Interferon
ATCC number:	CRL-1427
CLS number:	300441

Further Reading

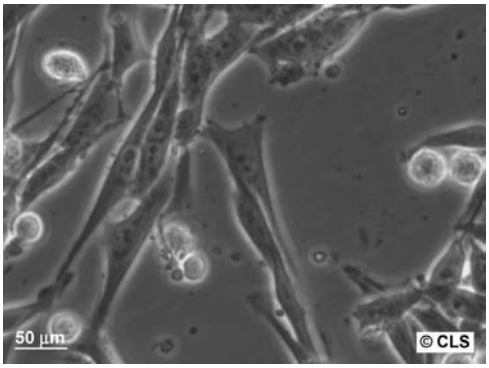
Billiau, A. *et al.* (1977) Human interferon: mass production in a newly established cell line, MG-63. *Antimicrob. Agents Chemother.*, **12**, 11–15.



MML-1, 100× Leica.



MML-1, 100× Leica.



MML-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MML-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Skin
Cell type: Malignant melanoma
Morphology: Epithelial
Growth properties: Monolayer

Culture Conditions and Handling

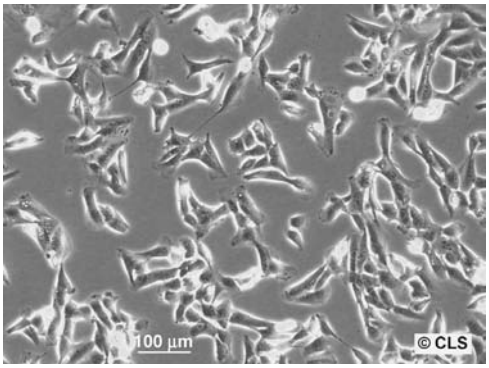
Culture medium: RPMI 1640 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA/PBS solution. Add fresh 0.025% trypsin/0.02% EDTA and incubate for 2–3 min. Add fresh medium, remove trypsin by centrifugation, and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

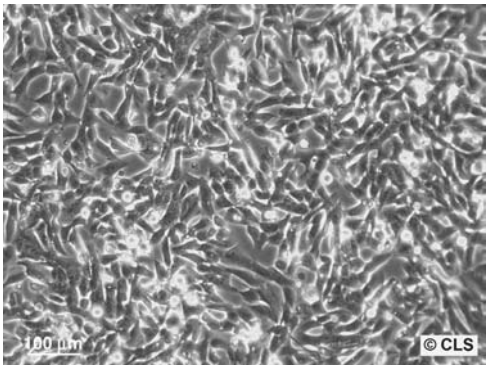
Tumorigenic: Yes, in nude mice
DNA profile (STR): Amelogenin: X, X; CSF1PO: 10; D13S317: 8, 13; D16S539: 10, 11 D5S818: 10, 12; D7S820: 10, 12; THO1: 6, 10; TPOX: 11; vWA: 17, 18; D3S1358: 17 D21S11: 31; D18S51: 13, 14; Penta E: 7, 11; Penta D: 14; D8S1179: 13, 14; FGA: 23
Reverse transcriptase: Negative
CLS number: 300288

Further Reading

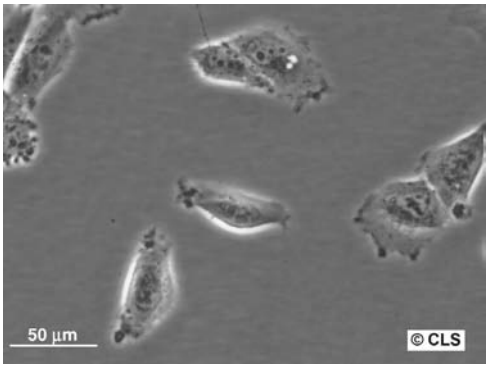
Komada, Y. *et al.* (1995) Fas receptor (CD95)-mediated apoptois is induced in leukemic cells entering G1B compartment of the cell cycle. *Blood*, **86**, 3848–3860.



MNNG-HOS, 100× Leica.



MNNG_HOS, 100× Leica.



MNNG-HOS, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MNNG-HOS

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Female
Age: 13 years
Tissue: Bone
Cell type: Osteosarcoma
Growth properties: Monolayer
Description: This line was derived from HOS cells by transformation with 0.01 μg/ml MNNG (a carcinogenic nitrosamine). The cells exhibit a high saturation density, a high plating efficiency in soft agar, and are tumorigenic in nude mice

Culture Conditions and Handling

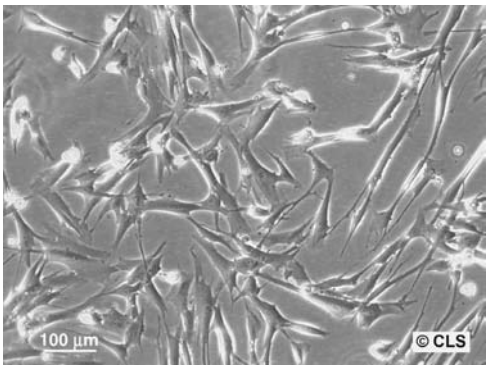
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at room temperature for 5 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

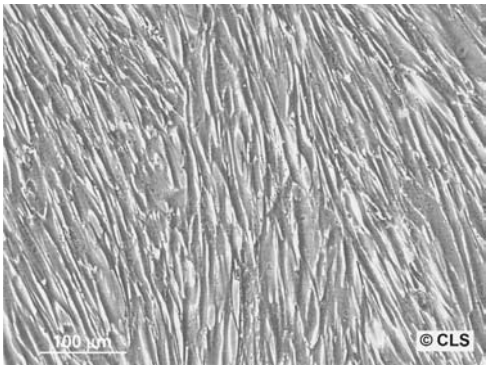
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D3S1358: 15; D5S818: 13; D7S820: 11, 12; D8S1179: 11, 14; D13S317: 12; D16S539: 10, 13; D18S51: 14; D21S11: 31.2; FGA: 24, Penta D: 9, 10; Penta E: 7, 12; TH01: 6; TPOX: 8, 11; vWA: 18
Tumorigenic: Yes, in nude mice
Isoenzymes: G6PD, B
ATCC number: CRL-1547
CLS number: 300289

Further Reading

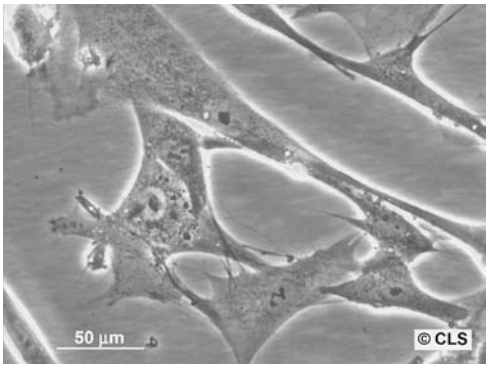
Rhim, J.S. *et al.* (1975) Transformation of human cells in culture by N-methyl-N′-nitro-N- nitrosoguanidine. *Nature*, **256**, 751–753.



MRC-5, 100× Leica.



MRC-5, 100× Leica.



MRC-5, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MRC-5

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Tissue:	Lung
Morphology:	Fibroblast
Growth properties:	Monolayer
Description:	The cells are capable of 42–46 population doublings before the onset of senescence

Culture Conditions and Handling

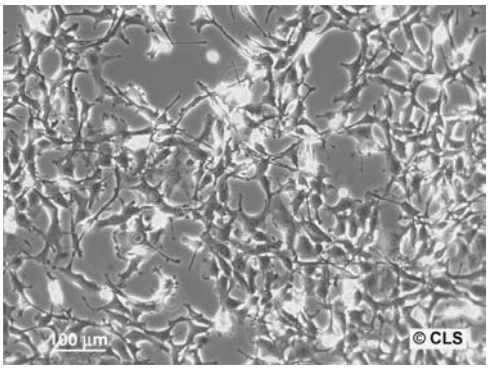
Culture medium:	DMEM:Ham's F12 (1:1, vol:vol) supplemented with L-glutamine and 5–10% fetal bovine serum
Subculture routine:	Remove medium, add fresh 0.02% EDTA in PBS (CA^{2+}/MG^{2+}free) for 1 min. Remove EDTA solution, add fresh 0.02% EDTA/0.025% trypsin solution for 1 min at 37 °C, remove solution. Add fresh growth medium, collect the cells, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

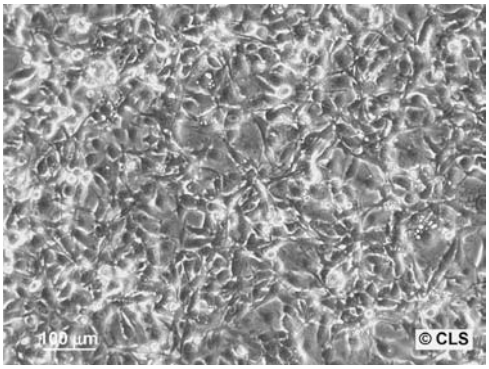
Karyotype:	Normal human male; diploid; stable
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
ATCC number:	CCL-171
CLS number:	300395

Further Reading

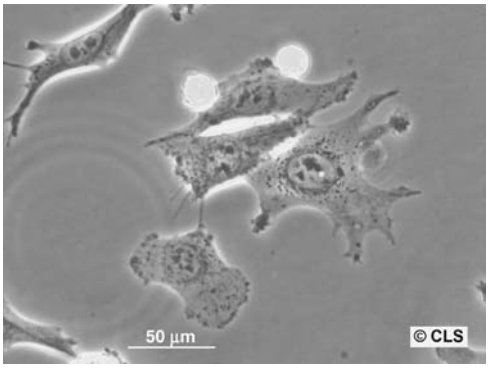
Jacobs, J.P. *et al.* (1970) Characteristics of a human diploid cell designated MRC-5. *Nature*, **227**, 168–170.



MSTO-211H, 100× Leica.



MSTO-211H, 100× Leica.



MSTO-211H, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MSTO-211H

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 62 years
Gender: Male
Tissue: Mesothelioma, biphasic; from metastatic site: lung
Morphology: Fibroblast
Growth properties: Monolayer
Description: The MSTO-211H cell line was established in 1985 from the pleural effusion of a patient with biphasic mesothelioma of the lung. High affinity binding sites for EGF; neuron-specific enolase (NSE); alpha and beta subunits of human chorionic gonadotropin (HCG). Overexpression of c-myc protooncogene

Culture Conditions and Handling

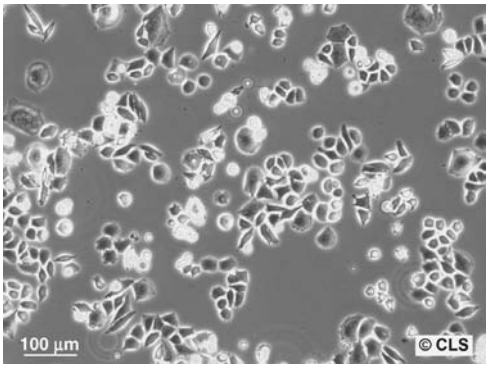
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine, and 10% fetal bovine serum
Subculture routine: The cells can reach a saturation density of 400 000 cells per cm^2, but will slough off the surface as they attain this density. Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Every two to three days
Doubling time: 20 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

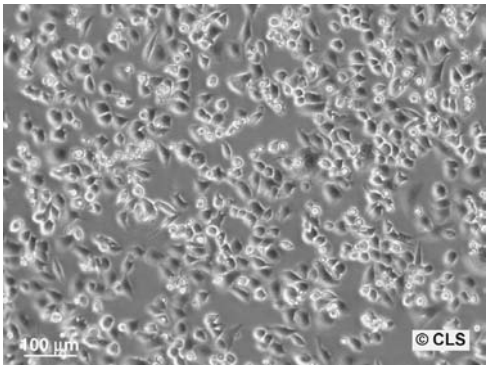
Karyotype: Modal number = 72; range = 70 to 78
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 11, 14; D16S539: 13; D18S51: 16, 18; D21S11: 28, 31; D3S1358: 15; D5S818: 12; D7S820: 8, 12; D8S1179: 13; FGA: 21; Penta D: 11, 12; Penta E: 7, 13; THO1: 8, 9.3; TPOX: 11; vWA: 16, 18
Tumorigenic: Yes, tumors formed in ~20% of nude mice
Oncogene: c-myc; v-src +; v-abl +; v-erb B +; c-raf 1 +; Ha-ras +; Ki-ras +; N-ras +; N-myc −; L-myc – c-myb −; c-fos −; v-fes −; v-fms −; v-sis −
ATCC number: CRL-2081
CLS number: 300450

Further Reading

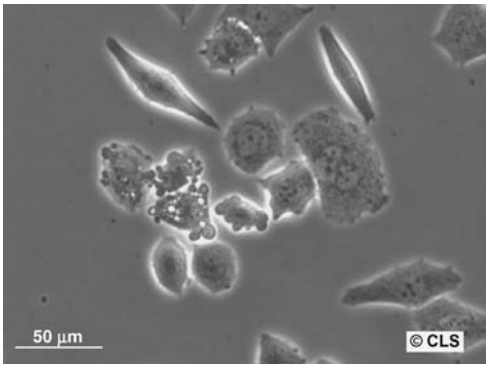
Bepler, G. *et al.* (1988) Characterization of the state of differentiation of six newly established human non-small-cell lung cancer cell lines. *Differentiation*, **37**, 158–171.



MX-1, 100× Leica.



MX-1, 100× Leica.



MX-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MX-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	40 years
Gender:	Female
Tissue:	Breast carcinoma
Morphology:	Epithelial
Cell type:	Infiltrating duct carcinoma
Growth properties:	Monolayer
Description:	The MX-1 cell line has been established *in vitro* from the primary infiltrating duct carcinoma of a 40-year-old female; cells are estrogen receptors negative

Culture Conditions and Handling

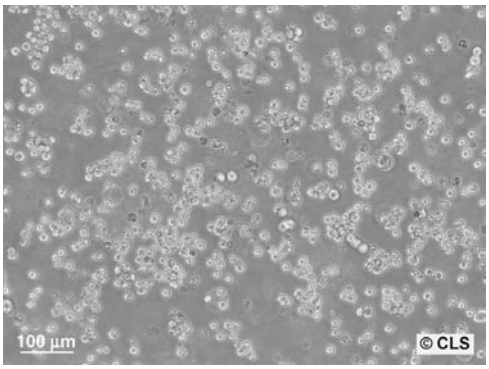
Culture medium:	DMEM:Ham's F12 (1 : 1/vol:vol) medium supplemented with 2 mM L-glutamine and 5–10% fetal bovine serum
Subculture routine:	Remove medium, add fresh 0.025% trypsin/0.02% EDTA solution, and incubate at 37 °C until the cells detach. Add fresh medium, aspirate to disperse the cells, and centrifuge at 800 rpm for 3 min. Add fresh medium to the pellet and dispense into new flasks. Note: The cells do not form a confluent monolayer. Subculture when a dense layer of cells is observed macroscopically
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	30–35 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

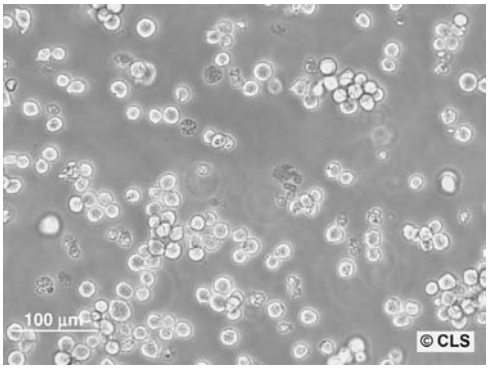
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 11, 11; D13S317: 11, 12; D16S539: 12, 12; D18S51: 12, 16; D21S11: 29, 30, 32; D3S1358: 15, 15; D5S818: 12, 12; D7S820: 11, 12; D8S1179: 11, 12, 13; FGA: 20, 20; Penta D: 9, 11; Penta E: 14, 14; THO1: 7, 9; TPOX: 8, 8; vWA: 17, 18
Tumorigenic:	Yes, in nude mice
CLS number:	300296

Further Reading

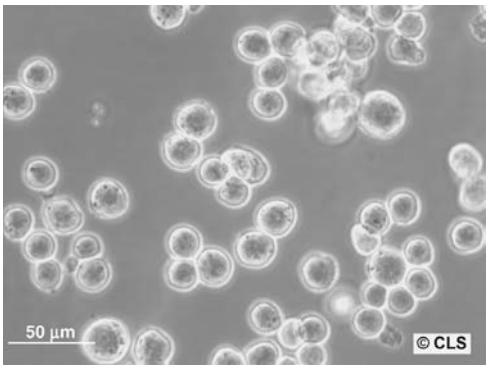
Ovejera, A.A. *et al.* (1978) Chemotherapy of human tumor xenografts in genetically athymic mice. *Ann. Clin. Lab. Sci.*, **8**, 50–56.



NB-4, 100× Leica.



NB-4, 200× Leica.



NB-4, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

NB-4

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 23 years
Gender: Female
Tissue: Bone marrow
Morphology: Round cells
Cell type: Acute promyelocytic leukemia
Growth properties: Suspension (single cells)
Description: The NB-4 cell line was derived from the marrow of a patient with acute promyelocytic leukemia (APL; M3 in the FAB nomenclature) in second relapse in 1989

Culture Conditions and Handling

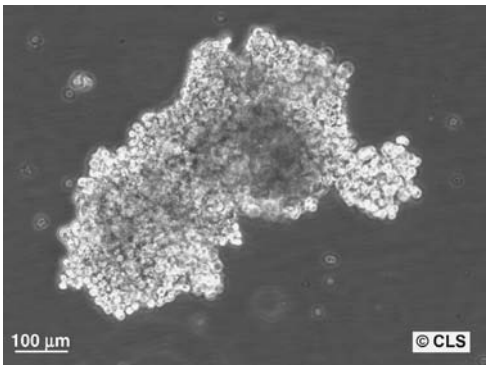
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Establish new cultures at 0.5×10^6 viable cells/ml and subculture at 1×10^6 cells/ml. Maximum cell density at 1 to 2×10^6 cells/ml. Prepare dilutions by transferring the appropriate amount of cell suspension into new flasks with fresh medium
Fluid renewal: Two to three times weekly
Doubling time: ~36–40 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

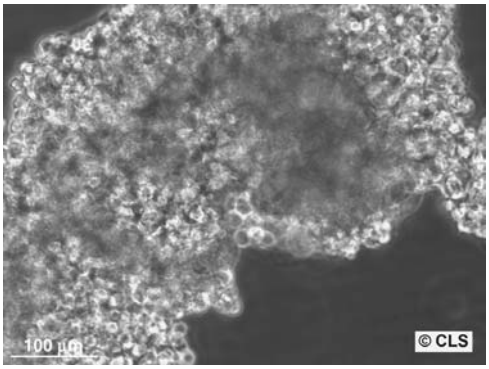
Karyotype: t(15;17) (q22;q11-12) translocation
DNA profile (STR): Amelogenin: X; CSF1PO: 11, 12; D13S317: 11, 12; D16S539: 9; D18S51: 12, 14; D21S11: 28, 33.2; D3S1358: 15, 17; D5S818: 13; D7S820: 10, 13; D8S1179: 10, 14; FGA: 21, 22; Penta D: 10, 13; Penta E: 7, 13; THO1: 7, 9, 3; TPOX: 8, 11; vWA: 16, 19
Immunology: CD4+, CD14−, CD36−
Reverse transcriptase: Negative
ATCC number: Not available
CLS number: 300299

Further Reading

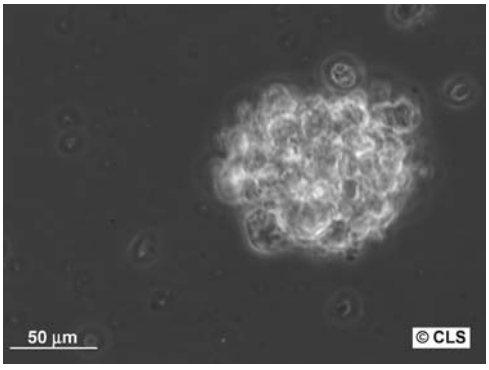
Lanotte, M. *et al.* (1991) NB4, a maturation inducible cell line with t(15;17) marker isolated from a human acute promyelocytic leukemia (M3). *Blood*, **77**, 1080–1086.



NCI-H69, 100× Leica.



NCI-H69, 200× Leica.



NCI-H69, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

NCI-H69

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 55 years
Gender: Male
Tissue: Lung
Morphology: Floating aggregates
Cell type: Small cell carcinoma
Growth properties: Suspension
Description: This cell line is aneuploid, will form colonies in soft agar and retains small cell carcinoma morphology and ultrastructure as well as APUD cell characteristics. The cells grow in aggregates, thus cell counts are not accurate. The cells stain positively for cytokeratins. The line can be adapted to grow in shaker flask or spinner flask systems. The N-myc gene is amplified, and there is expression of the mRNA and protein.C-myc mRNA, but not protein, is expressed at a low level. There is expression of c- myb, v-fes, v-fms, c-raf 1, Ha-ras, K-ras, and N-ras mRNA

Culture Conditions and Handling

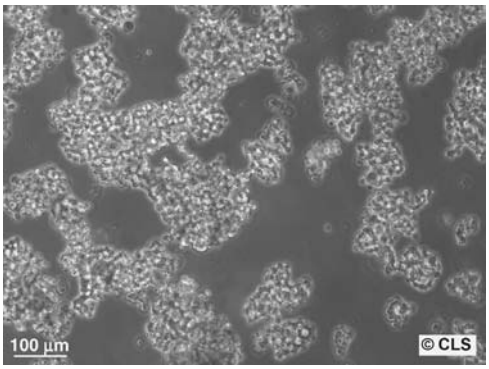
Culture medium: RPMI 1640 medium supplemented with 2mM L-glutamine, 4.5 g/l glucose, 10mM HEPES, 1.0mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Fluid renewal: Allow aggregates to settle to the bottom of the flask, remove and discard the supernatant. Add the same volume of fresh culture medium and disperse cells by gentle pipetting. Subculture by transferring one vol of cell suspension to 2 to 4 vol in new culture flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Every two to three days
Doubling time: 69 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

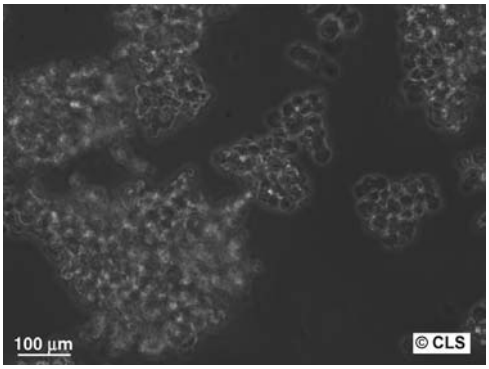
Karyotype: Aneuploid, with 3p deletion; range = 40 to 73
DNA profile (STR): Amelogenin: X; CSF1PO: 10, 12; D13S317: 12; D16S539: 11; D18S51: 12; D21S11: 30, 31.2; D3S1358: 16; D5S818: 11, 13; D7S820: 9; D8S1179: 13; FGA: 24; Penta D: 9, 11; Penta E: 12; THO1: 8, 9; TPOX: 10; vWA: 16, 17
Tumorigenic: Yes, in nude mice; forms tumors with typical small cell carcinoma histology
Oncogene: myc +; myb +; fes +, fms +; raf +; ras +
Receptors expressed: Insulin-like growth factor II receptor (IGF II)
Isoenzymes: Insulin-like growth factor II receptor (IGF II)
ATCC number: HTB-119
CLS number: 300185

Further Reading

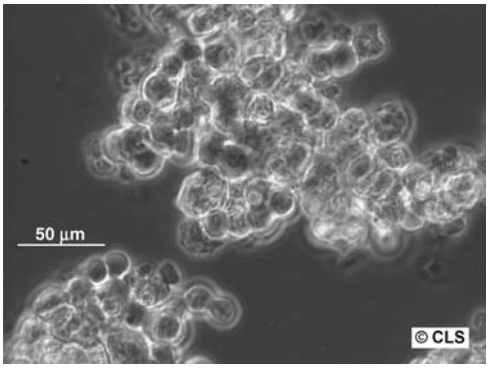
Gazdar, A.F. *et al.* (1980) Establishment of continuous, clonable cultures of small-cell carcinoma of lung which have amine precursor uptake and decarboxylation cell properties. *Cancer Res.*, **40**, 3502–3507.



NCI-H82, 100× Leica.



NCI-H82, 200× Leica.



NCI-H82, 400× Leica.

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NCI-H82

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Male
Age: 40 years
Tissue: Lung (pleural effusion)
Cell type: Small cell carcinoma
Morphology: Epithelial
Growth properties: Aggregates in suspension; the cells grow in very large aggregates, and the aggregates are the only viable cell population
Description: The NCI-H82 cell line was derived by A.F. Gazdar and associates in 1978 from the pleural fluid of a patient with small cell cancer of the lung

Culture Conditions and Handling

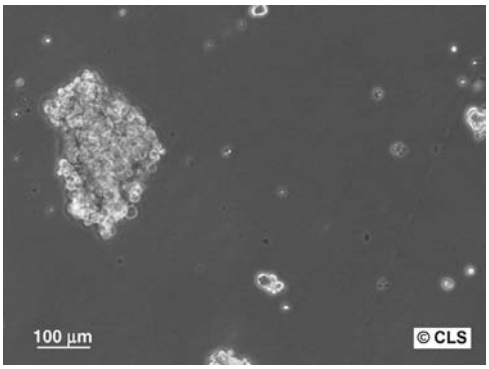
Culture medium: RPMI 1640 medium supplemented with L-glutamin and 10% fetal bovine serum
Subculture routine: This line grows as aggregates of cells in suspension. Subculture by transferring the cell suspension into new cell culture flasks already filled with the appropriate volume of fresh cell culture medium. Alternatively, the cells may be collected by centrifugation and dispersed into fresh medium
Split ratio: A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

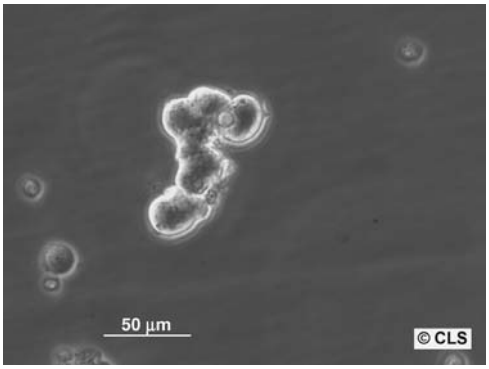
Karyotype: This is a near triploid human cell line.
DNA profile (STR): Amelogenin: X; CSF1PO: 11; D13S317: 8; D16S539: 12; D18S51: 14, 18; D21S11: 28, 30; D3S1358: 17; D5S818: 12; D7S820: 10, 13; D8S1179: 13; FGA: 24, 25; Penta D: 10, 12; Penta E: 11, 12; THO1: 9, 9.3; TPOX: 11; vWA: 14
Tumorigenic: Yes; forms transplantable tumors with nontypical SCLC histology in nude mice
Oncogene: myc +; myb −; raf +; ras +; fms +; fes +
Receptors expressed: Insulin-like growth factor II receptor (IGF II); atrial natriuretic peptide (ANP)
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1-2; ES-D, 1; Me-2, 1; AK-1, 1; GLO-1, 1; Phenotype Frequency Product: 0.0082
ATCC number: HTB-175
CLS number: 300442

Further Reading

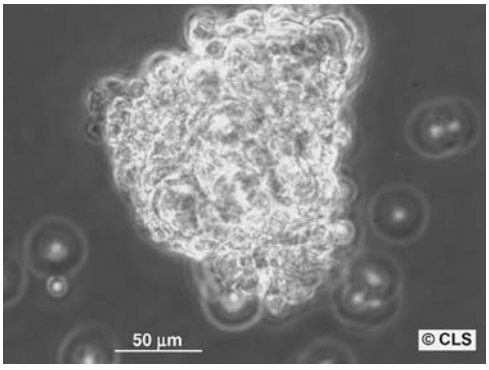
Gazdar, A.F. *et al.* (1981) Levels of creatine kinase and its BB isoenzyme in lung cancer specimens and cultures. *Cancer Res.*, **41**, 2773–2777.



NCI-H209, 100× Leica.



NCI-H209, 400× Leica.



NCI-H209, 400× Leica.

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NCI-H209

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Male
Tissue: Lung; from metastatic site: bone marrow
Morphology: Epithelial
Cell type: Small cell lung carcinoma
Growth properties: Large aggregates in suspension
Description: The NCI-H209 cell line was derived by A.F. Gazdar and associates in 1979 from the bone marrow of a patient with small cell cancer of the lung. The bone marrow specimen was taken prior to therapy. Only the aggregates are viable, but no meaningful viability percentage can be measured. The medium will normally contain large amounts of cell debris

Culture Conditions and Handling

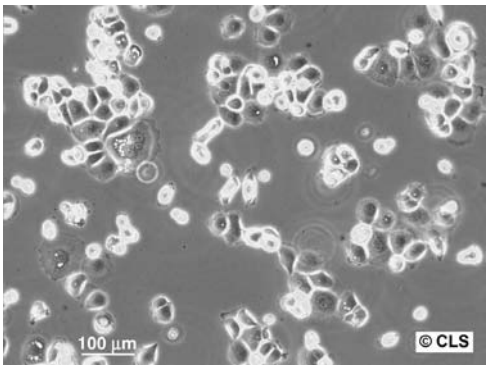
Culture medium: Iscove's modified Dulbecco's medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: The line should be subcultured by dilution with fresh medium. Alternatively, the clusters may be collected by centrifugation and resuspended in fresh medium
Split ratio: A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

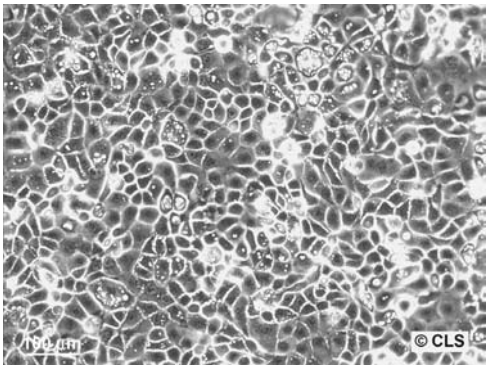
Karyotype: This is a hyperdiploid human cell line.
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11; D13S317: 11; D16S539: 9, 12; D18S51: 13; D21S11: 32.2; D3S1358: 18; D5S818: 12; D7S820: 9; D8S1179: 12, 13; FGA: 20, 24; Penta D: 11, 12; Penta E: 11, 12; THO1: 7, 9; TPOX: 8; vWA: 18, 19
Tumorigenic: Yes; forms transplantable tumors with typical SCLC histology in nude mice
Oncogene: pRB (RB1, abnormal)
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1; ES-D, 1; Me-2, 0; AK-1, 1; GLO-1, 1-2
Products: The line produces normal amounts of p53 mRNA relative to normal lung
ATCC number: HTB-172
CLS number: 300183

Further Reading

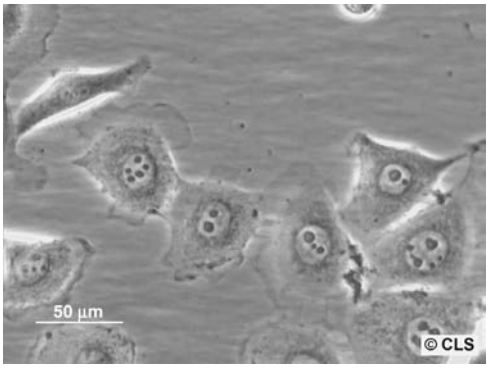
Moody, T.W. *et al.* (1983) Bombesin-like peptides in small cell lung cancer: biochemical characterization and secretion from a cell line. *Life Sci.*, **32**, 487–493.



NIH:Ovcar-3, 100× Leica.



NIH:Ovcar-3, 100× Leica.



NIH:Ovcar-3, 400× Leica.

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NIH: Ovcar-3

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Morphology: Epithelial
Age: 60 years
Gender: Female
Tissue: Ovary (ascites)
Cell type: Adenocarcinoma
Growth properties: Monolayer
Description: The NIH:OVCAR-3 line was established in 1982 by T.C. Hamilton *et al.* from the malignant ascites of a patient with progressive adenocarcinoma of the ovary. The cells form colonies in soft agar and have an abnormal karyotype

Culture Conditions and Handling

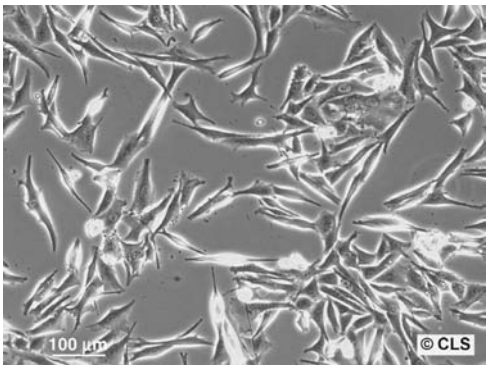
Culture medium: RPMI 1640 medium with 1.5 g/l sodium bicarbonate, supplemented with 2 mM L-glutamine, 4.5 g/l glucose, 10 mM HEPES, 1.0 mM sodium pyruvate, 0.01 mg/ml bovine insulin and 10–20% fetal bovine serum
Subculture routine: Remove medium and rinse with EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) solution, and let the culture sit at 37 °C until the cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety Level: 1

Special Features of the Cell Line and Recommended Use

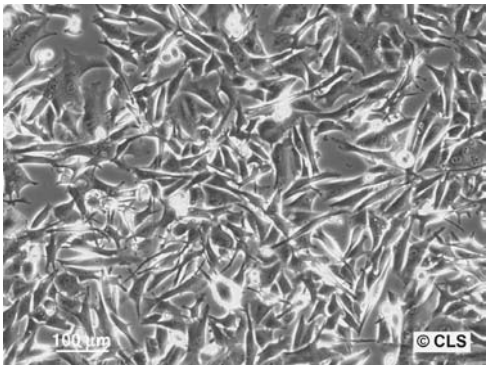
DNA profile (STR): Amelogenin: X, X; CSF1PO: 11, 12; D13S317: 12; D16S539: 12; D18S51: 13; D21S11: 29, 31.2; D3S1358: 17, 18; D5S818: 11, 12; D7S820: 10; D8S1179: 10, 15; FGA: 21; Penta D: 12, 13; Penta E: 7, 13; THO1: 9, 9.3; TPOX: 8; vWA: 17
Tumorigenic: Yes, in nude mice
Receptors expressed: Androgen; estrogen; progesterone
Isoenzymes: G6PD, B; PGM1, 1; PGM3, 1; ES-D, 1; AK-1, 1; GLO-1, 1
ATCC number: HTB-161
CLS number: 300307

Further Reading

Hamilton, T.C. *et al.* (1983) Characterization of a human ovarian carcinoma cell line (NIH:OVCAR-3) with androgen and estrogen receptors. *Cancer Res.*, **43**, 5379–5389.



NIS-G, 100× Leica.



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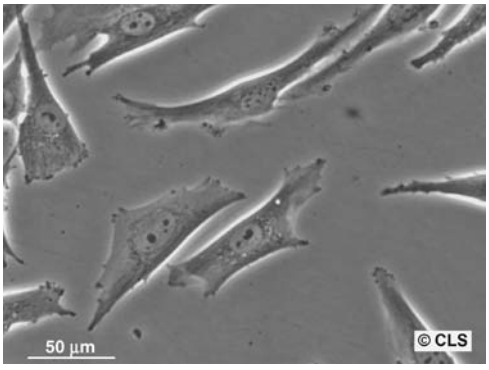

NIS-G, 400× Leica.

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NIS-G

Origin and General Characteristics

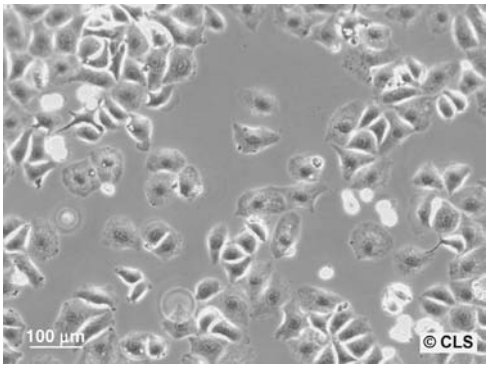
Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Melanosarcoma
Growth properties: Monolayer
Description: *In vitro* established from the metastatic melanosarkoma

Culture Conditions and Handling

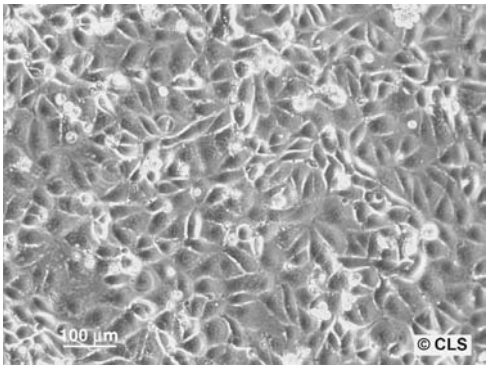
Culture medium: DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

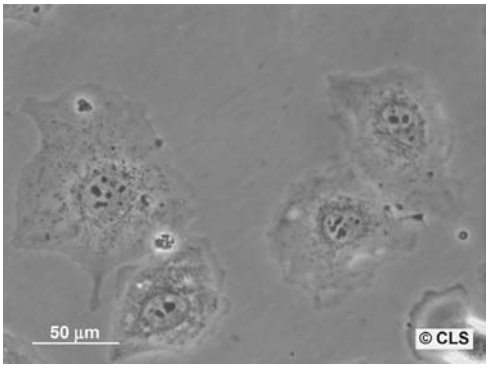
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 11; D16S539: 11, 12; D18S51: 21; D21S11: 31, 31.2; D3S1358: 16; D5S818: 12; D7S820:12; D8S1179: 12, 14; FGA: 21; Penta D: 9; Penta E:12, 13; THO1: 7, 9.3; TPOX: 8, 10; vWA: 14, 18
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300303



OAW-42, 100× Leica.



OAW-42, 100× Leica.



OAW-42, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

OAW-42

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Gender: Female
Age: 68 years
Tissue: Ovary carcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: The OAW-42 cell line was established from the ascites of a patient with ovarian cystadenocarcinoma. It has retained the ability to form free-floating cysts *in vitro*, produces extracellular matrix, and shows a defined chemosensitivity pattern. It is a valuable cell line for studies on the biology of human ovarian cancer

Origin and General Characteristics

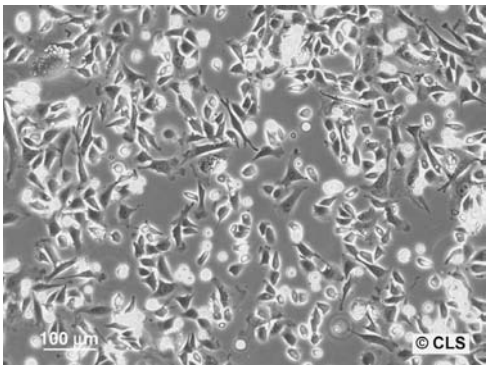
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, nonessential amino acids and 10% heat-inactivated fetal bovine serum. Alternatively, the cells may be cultured in DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose, and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02 EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) solution and let the culture sit at 37 °C until the cells detach. Add fresh medium to inhibit trypsin, remove trypsin by centrifugation, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

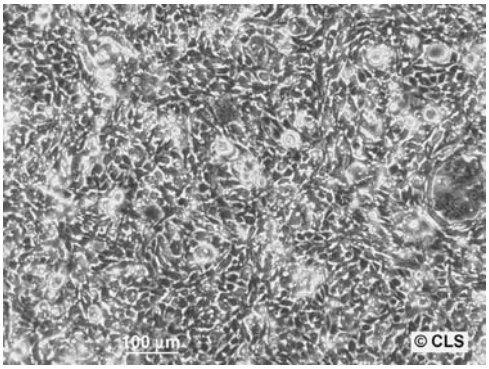
Karyotype: Hypotetraploid
DNA profile (STR): Amelogenin: X; CSF1PO: 11; D13S317: 11; D16S539: 12, 13; D18S51: 16, 21; D21S11: 26; D3S1358: 15, 16; D5S818: 11, 12; D7S820: 8; D8S1179: 13; FGA: 22, 25; Penta D: 10; Penta E: 12; THO1: 6, 7; TPOX: 8, 11; vWA: 15, 16
ATCC number: Not available
CLS number: 300304

Further Reading

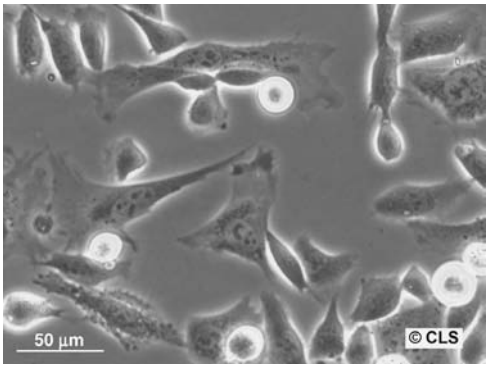
Wilson, A.P. (1984) Characterization of a cell line derived from the ascites of a patient with papillary serous cystadenocarcinoma of the ovary. *J. Nat. Cancer Inst.*, **72**, 513–521.



PA-CLS-52, 100× Leica.



PA-CLS-52, 100× Leica.



PA-CLS-52, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

PA-CLS-52

Origin and General Characteristics

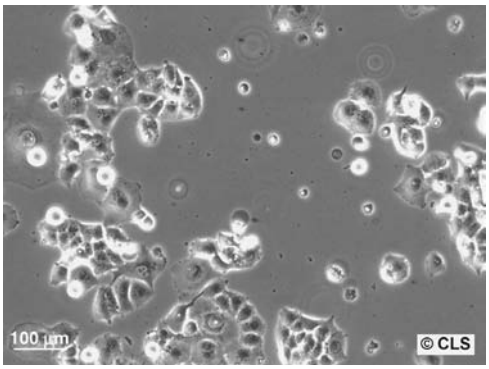
Organism:	*Homo sapiens* (human)
Ethnicity:	European
Age:	48 years
Tissue:	Pancreas
Morphology:	Epithelial
Cell type:	Adenocarcinoma
Growth properties:	Adherent epitheloid cells growing in monolayers
Description:	Established from the primary pancreas adenocarcinoma of a 48-year-old female in 1995, Dr Schmidt, H. Löhrke

Culture Conditions and Handling

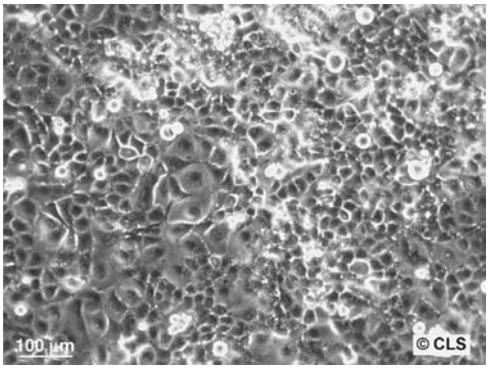
Culture medium:	RPMI 1640 medium supplemented with 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin, and let the culture sit at 37 °C until the cells detach (maximum 5 min). Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	~45 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

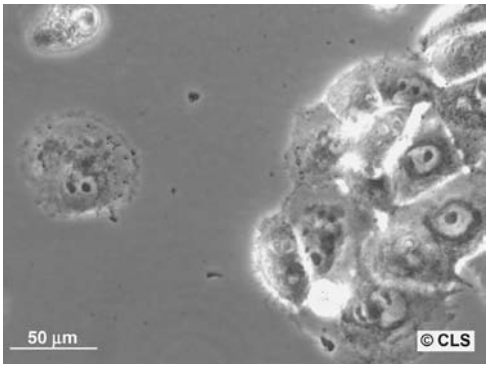
Karyotype:	Confirmed human
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 12; D16S539: 9, 13; D18S51: 12; D21S11: 30; D3S1358: 15, 18; D5S818: 9, 11; D7S820: 8; D8S1179: 12; FGA: 24; Penta D: 11; Penta E: 17; THO1: 6, 9.3; TPOX: 8; vWA: 17
Tumorigenic:	Yes, in nude mice, adenocarcinoma
ATCC number:	Not available
CLS number:	300386



Panc-1, 100× Leica.



Panc-1, 100× Leica.



Panc-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Panc-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	56 years
Gender:	Male
Tissue:	Pancreas (ductal cell origin)
Morphology:	Epitheloid
Cell type:	Epithelioid carcinoma
Description:	Growth is inhibited by 1 unit/ml L-asparaginase. The cells will grow in soft agar

Culture Conditions and Handling

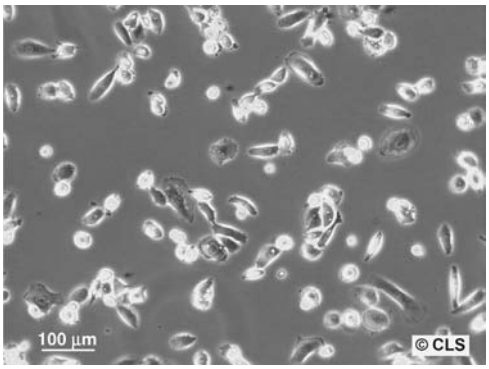
Culture medium:	Dulbecco's modified Eagle's media supplemented with 4 mM L-glutamine, 4.5 g/l glucose, 1 mM Na-pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with EDTA (versene) solution. Add fresh 0.05%trypsin/0.02% EDTA (versene) and let the culture to sit at 37 °C until cells are dispensed. Add fresh medium, remove trypsin by centrifugation, resuspend in fresh medium, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	52 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

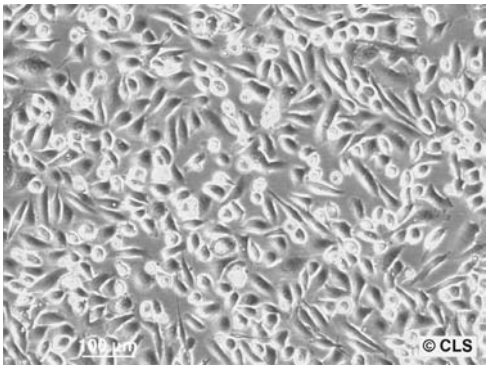
Karyotype:	Three distinct marker chromosomes and one 1 ring chromosome
DNA profile (STR):	Amelogenin: X, X; CSF1PO:10, 12; D13S317: 11; D16S539: 11; D18S51: 12; D21S11: 28; D3S1358: 17; D5S818: 11, 13; D7S820: 8, 10; D8S1179: 14, 15; FGA: 21; Penta D: 14; Penta E: 7, 14; TH01: 7, 8; TPOX: 8, 11; vWA: 15
Tumorigenic:	Growth in soft agar; formation of progressively growing carcinomas in nude athymic mice
Modal number:	63
Isoenzymes:	G6PD, B
ATCC number:	CRL1469
CLS number:	300228

Further Reading

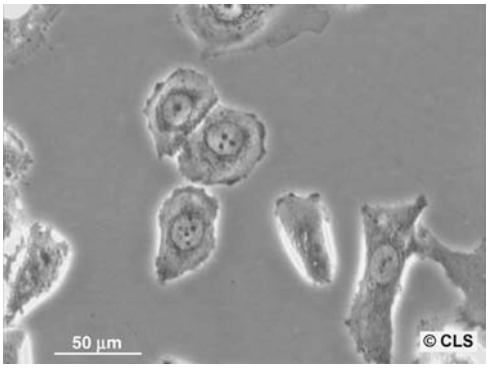
Lieber, M. *et al.* (1975) Establishment of a continuous tumor-cell line (panc-1) from a human carcinoma of the exocrine pancreas. *Int. J. Cancer*, **15**, 741–747.



PC-3, 100× Leica.



PC-3, 100× Leica.



PC-3, 400× Leica.

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PC-3

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	62 years
Tissue:	Prostate; from metastatic site: bone
Cell type:	Adenocarcinoma, grade IV
Morphology:	Epithelial
Growth properties:	Monolayer; the cells form clusters in soft agar and can be adapted to suspension growth
Description:	The cells exhibit low acid phosphatase and testosterone-5-alpha reductase activities

Culture Conditions and Handling

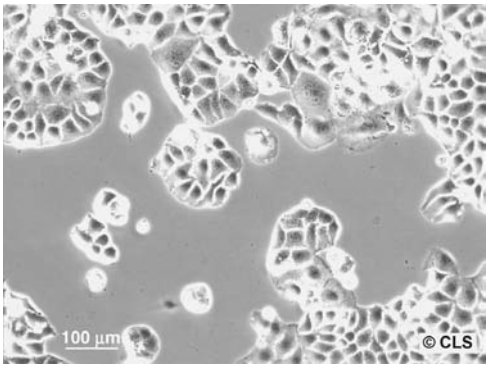
Culture medium:	DMEM: Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum.
Subculture routine:	Remove the cell culture medium and rinse with 0.02% EDTA solution (versene). Add 0.025% trypsin/0.03% EDTA solution. Incubate at room temperature until the cells detach. Incubation at 37 °C may facilitate the detachment. Add complete cell culture medium, resuspend the cells gently, and distribute into new cell culture flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

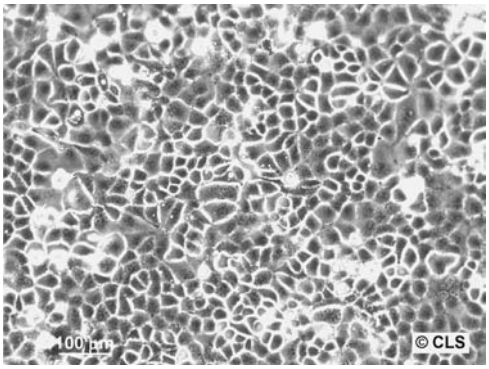
DNA profile (STR):	Amelogenin: X, X; CSF1PO: 11; D13S317: 11; D16S539: 11; D5S818: 13; D7S820: 8, 11; THO1: 6, 7; TPOX: 8, 9; vWA: 17; D3S1358: 16; D21S11: 29, 31.2; D18S51: 14, 15; Penta E: 10, 17; Penta D: 9; D8S1179: 13; FGA: 24
Tumorigenic:	Yes, in nude mice
Antigen expression:	HLA A1, A9
ATCC number:	CRL 1435
CLS number:	300312

Further Reading

Kaighn, M.E. *et al*. (1978) Prostate carcinoma: tissue culture cell lines. *Natl. Cancer Inst. Monogr.*, **49**, 17–21.



PLC-PRF-5, 100× Leica.



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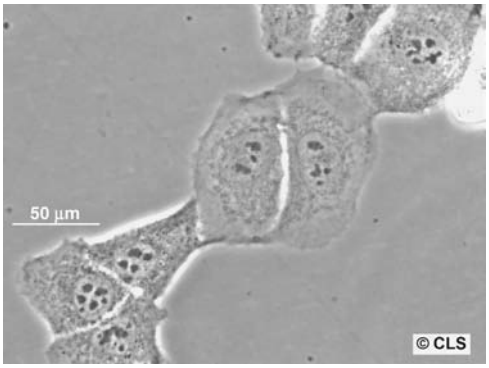

PLC-PRF-5, 400× Leica.

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PLC-PRF-5

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Tissue: Hepatoma; liver; Alexander cells
Morphology: Epithelial
Growth properties: Monolayer
Description: The cells produce HBsAg. At present, there is no evidence that this cell line produces infectious hepatitis B virus

Culture Conditions and Handling

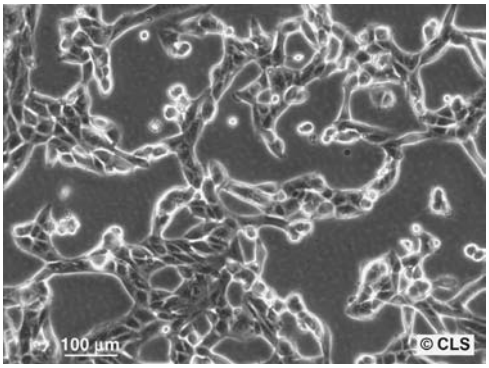
Culture medium: DMEM medium supplemented with 2 mM glutamine and 10% fetal bovine serum
Subculture routine: Remove medium from subconfluent cultures, add fresh 0.25% trypsin for 2–3 min, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended; seeding density 2–3 $\times$ 10^4 cells/cm^2.
Fluid renewal: Twice weekly
Biosafety level: 2

Special Features of the Cell Line and Recommended Use

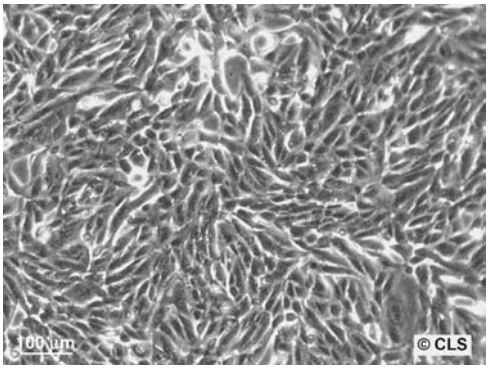
DNA profile (STR): Amelogenin: X; CSF1PO: 10; D13S317: 11, 12; D16S539: 13; D18S51: 17; D21S11: 30, 33.2; D3S1358: 15; D5S818: 12; D7S820: 9; D8S1179: 13, 16; FGA: 25; Penta D: 6, 10; Penta E: 10, 16; THO1: 7, 8; TPOX: 8; vWA: 15, 16
Oncogene: c-abl, c-fes, c-fms, c-myc, c-ha-ras, c-sis
Products: hepatitis virus B surface antigen (HBsAg)
ATCC number: CRL-8024
CLS number: 300315

Further Reading

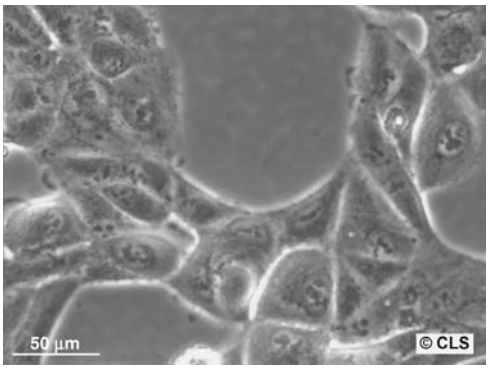
Alexander, J.J. *et al.* (1976) Establishment of a continuously growing cell line from primary carcinoma of the liver. *S. Afr. Med. J.*, **50**, 2124–2218.



RC-124, 100× Leica.



RC-124, 100× Leica.



RC-124, 400× Leica.

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RC-124

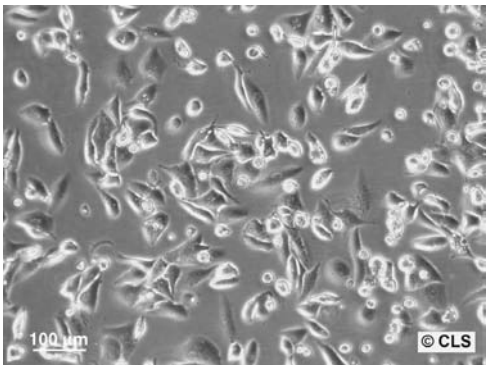
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	63 years
Tissue:	Kidney
Morphology:	Epithelial
Growth Properties:	Monolayer
Description:	Established from nontumor tissue of a 63-year-old man diagnosed with kidney carcinoma in 1998.

Culture Conditions and Handling

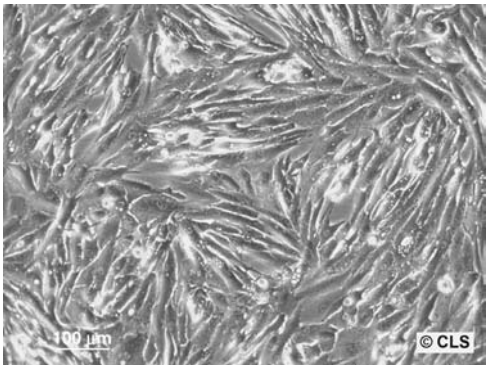
Culture medium:	McCoy's 5a medium supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium, resuspend the cells thoroughly, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

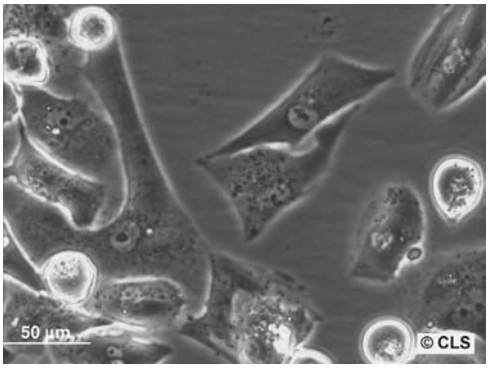
Karyotype:	$2n = 46$
DNA profile (STR):	Amelogenin: X, CSF1PO: 12; D5S818: 11; D3S1358: 16; THO1: 6, 9; Penta E: 7, 12; TPOX: 8, 11; Penta D: 9, 12; D7S820: 10, 11; D16S539: 10, 12; D21S11: 29, 30; D8S1179: 12, 13; D13S317: 13, 14; D18S51: 17, 23; vWA: 18, 19; FGA: 22, 26
Tumorigenic:	No
Immunology:	Cytokeratine 8, 18, 19, vimentin
ATCC number:	Not available
CLS number:	300251



RCC-ER, 100× Leica.



RCC-ER, 100× Leica.



RCC-ER, 400× Leica.

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RCC-ER

Origin and General Characteristics

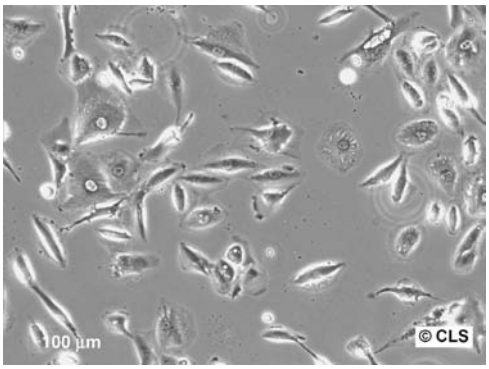
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	57 years
Gender:	Male
Tissue:	Clear cell carcinoma pT3a, N1, Mx/GIII; kidney
Morphology:	Epithelial, cytokeratine positive 8, 18,1 9, vimentin
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma pT3a, N1, Mx/GIII of a 57-year-old male, 1999

Culture Conditions and Handling

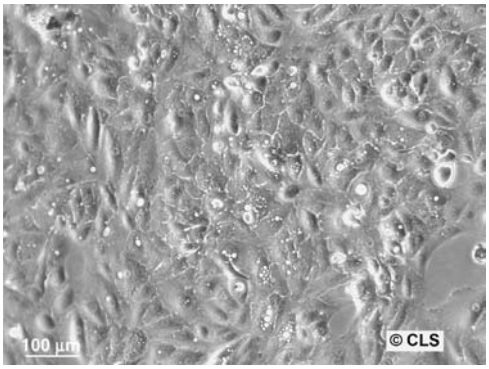
Culture medium:	McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

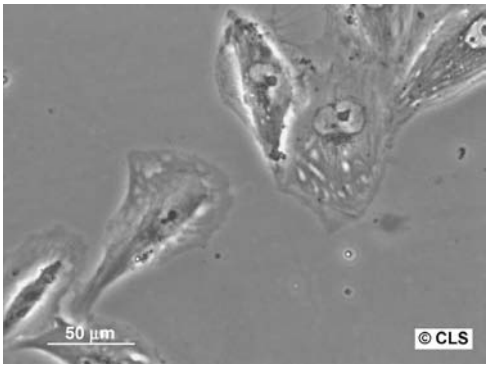
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 11; D13S317: 11, 13; D16S539: 9, 12; D18S51: 14, 17; D21S11: 30, 31.2; D3S1358: 18; D5S818: 11; D7S820: 10, 12; D8S1179: 12, 15; FGA: 21, 26; Penta D: 10, 12; Penta E: 11, 12; THO1: 6; TPOX: 8, 11; vWA: 17, 18
Tumorigenic:	Yes, in nude mice
ATCC number:	Not available
CLS number:	300238; vital: 330238



RCC-FG-1, 100× Leica.



RCC-FG-1, 100× Leica.



RCC-FG-1, 400× Leica.

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RCC-FG1

Origin and General Characteristics

Synonym:	KTCTL26
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	69 years
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Clear cell carcinoma pT2a, M1/GII
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma pT2a, M1/GII of a 69-year-old-male, 1999; PAS positive. The cells show high expression of P-170 glycoprotein

Culture Conditions and Handling

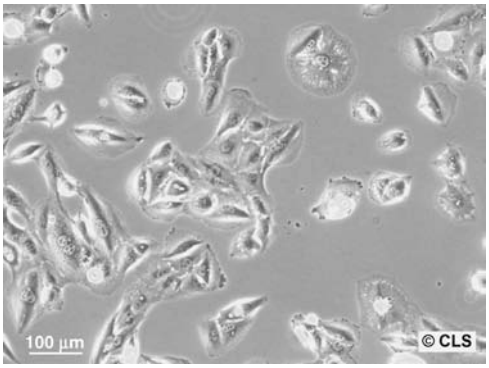
Culture medium:	McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1: 2 to 1: 3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 11; D13S317: 11,12; D16S539: 11, 13; D18S51: 14, 17; D21S11: 29, 30; D3S1358: 16, 16; D5S818: 10, 11, 12; D7S820: 10, 11, 12; D8S1179: 12, 13, 15; FGA: 19, 23; Penta D: 9, 13; Penta E: 12, 17, 18; THO1: 9, 9; TPOX: 8, 11; vWA: 18, 19
Tumorigenic:	Yes, in nude mice
Immunology:	HLA-A2 negative; cytokeratine 8+, 18+, 19+; vimentin+
ATCC number:	Not available
CLS number:	300248; vital: 330248

Further Reading

Frank, M.H. and Pomer, S. (1999) Interferon alpha2b differentially affects proliferation of two human renal cell carcinoma cell lines differing in the P-glycoprotein-associated multidrug-resistant phenotype. *J. Cancer Res. Clin. Oncol.*, **125** (2), 117–120.



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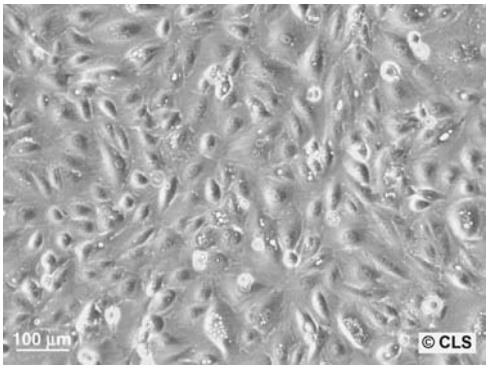

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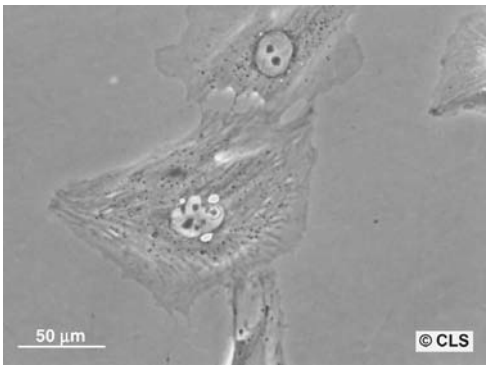


RCC-FG2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-FG2 (KTCTL-26A)

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	69 years
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Clear cell carcinoma pT2a, Nx, M1/GII
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma of a 69-year-old-male, pT2a, Nx, M1/GII; 1999; HLA-A2 positive; PAS positive, G250 positive

Culture Conditions and Handling

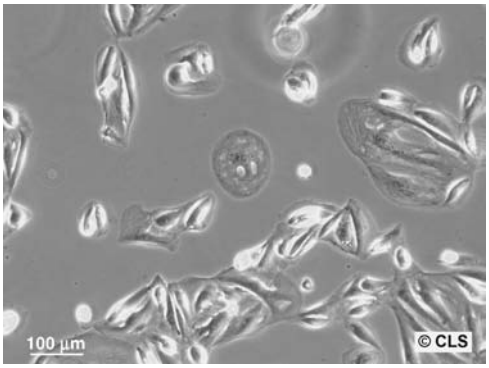
Culture medium:	RPMI 1640 medium supplemented with 5.1 ml L-glutamine (200 mM) and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X; CSF1PO: 11; D13S317: 11, 12; D16S539: 11, 13; D18S51: 15, 17; D21S11: 29, 30; D3S1358: 16; D5S818: 10, 12; D7S820: 11, 12; D8S1179: 12, 15; FGA: 19, 23; Penta D: 9, 13; Penta E: 12, 18; THO1: 9; TPOX: 8, 11; vWA: 18, 19
Tumorigenic:	Yes, in nude mice
Immunology:	Cytokeratin 8+, 18+, 19+; vimentin
ATCC number:	Not available
CLS number:	300249

Further Reading

Hogernann, I. *et al.* (1994) Cytogenetic and growth factor gene analysis of a renal carcinoma cell line. *Cancer Genet. Cytogenet.*, **78** (2), 175–180.



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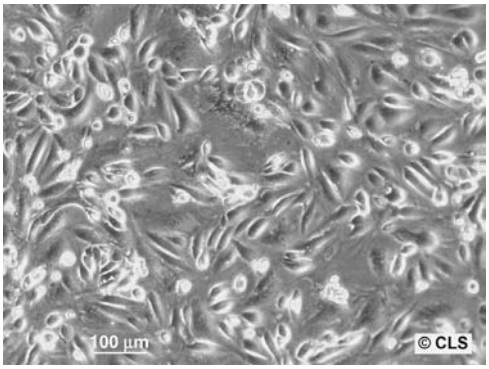

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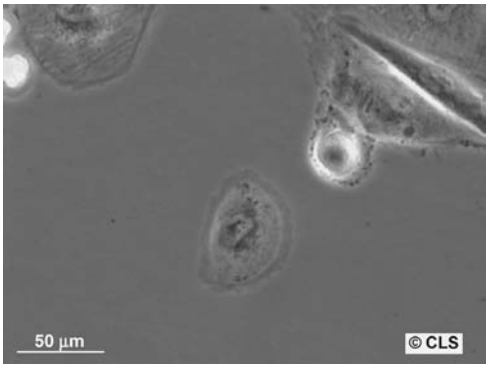


RCC-LR, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-LR (KTCTL-120)

Origin and General Characteristics

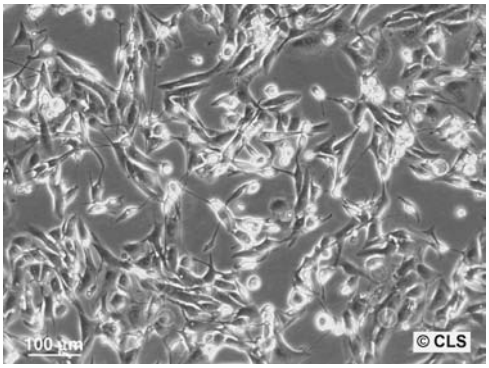
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	63 years
Gender:	Female
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Clear cell carcinoma
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma pT3a, No, M1/GIII of a 63-year-old female in 1999; HLA-A2.1 positive

Culture Conditions and Handling

Culture medium:	McCoy's 5a medium or RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 12, 14; D16S539: 12; D18S51: 13, 14; D21S11: 29, 30; D3S1358: 16, 17; D5S818: 13; D7S820: 11, 12; D8S1179: 14, 15; FGA: 20, 22; Penta D: 9, 14; Penta E: 12; THO1: 7, 8; TPOX: 8, 10; vWA: 16, 17
Tumorigenic:	Not tested
Immunology:	Cytokeratine 8, 18, 19, vimentin
CLS number:	300236



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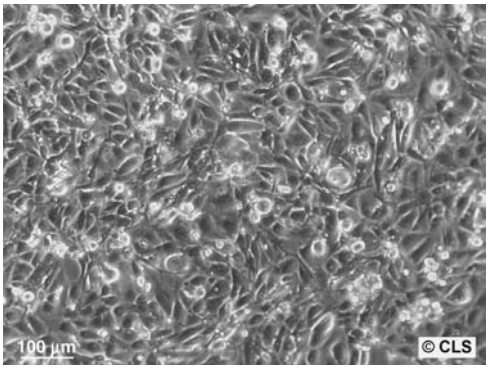

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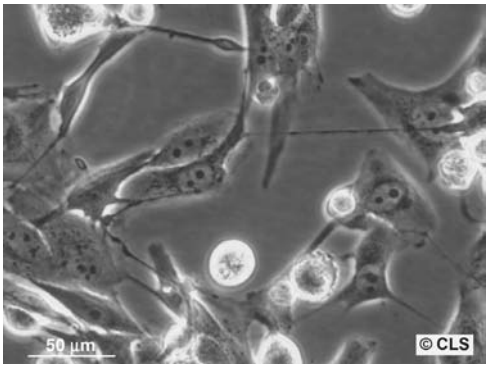


RCC-MH, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-MH (KTCTL-129)

Origin and General Characteristics

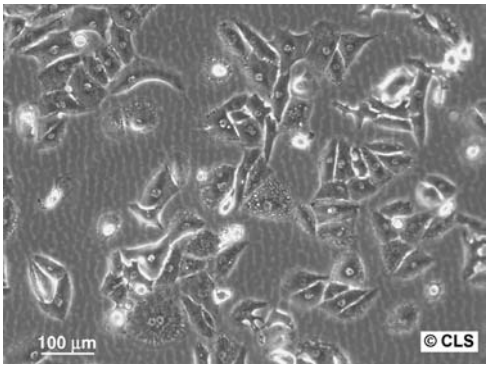
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	59 years
Gender:	Female
Tissue:	Kidney
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma pT2, No, M0/GII of a 59-year-old female in 1999; HLA-A2 negative

Culture Conditions and Handling

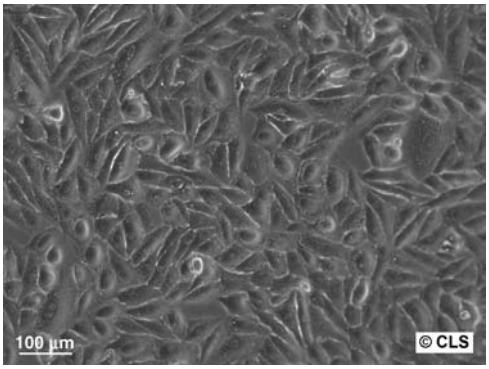
Culture medium:	McCoy's 5a medium or RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1:2 to 1:3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D3S1358: 17; D5S818: 9, 10; D7S820: 8, 12; D8S1179: 9, 15; D13S317: 11; D16S539: 12; D18S51: 16; D21S11: 29, 30; FGA: 22; THO1: 7; TPOX: 8; vWA: 15, 18; Penta D: 12, 13; Penta E: 5, 12
Tumorigenic:	Not tested
Immunology:	Cytokeratine 8, 18, 19, vimentin
ATCC number:	Not available
CLS number:	300237



RCC-OF1, 100× Leica.



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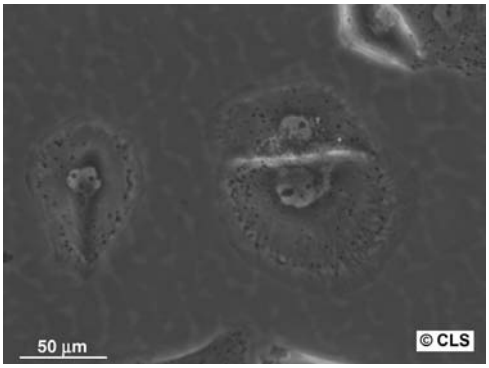


RCC-OF1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-OF1 (KTCTL-54)

Origin and General Characteristics

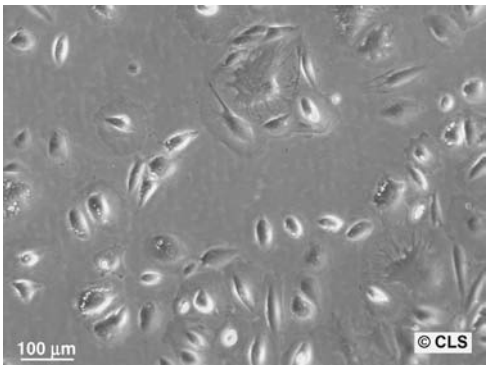
Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 61 years
Gender: Male
Tissue: Kidney
Morphology: Epithelial
Cell type: Clear cell carcinoma
Growth properties: Monolayer
Description: Established from the kidney clear cell carcinoma pT2, Nx, Mx/GI of a 61-year-old male in 1999

Culture Conditions and Handling

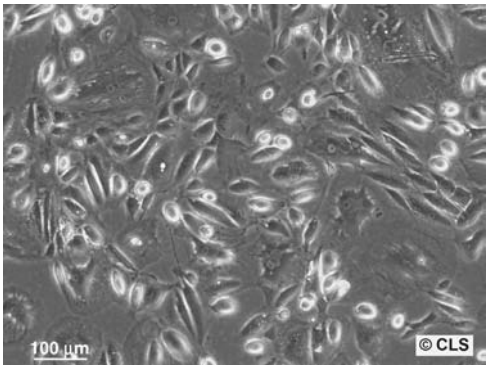
Culture medium: McCoy's 5a medium or RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal: One to two times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

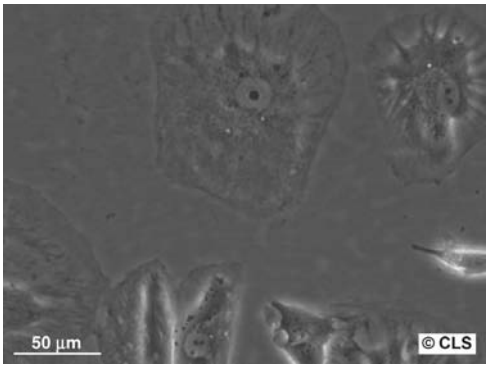
DNA Profile (STR): Amelogenin: X; CSF1PO: 12, 14; D3S1358: 15; D5S818: 10, 13; D7S820: 10, 11; D8S1179: 13, 15; D13S317: 12, 13; D16S539: 12; D18S51: 16; D21S11: 28, 29; FGA: 19, 21; Penta D: 9, 13; Penta E: 13THO1: 7, 9.3; TPOX: 8; vWA: 17
Tumorigenic: Yes, in nude mice
ATCC number: Not available
CLS number: 300255



RCC-PR, 100× Leica.



RCC-PR, 100× Leica.



RCC-PR, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-PR

Origin and General Characteristics

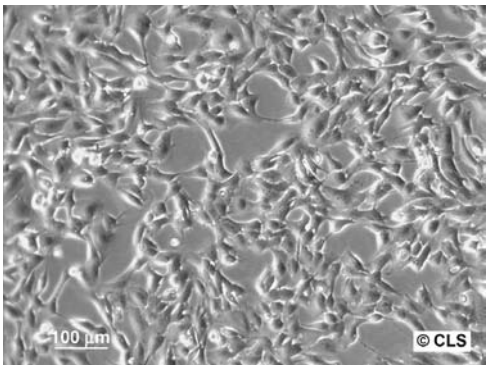
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian/European
Age:	81 years
Gender:	Female
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Carcinoma
Growth Properties:	Monolayer, adherent
Description:	Established from kidney carcinoma

Culture Conditions and Handling

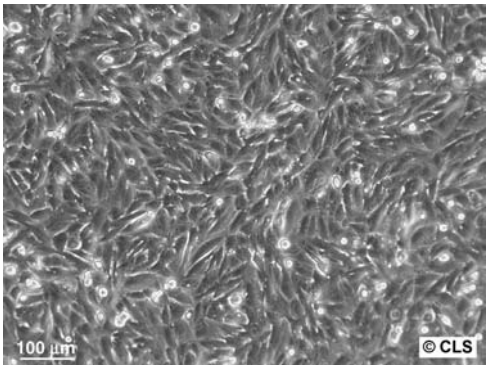
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

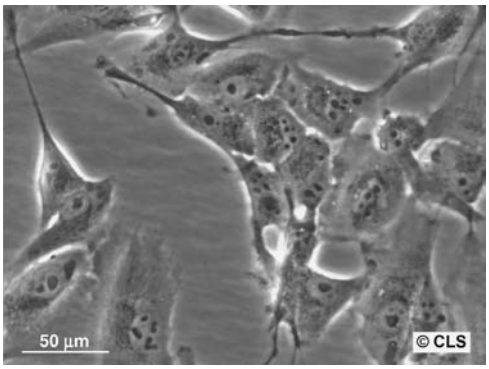
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 12; D3S1358: 15, 16; D5S818: 9; D7S820: 101; D8S1179: 13, 15; D13S317: 11; D16S539: 12; D18S51: 12, 18; D21S11: 29, 31.2; FGA: 20, 22; Penta D: 11, 12; Penta E: 7; TH01: 9; TPOX: 8; vWA: 17
CLS number:	300267



RCC-WK, 100× Leica.



RCC-WK, 100× Leica.



RCC-WK, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RCC-WK (KTCTL-87)

Origin and General Characteristics

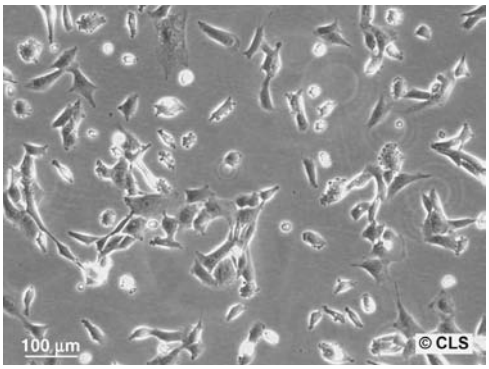
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	75 years
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Clear cell carcinoma
Growth properties:	Monolayer
Description:	Established from the kidney clear cell carcinoma pT3b, No, Mx/GII of a 75-year-old male in 1999

Culture Conditions and Handling

Culture medium:	McCoy's 5a medium or RPMI 1640 medium supplemented with 2 mM L-glutamin and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA Profile (STR):	Amelogenin: X, Y; CSF1PO: 12, 11; D3S1358: 16; D5S818: 11; D7S820: 9, 12; D8S1179: 11, 12; D13S317: 12; D16S539: 10, 12; D18S51: 17; D21S11: 28, 31.2; FGA: 21, 23; Penta D: 12, 15; Penta E: 5, 16; THO1: 8, 9; TPOX: 9, 12; vWA: 14, 16
Tumorigenic:	Not tested
ATCC number:	Not available
CLS number:	300243



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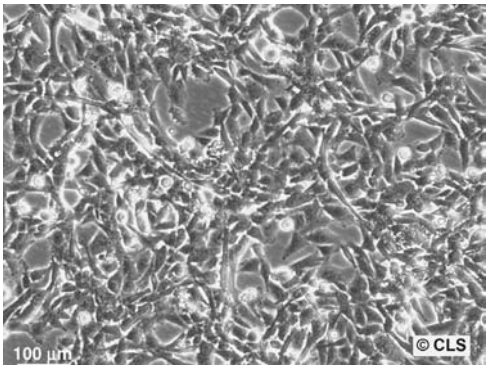

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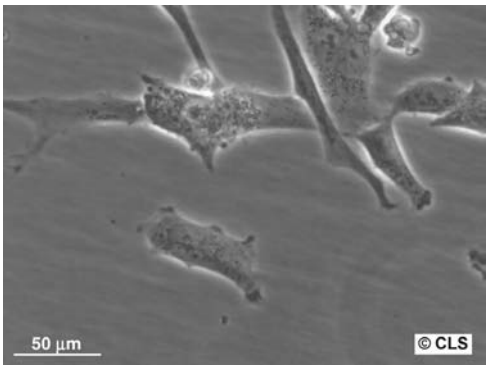


RD, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RD

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	Embryo
Gender:	Female
Tissue:	Rhabdomyosarcoma
Morphology:	Spindle cells and large multinucleated cells
Cell type:	Embryonal rhabdomyosarcoma
Growth properties:	Monolayer
Description:	This line has recently been shown to be at least parental, if not identical, to TE-671 (ATCC HTB 139)

Culture Conditions and Handling

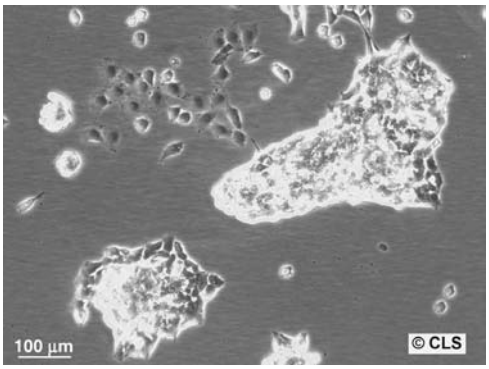
Culture medium:	Dulbecco's modified Eagle's medium supplemented with L-glutamin, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine:	Add fresh 0.025% trypsin and place at 37 °C for 3–5 min. Add fresh culture medium, aspirate, and dispense into new culture vessels
Split ratio:	A ratio of 1 : 2 is recommended
Fluid renewal:	Every three to four days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

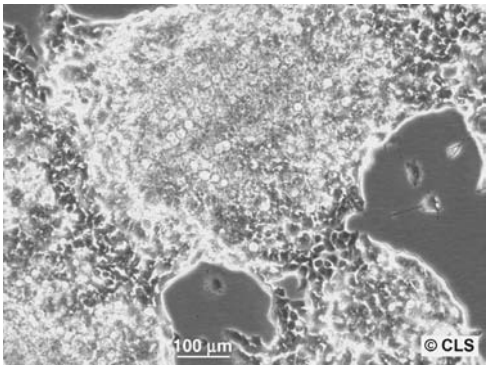
Karyotype:	$2n = 48$
DNA Profile (STR):	Amelogenin: X; CSF1PO: 10, 11; D3S1358: 15, 17; D5S818: 11; D7S820: 8, 12; D8S1179: 11, 15; D13S317: 13; D16S539: 10, 11; D18S51: 13, 18; D21S11: 28, 29; FGA: 20, 21; Penta D: 11, 13; Penta E: 12; THO1: 9, 3; TPOX: 9; vWA: 18
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
Virus susceptibility:	Poliovirus 1; vesicular stomatitis (Indiana); herpes simplex; vaccinia
Products:	Myoglobin; myosin ATPase
ATCC number:	CCL-136
CLS number:	300401

Further Reading

McAllister, R.M. *et al.* (1969) Cultivation *in vitro* of cells derived from a human rhabdomyosarcoma. *Cancer*, **24**, 520–526.



RD-ES, 100× Leica.



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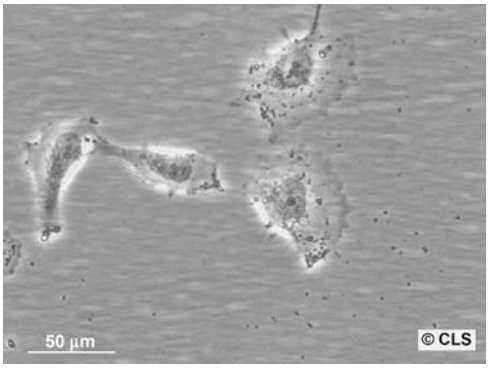


RD-ES, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RD-ES

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	19 years
Gender:	Male
Tissue:	Bone
Morphology:	Epithelial
Cell type:	Ewing's sarcoma
Growth properties:	Adherent
Description:	The cell line was initiated by G. Marshall and M. Kirchen from a primary osseous Ewing's sarcoma of the humerus. Ultrastructurally, the cells exhibit primitive cell junctions, possess glycogen pools and are 20–25 μm in diameter. The cells grow as a loosely attached monolayer in small clusters of 5–10 cells. The cells form a loose adherent layer when cultured in EMEM

Culture Conditions and Handling

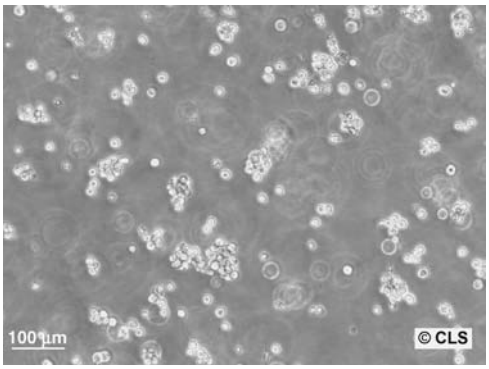
Culture medium:	Minimum essential medium Eagle (Earle's salts) supplemented with L-glutamine, 1% NEAA, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Shake the flask after removing most of the medium. Add fresh medium and transfer to new flasks. For adherent cells, use Accutase for detachment (2.5 ml, 5 min 37 °C, T75 cm^2 flask)
Split ratio:	A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal:	Two to three times per week
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

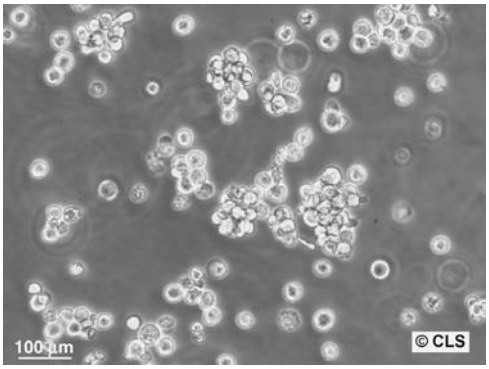
DNA profile (STR):	Amelogenin: X, Y; vWA: 17, 17; D3S1358: 15, 15; D18S51: 14, 18; D8S1179: 13, 13; FGA: 21, 25; THO1: 7, 7; D7S820: 10, 10; D16S539: 9, 11; TPOX: 9, 11; CSF1PO: 11, 11; D5S818: 11, 11; D21S11: 28, 28; Penta E: 11, 13; Penta D: 9, 12; D13S317: 11, 12
Antigen expression:	Blood type B; Rh+
Isoenzymes:	G6PD, B; PGM1, 1-2; PGM3, 1; ES-D, 1; Me-2, 1-2; AK-1, 1; GLO-1, 1-2; Phenotype Frequency Product: 0.0359
ATCC number:	HTB-166
CLS number:	300410

Further Reading

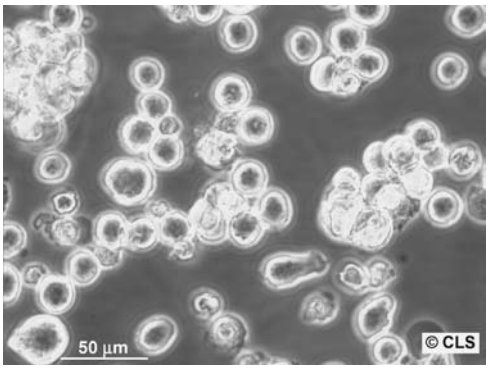
Sano, K. *et al.* (1990) Expression of the smg p25A (a ras p21-like GTP-binding protein) gene in human neuroblastoma cell lines and tumor tissue. *Cancer Res.*, **50**, 7242–7245.



RPMI 8226, 100× Leica.



RPMI 8226, 200× Leica.



RPMI 8226, 400× Leica.

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RPMI 8226

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 61 years
Gender: Male
Tissue: Blood
Morphology: Lymphoblast
Cell type: Myeloma
Growth properties: Monolayer/suspension
Description: There is no evidence of heavy chain production (cytoplasmic or secreted)

Culture Conditions and Handling

Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Start new cultures at 5×10^5 viable cells/ml and subculture at 1–2×10^6 cells/ml. Prepare dilutions by transferring the appropriate amount of cell suspension into new flasks with fresh medium. Maximum cell density is at 1–2×10^6 cell/ml
Biosafety level: 1

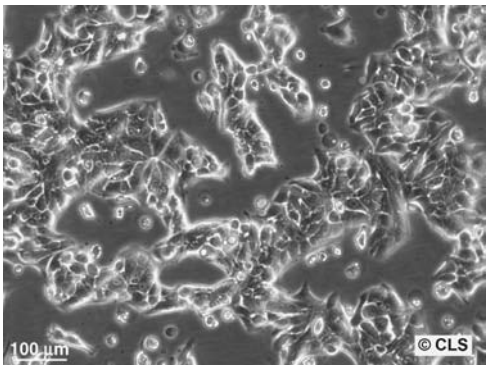
Special Features of the Cell Line and Recommended Use

DNA profile (STR): Amelogenin: X, Y; CSF1PO: 12; D13S317: 11; D16S539: 9; D18S51: 15, 19; D21S11: 28, 29; D3S1358: 16, 17; D5S818: 11, 13; D7S820: 9, 10; D8S1179: 13; FGA: 19; Penta D: 2, 2.11; Penta E: 16, 17; THO1: 8; TPOX: 8, 11; vWA: 16, 18
Antigen expression: HLA Aw19, B15, B37, Cw2
Isotype: Lambda light chain
Isoenzymes: G6PD, A
Reverse transcriptase: Negative
Products: Immunoglobulin light chain
ATCC number: CCL-155
CLS number: 300431

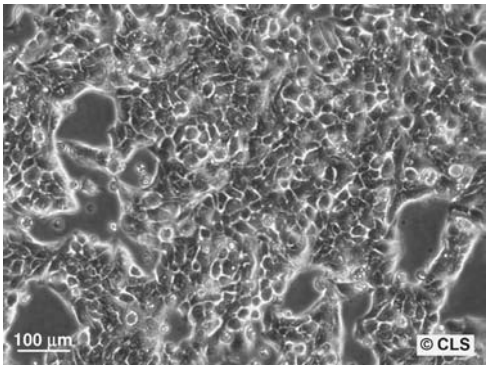
Further Reading

Matsuoka, Y. *et al.* (1967) Production of free light chains of immunoglobulin by a hematopoietic cell line derived from a patient with multiple myeloma. *Proc. Soc. Exp. Biol. Med*, **125**, 1246–1250.

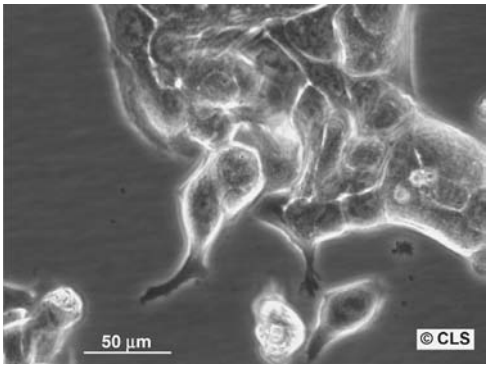
Moore, G.E. and Kitamura, H. (1968) Cell line derived from patient with myeloma. *N.Y. State J. Med.*, **68** (15), 2054–2060.



RT4, 100× Leica.



RT4, 100× Leica.



RT4, 400× Leica.

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RT4

Origin and Generl Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	63 years
Gender:	Male
Tissue:	Transitional cell papilloma; bladder, urinary
Morphology:	Epithelial
Growth properties:	Monolayer

Culture Conditions and Handling

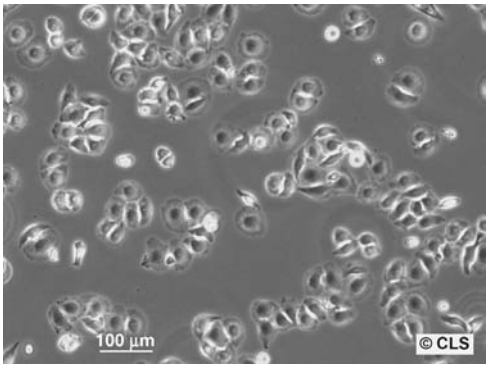
Culture medium:	McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

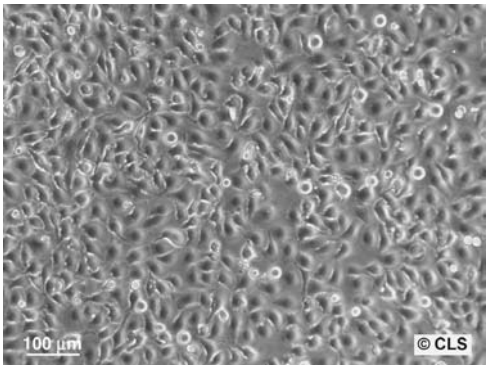
Karyotype:	(P174) Hyperdiploid and hypotetraploid to hypertetraploid with abnormalities including dicentrics, breaks, translocations, and minutes
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 8; D16S539: 9; D18S51: 15, 17; D21S11: 30, 32.2; D3S1358: 15; D5S818: 11, 12; D7S820: 9, 9; D8S1179: 13, 15; FGA: 22, 24; Penta D: 12; Penta E: 7, 10; THO1: 9, 9.3; TPOX: 8, 11; vWA: 14, 17
Tumorigenic:	Yes, in cheek pouch of steroid treated hamsters
Antigen expression:	HLA A25(10), A3, B12, Cw3; blood type O
Isoenzymes:	Me-2, 1; PGM1, 1-2; PGM3, 1-2; ES-D, 1-2; AK-1, 1; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0050
ATCC number:	CRL-2768
CLS number:	300326

Further Reading

Rigby, C.C. *et al*. (1970) A human tissue culture cell line from a transitional cell tumour of the urinary bladder: growth, chromosone pattern and ultrastructure. *Br. J. Cancer*, **24**, 746–754.



RT-112, 100× Leica.



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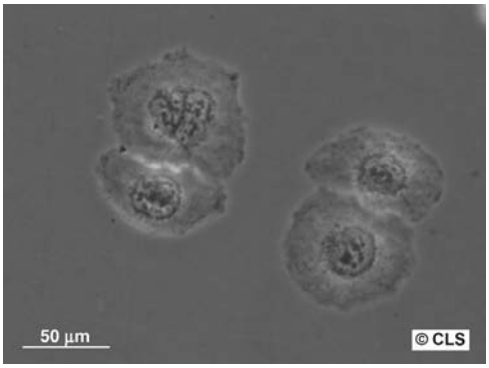

RT-112, 400× Leica.

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RT-112

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Tissue:	Urinary bladder
Morphology:	Epithelial
Cell type:	Carcinoma
Growth properties:	Monolayer
Description:	Cytokeratine (4),5,(6), 7, 8, 13, 17, 18, 19, Desmoplakin; DNA-index = 2, 1

Culture Conditions and Handling

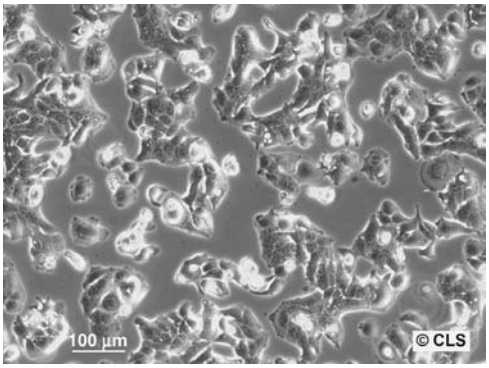
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

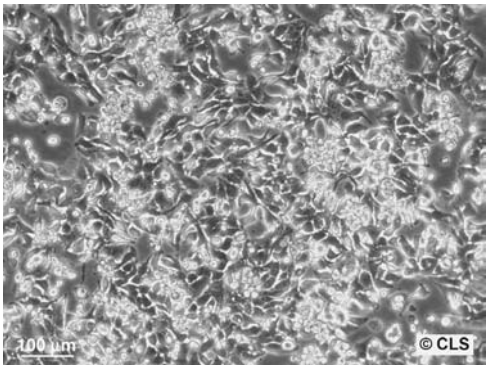
DNA Profile (STR):	Amelogenin: X; CSF1PO: 10, 11; D3S1358: 15; D5S818: 10, 13; D7S820: 12, 11; D8S1179: 13, 15; D13S317: 13, 14; D16S539: 11, 13; D18S51: 15; D21S11: 27, 30; FGA: 23; Penta D: 10, 11; Penta E: 12, 16; THO1: 7; TPOX: 8, 11; vWA: 14, 17
Tumorigenic:	Yes, in nude mice
ATCC number:	DSMZ: ACC 418
CLS number:	300324

Further Reading

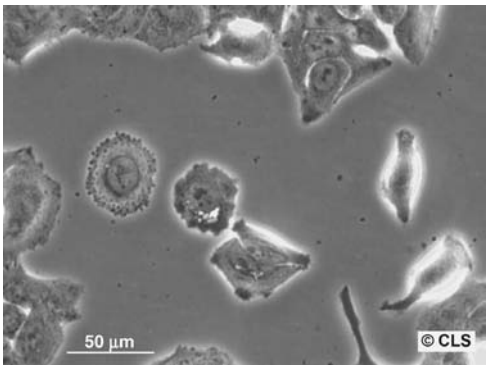
Benham, F. *et al*. (1977) Alkaline phosphatase activity in human bladder tumor cell lines. *J. Histochem. Cytochem.*, **25**, 266–274.



RT-112-D21, 100× Leica.



RT-112-D21, 100× Leica.



RT-112-D21, 400× Leica.

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RT-112-D21

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Urinary bladder carcinoma
Morphology: Epithelial
Growth properties: Monolayer, adherent
Description: Cytokeratine (4), 5, (6), 7, 8, 13, 17, 18, 19, Desmoplakin; DNA-index = 2,1

Culture Conditions and Handling

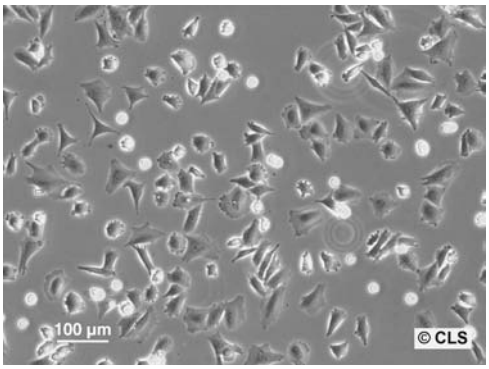
Culture medium: RPMI 1640 medium supplemented with 10% fetal bovine serum
Subculture routine: Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.25% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

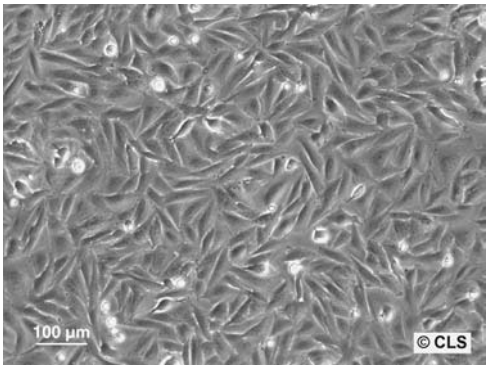
DNA Profile (STR): Amelogenin: X; CSF1PO: 10, 11; D3S1358: 15; D5S818: 10, 13; D7S820: 11, 12; D8S1179: 13, 15; D13S317: 13, 14; D16S539: 11, 13; D18S51: 15; D21S11: 27, 30; FGA: 23; Penta D: 10, 11; Penta E: 12, 16; THO1: 7; TPOX: 8, 11; vWA: 14, 17
Tumorigenic: Yes, in nude mice
CLS number: 300325

Further Reading

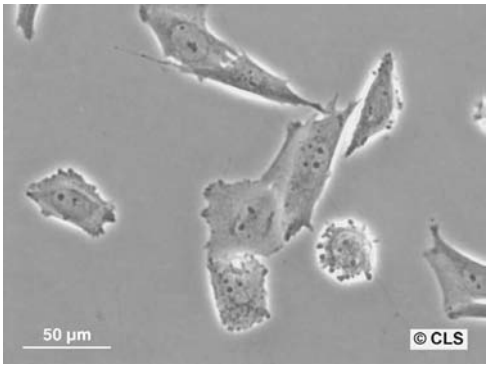
Seemann, O. *et al.* (1995) Establishment and characterization of a multidrug-resistant human bladder carcinoma cell line. *Urol. Res.*, **22**, 353–360.



SaOS-2, 100× Leica.



SaOS-2, 100× Leica.



SaOS-2, 400× Leica.

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Saos-2

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	11 years
Gender:	Female
Tissue:	Bone
Morphology:	Epithelial
Cell type:	Osteosarcoma
Growth properties:	Adherent
Description:	The SaOS-2 cell line was established by J. Fogh in 1973

Culture Conditions and Handling

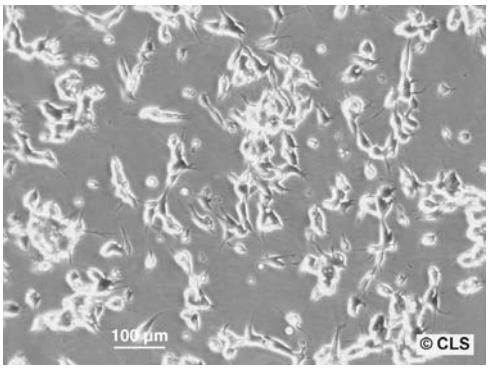
Culture medium:	DMEM:Ham's F12 (1:1, vol:vol) supplemented with L-glutamine and 5–10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh EDTA (versene) solution. Add fresh 0.025% trypsin/EDTA solution, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium, dislodge cells, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times per week
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

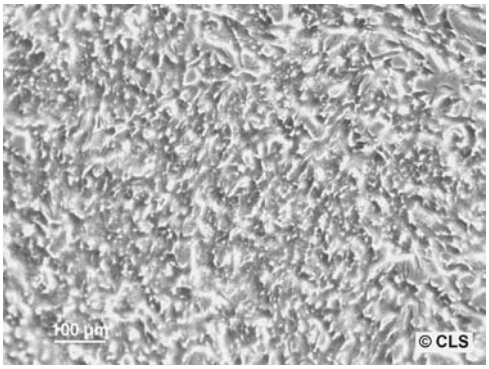
Karyotype:	Hypotriploid, modal number = 56
DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 10; D13S317: 12, 13; D16S539: 12, 13; D18S51: 15, 15; D21S11: 28, 30; D3S1358: 14, 18; D5S818: 12, 12; D7S820: 8, 10; D8S1179: 10,12; FGA: 22, 25; Penta D: 11, 12; Penta E: 14, 19; THO1: 6, 9; TPOX: 8, 8; vWA: 18, 18
Tumorigenic:	No
Antigen expression:	Blood type B, Rh+ ; HLA A2, A3, Bw16, Bw47
Receptors expressed:	epidermal growth factor (EGF); transforming growth factor beta (type 1 and type 2)
Isoenzymes:	Me-2, 1; PGM3, 1-2, PGM1, 1-2, ES-D, 2; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0002
ATCC number:	HTB-85
CLS number:	300331

Further Reading

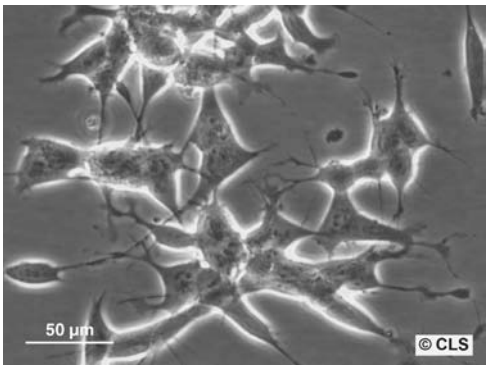
Fogh, J. and Trempe, G. (1975) New human tumor cell lines, in *Human Tumor Cells In Vitro* (ed. J. Fogh), Plenum Press, New York and London, pp 115–159.



SH-SY5Y, 100× Leica.



SH-SY5Y, 100× Leica.



SH-SY5Y, 400× Leica.

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S

SH-SY5Y

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: Four years
Gender: Female
Tissue: Brain (from metastatic site: bone marrow)
Morphology: The cells grow as clusters of neuroblastic cells with multiple, short, fine cell processes (neurites). Cells will aggregate, form clumps and float; a confluent monolayer is not formed
Cell type: Neuroblast (neuroblastoma)
Growth properties: Monolayer; form clumps at high cell density
Description: SH-SY5Y is one of three serially isolated neuroblast clones (SH-SY, SH-SY5, SH-SY5Y) of the human neuroblastoma cell line SK-N-SH which was established in 1970 from a metastatic bone tumor. The cells exhibit moderate levels of dopamine beta hydroxylase activity. They can convert glutamate to the neurotransmitter GABA. SH-SY5Y cells have a reported saturation density greater than 1×10^6 cells/cm^2. The loss of neuronal characteristics has been described with increasing passage numbers (approx. passage 20). Neuronal markers or uptake of noradrenalin should be determined routinely. It is recommended to control the status of neuronal markers

Culture Conditions and Handling

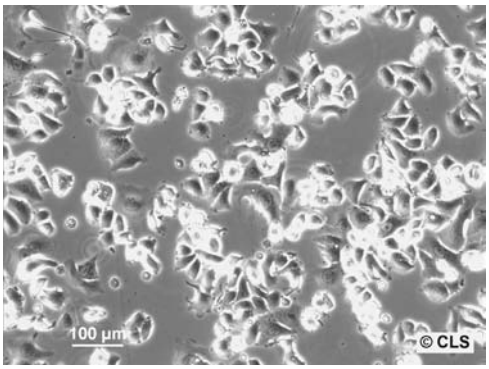
Culture medium: Minimum Essential medium Eagle (Earle's salts) supplemented with L-glutamine, 1% NEAA, 1 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 4 is recommended
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

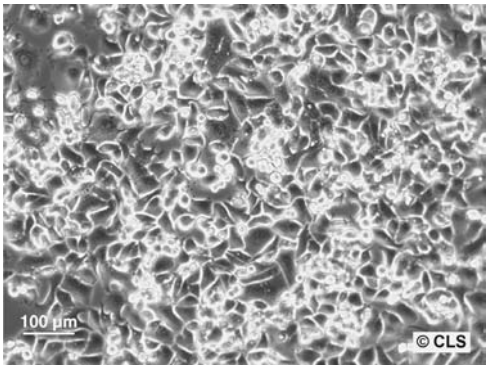
DNA profile (STR): Amelogenin: X; CSF1PO: 11; D13S317: 11; D16S539: 8, 13; D18S51: 13, 16; D21S11: 31, 31.2; D3S1358: 15, 16; D5S818: 12; D7S820: 7, 10; D8S1179: 15; FGA: 23.2, 24; Penta D: 10, 12; Penta E: 7, 11; THO1: 7, 10; TPOX: 8, 11; vWA: 14, 18
Tumorigenic: Forms tumors in nude mice within approx. 3–4 weeks.
ATCC number: CRL-2266
CLS number: 300154

Further Reading

Riedler, J.L. *et al.* (1978) Multiple neurotransmitter synthesis by human neuroblastoma cell lines and clones. *Cancer Res.*, **38**, 3751–3757.



SK-BR-3, 100× Leica.



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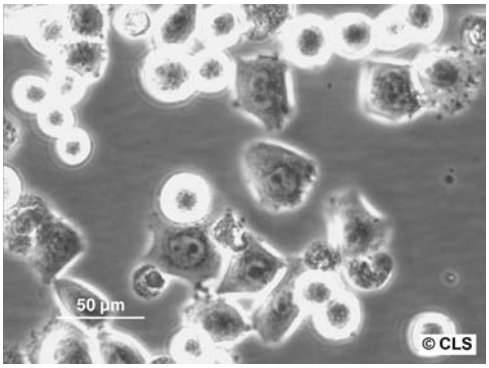

SK-BR-3, 400× Leica.

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S

SK-BR-3

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	43 years
Gender:	Female
Tissue:	Mammary gland (pleural effusion)
Morphology:	Epithelial
Cell type:	Adenocarcinoma; malignant
Growth properties:	Monolayer
Description:	Ultrastructural features include microvilli and desmosomes, glycogen granules, large lysosomes, bundles of cytoplasmic fibrils. No virus particles

Culture Conditions and Handling

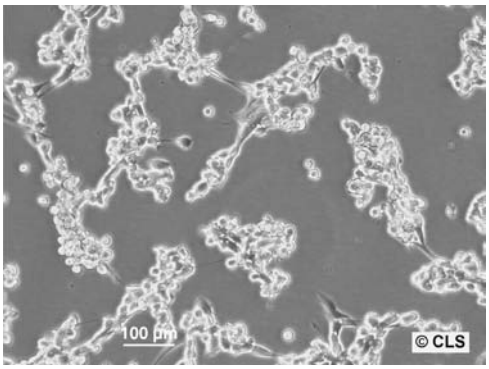
Culture medium:	DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine:	Remove media and rinse with fresh 0.02% EDTA (versene) solution. Add a fresh mixture of 0.025% trypsin/0.02% EDTA and let the culture sit at 37 °C until the cells detach. Add fresh media (containing FBS), remove trypsin by centrifugation, resuspend in fresh media, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

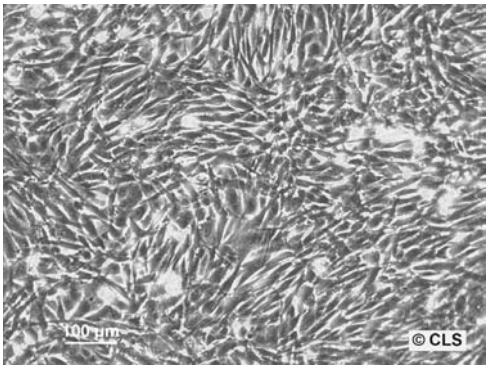
Karyotype:	(P9) hypertriploid to hypotetraploid (+A, +B, +C, +E, +F, +G, −D) with abnormalities including dicentrics, acrocentric fragments, rings, secondary constrictions, large metacentrics or polycentrics, and large submetacentric marker
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 11, 12; D16S539: 9; D18S51: 10, 13; D21S11: 30, 30.2; D3S1358: 17; D5S818: 9, 12; D7S820: 9, 12; D8S1179: 11, 12; FGA: 20; Penta D: 9, 13; Penta E: 10, 11; THO1: 8, 9; TPOX: 8, 11; vWA: 17
Tumorigenic:	Yes, in nude mice; forms poorly differentiated adenocarcinoma
Antigen Expression:	Blood Type A; Rh + ; HLA A11, Bw22(+/−), B40, B18
Isotype:	PGM3, 1; PGM1, 1-2; ES-D, 1; AK-1, 1-2; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0044
ATCC number:	HTB-30
CLS number:	300333

Further Reading

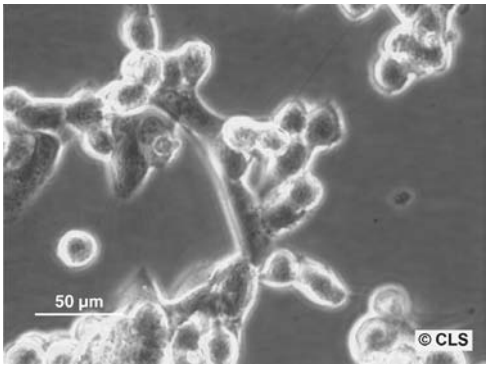
Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-LMS-1, 100× Leica.



SK-LMS-1, 100× Leica.



SK-LMS-1, 400× Leica.

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S

SK-LMS-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	43 years
Gender:	Female
Tissue:	Uterus
Morphology:	Fibroblast
Cell type:	Leiomyosarcoma
Growth properties:	Adherent

Culture Conditions and Handling

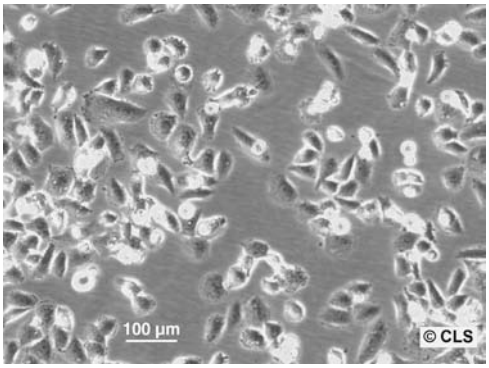
Culture medium:	DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with EDTA (versene) solution. Add fresh 0.25% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium to inhibit trypsin, centrifuge, aspirate, and dispense into new flasks. Subculture every six to eight days.
Split ratio:	A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

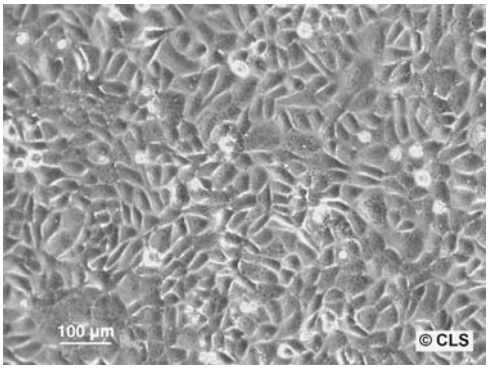
Karyotype:	(P12) hypotriploid to hypertriploid (+A2, +A3, +C, +D, +E, +F, +G, −A) with abnormalities including dicentrics, acrocentric fragments, breaks, secondary constrictions, minutes and large submetacentric markers
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 9,10; D13S317: 12; D16S539: 8, 11; D18S51: 14, 19; D21S11: 28, 30; D3S1358: 15, 16; D5S818: 11, 13; D7S820: 8, 9; D8S1179: 12; FGA: 22, 25; Penta D: 12, 13; Penta E: 7, 13; THO1: 6, 7; TPOX: 8, 9; vWA: 18
Tumorigenic:	Yes, in nude mice; forms leiomyosarcoma
Antigen expression:	Blood type O; Rh+
Isoenzymes:	Me-2, 2; PGM3, 1-2; PGM1, 1-2; ES-D, 1; AK-1, 1; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0027
ATCC number:	HTB-88
CLS number:	300125

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-LU-1, 100× Leica.



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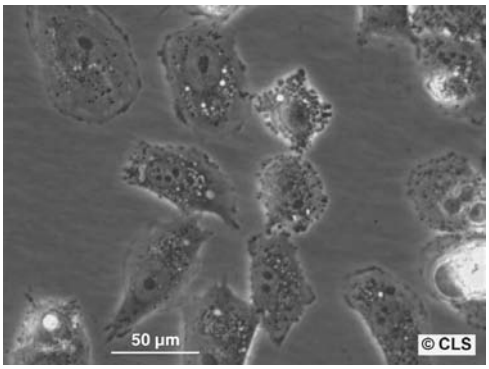

SK-LU-1, 400× Leica.

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SK-LU-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 60 years
Gender: Female
Tissue: Lung
Morphology: Epithelial
Cell type: Adenocarcinoma (grade III)
Growth properties: Monolayer

Culture Conditions and Handling

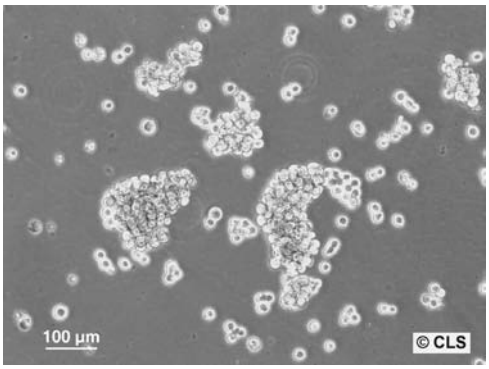
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1: 2 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

Karyotype: The stemline chromosome number is hypotetraploid, with the 2S component occurring at 4.4%. Marker chromosomes 1p, t(1q;11q); 11q+; t(13;?); 16q+; t(12q; 18q); M10; t(2q;13q); i(15); and ?t(xp;21q) occurred in all S metaphases, and t(1p;?); t(1p;14q); t(16;?), and t(14;21) occurred in some. In addition, 4 to 9 small markers of unidentifiable origin occurred frequently. Chromosome No. 7 was generally hexasomic, X chromosomes were disomic, and normal No. 15 was absent. No Y chromosome was detected in the QM stained preparation
DNA profile (STR): Amelogenin: X; CSF1PO: 10; D13S317: 10; D16S539: 8; D18S51: 18; D21S11: 29, 30.2; D3S1358: 18; D5S818: 11; D7S820: 9; D8S1179: 10; FGA: 21, 22; Penta D: 10, 13; Penta E: 5; THO1: 7; TPOX: 8, 10; vWA: 16, 17
Tumorigenic: Yes, in immunotolerant rats and nu-nu mice
Antigen expression: Blood type O; Rh+; HLA Aw24, Aw32, B27, Bw41
Isoenzymes: Me-2, 1; PGM3, 1; PGM1, 2; ES-D, 2; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.00003
ATCC number: HTB-57
CLS number: 300335

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



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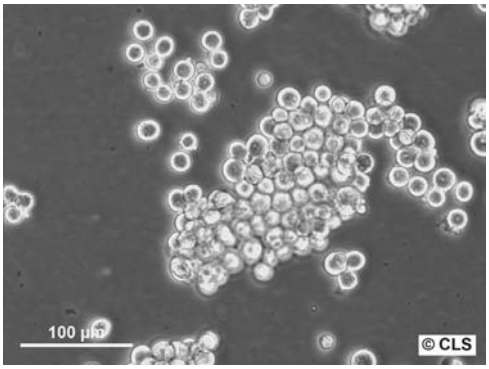

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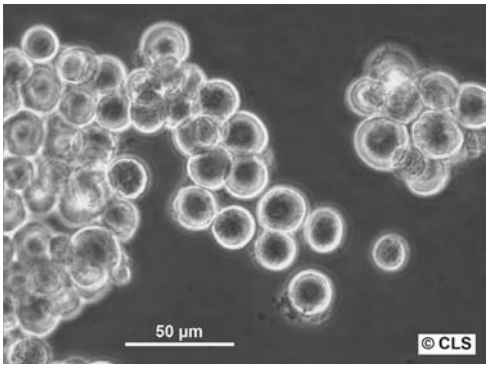

SK-MEL-1, 400× Leica.

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S

SK-MEL-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 29 years
Gender: Male
Tissue: Melanoma, malignant; skin; from metastatic site: lymphatic system
Morphology: Spherical
Growth properties: Suspension
Description: F. Oettgen and associates isolated this line using cells obtained from the thoracic duct of a patient with widespread and rapidly progressing malignant melanoma. Electron microscopy revealed pigment granules relating both to synthesis and to phagocytosis. Antibody to this line was detected in 63% of patients with malignant melanoma and in 10% of patients with other diseases

Culture Conditions and Handling

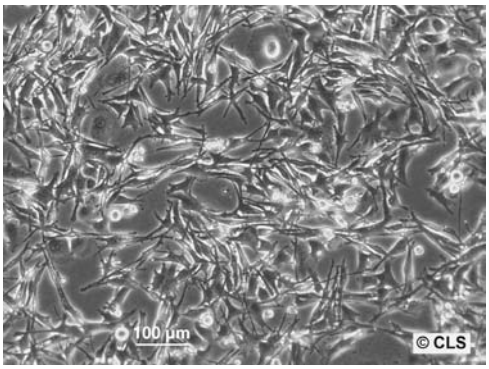
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Cultures can be maintained by addition or replacement of fresh medium. Establish new cultures at 1×10^5 cells/ml and maintain at $2–5 \times 10^5$ cells/ml
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

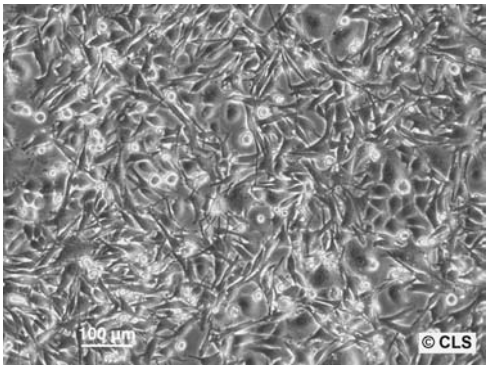
DNA Profile (STR): Amelogenin: X; CSF1PO: 11, 12; D3S1358: 16; D5S818: 10, 13; D7S820: 8, 11; D8S1179: 13, 14; D13S317: 8, 12; D16S539: 12; D18S51: 13, 15; D21S11: 29, 31; FGA: 17; Penta D: 13, 14; Penta E: 13, 21; THO1: 7, 9; TPOX: 9; vWA: 14, 17
Antigen expression: Blood type A; Rh+
Isoenzymes: PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 1-2; G6PD, B
Products: Melanin
ATCC number: HTB-67
CLS number: 300424

Further Reading

Oettgen, H.F. *et al.* (1968) Suspension culture of a pigment-producing cell line derived from a human malignant melanoma. *J. Natl. Cancer Inst.*, **41**, 827–843.



SK-MEL-2, 100× Leica.



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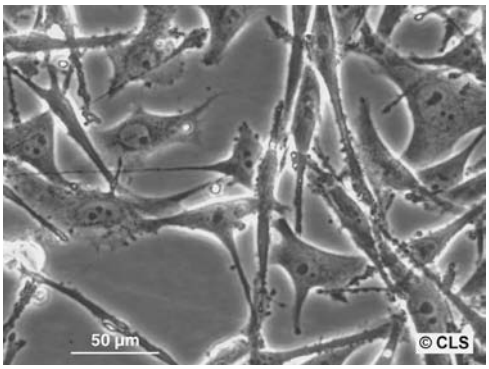

SK-MEL-2, 400× Leica.

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SK-MEL-2

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	60 years
Gender:	Male
Tissue:	Skin; from metastatic site: skin of thigh
Morphology:	Polygonal
Cell type:	Malignant melanoma
Growth properties:	Adherent

Culture Conditions and Handling

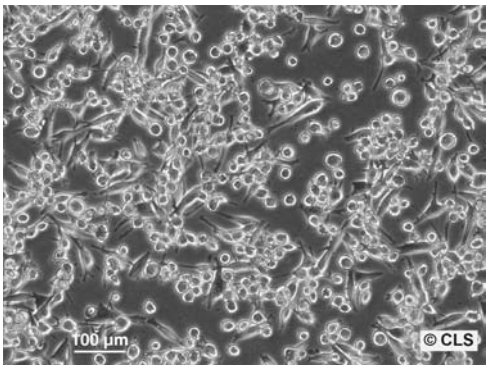
Culture medium:	DMEM:Ham's F12 medium (1 : 1 mixture) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times per week
Freeze medium:	CM-1 (CLS · Cell Lines Service)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

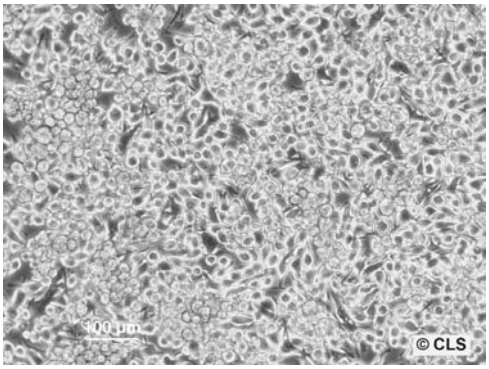
Karyotype:	(P6) hypodiploid to hypertetraploid with abnormalities including dicentrics, secondary constrictions, and large telocentric marker. Phenotype Frequency Product: 0.0742
DNA Profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D3S1358: 14, 16, 18; D5S818: 12, 13; D7S820: 8, 11, 12; D8S1179: 12, 13; D13S317: 11, 12; D16S539: 8, 9, 10; D18S51: 14, 15, 16; D21S11: 27, 28, 29, 30; FGA: 19, 21, 24, 25; Penta D: 10, 15; Penta E: 7, 16, 17; THO1: 7, 9; TPOX: 8, 9, 12; vWA: 17, 18
Tumorigenic:	Yes, in nude mice; forms malignant melanoma
Antigen expression:	Blood type A; Rh+
Isoenzymes:	PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD, B
CLS number:	300423

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-MEL-5, 100× Leica.



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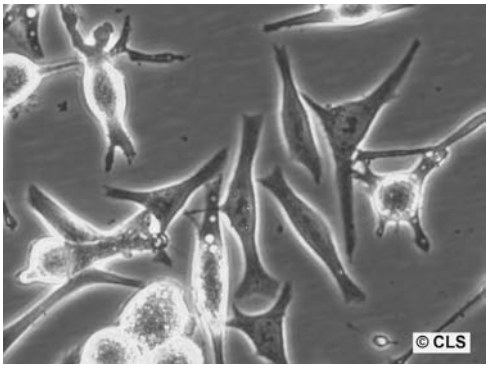

SK-MEL-5, 400× Leica.

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SK-MEL-5

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 24 years
Gender: Female
Tissue: Skin; Melanoma, malignant; from metastatic site: axillary node
Morphology: Stellate
Growth properties: Adherent
Description: This is one of a very extensive series of melanoma lines that have been isolated by T. Takahashi and associates. The lines served as source of target cells for the detection of melanoma specific antibody in patients with this disease

Culture Conditions and Handling

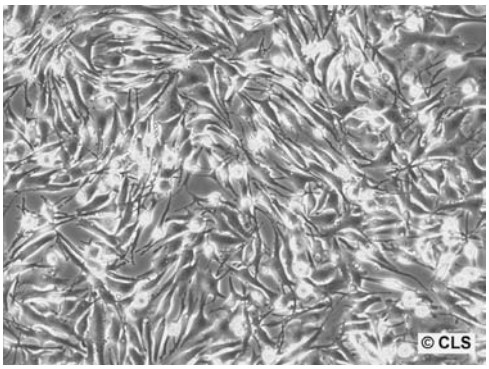
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 1% NEAA (nonessential amino acids, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times per week
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

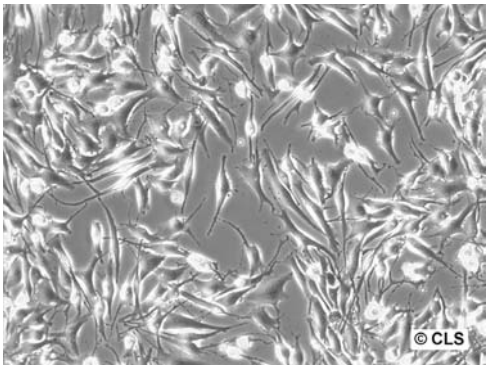
DNA profile (STR): Amelogenin: X; CSF1PO: 10, 13; D13S317: 10, 12; D16S539: 10, 12; D18S51: 15, 16; D21S11: 29; D3S1358: 16, 17; D5S818: 11, 13; D7S820: 9, 12; D8S1179: 12, 15; FGA: 20.2, 22.2; Penta D: 9, 11; Penta E: 5, 12; THO1: 6, 9; TPOX: 11; vWA: 14, 18
Tumorigenic: Yes, in nude mice; forms malignant melanoma
Antigen expression: Blood type O; Rh + ; HLA A2, A11, B40, Bw16
Isoenzymes: PGM1, 1-2, PGM3, 1; ES-D, 1; AK-1, 1; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0860
ATCC number: HTB-70
CLS number: 300157

Further Reading

Carey, T.E. *et al.* (1976) Cell surface antigens of human malignant melanoma: mixed hemadsorption assays for humoral immunity to cultured autologous melanoma cells. *Proc. Natl. Acad. Sci. USA*, **73**, 3278–3282.



SK-MEL-28, 100× Leica.



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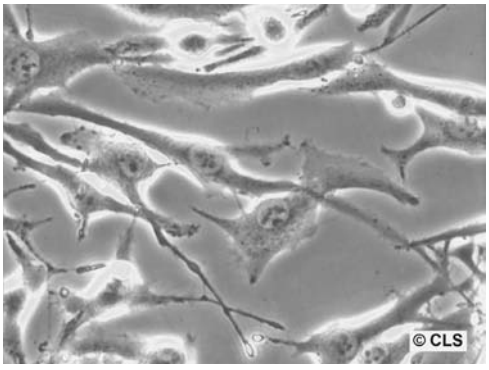

SK-MEL-28, 400× Leica.

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SK-MEL-28

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Age:	51 years
Gender:	Male
Tissue:	Skin
Morphology:	Polygonal
Cell type:	Malignant melanoma
Growth properties:	Monolayer
Description:	T. Takahashi and associates have isolated this cell line as a series of melanoma lines (SK-MEL-5, SK-MEL-24 and SK-MEL-31)

Culture Conditions and Handling

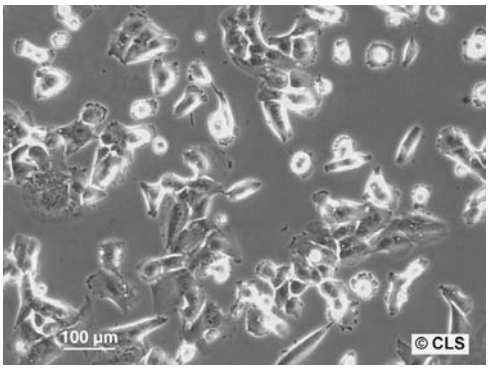
Culture medium:	DMEM supplemented with glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA/PBS solution. Add fresh 0.025% trypsin/0.02% EDTA/PBS solution and incubate at 37 °C until the cells detach. Add complete medium, remove trypsin by centrifugation, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

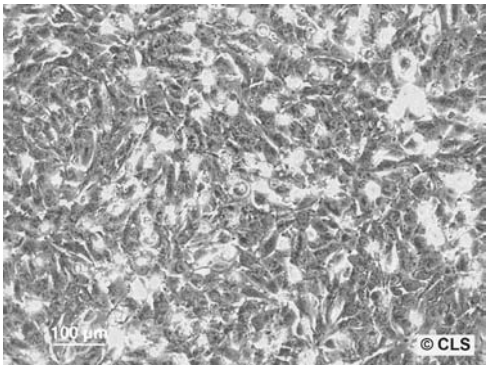
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 10, 12; D13S317: 11, 12; D16S539: 9, 12; D18S51: 12, 16; D21S11: 28, 29; D3S1358: 16, 18; D5S818: 13; D7S820: 10; D8S1179: 13; FGA: 19; Penta D: 9, 10; Penta E: 8, 12; THO1: 7; TPOX: 8, 12; vWA: 16, 19
Tumorigenic:	Yes, in nude mice; forms malignant melanoma (large round cell type)
Antigen expression:	Blood type A; Rh+; HLA A11, A26, B40, DRw4
Isoenzymes:	PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1-2; GLO-1, 2; G6PD, B
ATCC number:	HTB-72
CLS number:	300337

Further Reading

Carey, T.E. *et al.* (1976) Cell surface antigens of human malignant melanoma: mixed hemadsorption assays for humoral immunity to cultured autologous melanoma cells. *Proc. Natl. Acad. Sci. USA*, **73**, 3278–3282.



SK-MES-1, 100× Leica.



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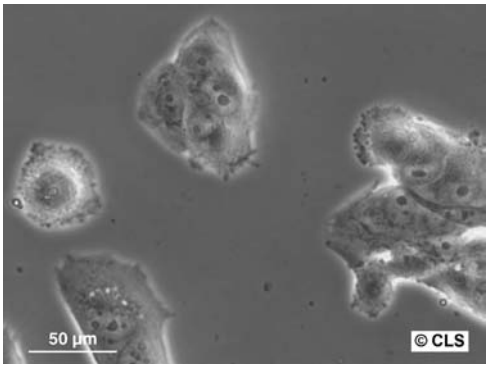

SK-MES-1, 400× Leica.

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SK-MES-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Age:	65 years
Tissue:	Lung (pleural effusion)
Cell type:	Epithelial; squamous carcinoma
Growth properties:	Monolayer

Culture Conditions and Handling

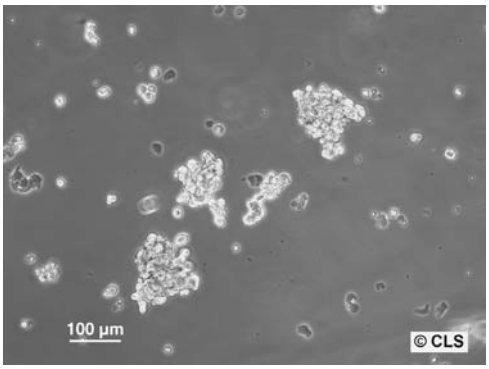
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with L-glutamine, 1% nonessential amino acids, 1 mM sodium pyruvate. and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA (versene). Rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh medium containing serum, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Freeze medium:	CM-1 (CLS · Cell Lines Service)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

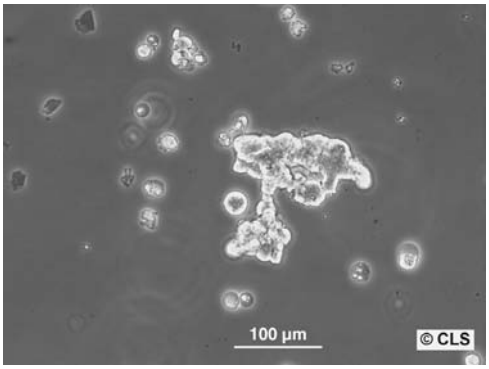
Karyotype:	The stemline chromosome number is hypotriploid, with the 2S component occurring at 3.2%. Seventeen to 20 marker chromosomes were common to most S metaphases. Normal X, 13, and 19 chromosomes were absent, and chromosomes 2, 3, 14, 17 and 20 were generally monosomic. The Y chromosome was not detected using QM staining
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 12; D13S317: 11; D16S539: 13; D18S51: 17; D21S11: 29, 30; D3S1358: 16; D5S818: 11; D7S820: 8; D8S1179: 13, 14; FGA: 20, 24; Penta D: 12, 13; Penta E: 5, 11; THO1: 6, 9.3; TPOX: 8; vWA: 14
Antigen expression:	Blood type O; Rh+ ; HLA A3, Aw30, B7, B27
Isoenzymes:	Me-2, 1-2; PGM3, 1; PGM1, 1-2; ES-D, 1; AK-1, 1; GLO-1, 1; G6PD, B; Phenotype Frequency Product: 0.0132
ATCC number:	HTB-58
CLS number:	300339

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-NEP-1, 100× Leica.



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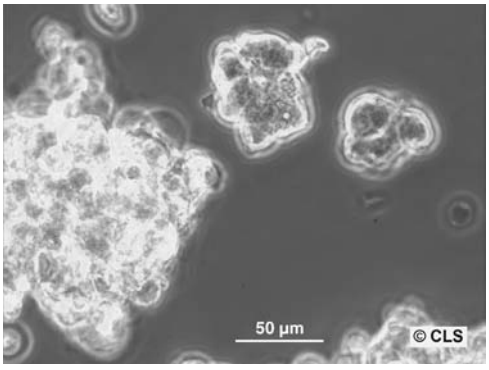


SK-NEP-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

SK-NEP-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 25 years
Gender: Female
Tissue: Wilms' tumor; pleural effusion
Morphology: Epithelial
Growth properties: Suspension
Description: Ultrastructural features include few microvilli, junctional complexes, well formed Golgi, mostly smooth ER, lipid droplets, no virus particles

Culture Conditions and Handling

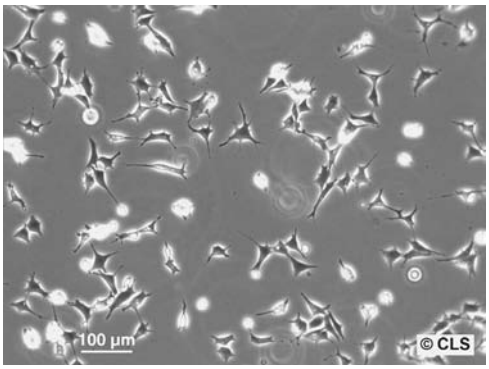
Culture medium: RPMI 1640 medium supplemented with L-glutamin and 10% fetal bovine serum
Subculture routine: Cultures can be maintained by addition or replacement of fresh medium. Establish new cultures at 1×10^5 cells/ml and maintain at between 10^5 and 10^6 cells/ml
Fluid renewal: Every two to four days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

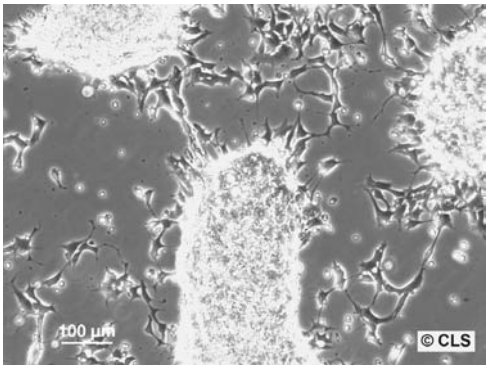
Karyotype: (P12) hypotriploid to hypertriploid (+A1, +A2, +C, +D, +E, +F, +G) with abnormalities including acrocentric fragments, secondary constrictions, and large subtelocentric markers
DNA profile (STR): Amelogenin: X; CSF1PO: 10; D13S317: 11; D16S539: 11; D18S51: 15, 17; D21S11: 29, 31; D3S1358: 14, 15; D5S818: 13; D7S820: 8, 10; D8S1179: 12; FGA: 24; Penta D: 11, 12; Penta E: 7, 18; THO1: 8, 9.3; TPOX: 8, 11; vWA: 15, 19
Tumorigenic: Yes, in nude mice; forms tumor with small cells consistent with Wilms' tumor
Antigen expression: Blood type A; Rh+
Isoenzymes: PGM3, 1; PGM1, 1-2; ES-D, 1; Me-2, 2; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0029
ATCC number: HTB-48
CLS number: 300341

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-N-LO, 100× Leica.



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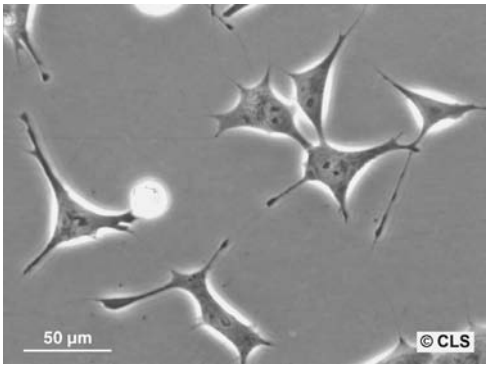

SK-N-LO, 400× Leica.

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SK-N-LO

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Tissue:	Brain
Morphology:	Epithelial
Cell type:	Neuroblastoma
Growth properties:	Adherent, on collagen-coated flasks
Description:	Sk-N-LO tend to pile up and loose adherence when cultured on untreated cell culture flasks. Collagen-treated flasks improve their adherence

Culture Conditions and Handling

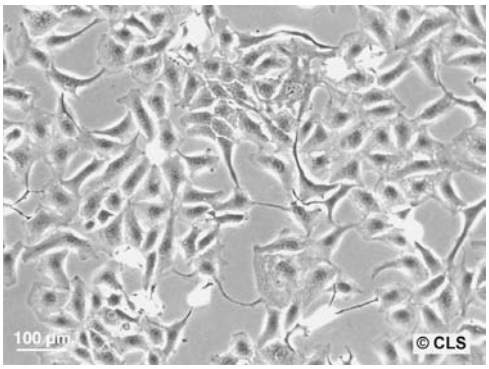
Culture medium:	Minimum essential medium Eagle supplemented with 2 mM L-glutamine and Earle's BSS adjusted to contain 1.5 g/l sodium bicarbonate, 0.1 mM nonessential amino acids, 1.0 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh PBS. For detachment, use either 0.25% trypsin solution or the trypsin-alternatives Accutase (PAA). Incubate the cells at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, add fresh medium, and dispense into new flasks. Attachment of Sk-N-LO cells is enhanced on collagen-coated flasks
Split ratio:	A ratio of 1 : 6 to 1 : 12 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

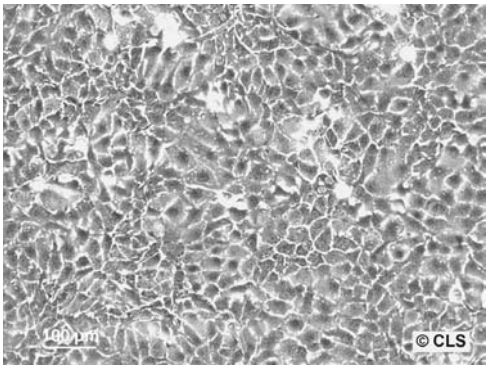
Karyotype:	Phenotype Frequency Product: 0.00005
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 8, 11; D16S539: 12; D18S51: 12; D21S11: 27, 28; D3S1358: 14, 17; D5S818: 11, 12; D7S820: 11; D8S1179: 12, 15; FGA: 25; Penta D: 9, 13; Penta E: 7; THO1: 10; TPOX: 8, 11; vWA: 14,17
ATCC number:	Not available
CLS number:	300400

Further Reading

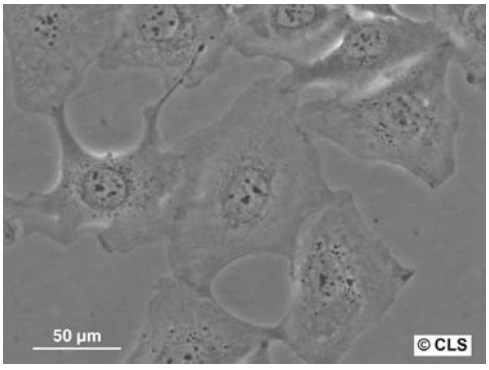
Bruchelt, G. *et al*. (1985) Effect of lithium on the proliferation of fibroblasts and tumor cell lines *in vitro*. *Klin Padatr*, **197**, 249–252.



SK-OV-3, 100× Leica.



SK-OV-3, 100× Leica.



SK-OV-3, 400× Leica.

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S

SK-OV-3

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	64 years
Gender:	Female
Tissue:	Ovary (ascites)
Morphology:	Ovary (ascites)
Cell type:	Adenocarcinoma
Growth properties:	Monolayer
Description:	Derived from the ascitic fluid from a 64-year-old caucasian female with an ovarian tumor. SK-OV-3 cells are resistant to tumor necrosis factor and to several cytotoxic drugs including diphtheria toxin, cis-platinum and adriamycin. Forms moderately well differentiated adenocarcinoma consistent with ovarian primary cells

Culture Conditions and Handling

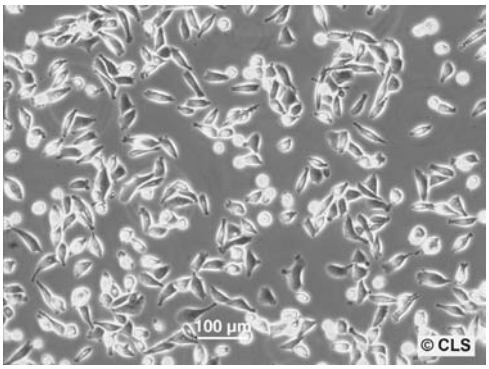
Culture medium:	McCoy's 5a medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum. Alternatively, DMEM:F-12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum may be used
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA solution, and let the culture sit at 37 °C until the cells detach. Add fresh medium containing FBS, centrifuge to remove trypsin, resuspend the cells in fresh cell culture media, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

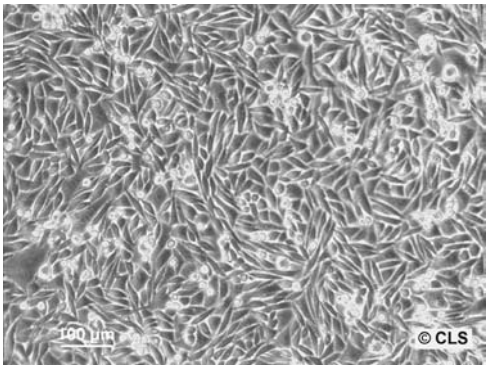
Karyotype:	(P16) hypodiploid to hypotetraploid with dicentrics and large telocentric
DNA profile (STR):	Amelogenin: X; CSF1PO: 11; D13S317: 8, 11; D16S539: 12; D18S51: 16, 17, 18; D21S11: 30, 31, 31.2; D3S1358: 14; D5S818: 11; D7S820: 13, 14; D8S1179: 14, 15; FGA: 24, 25, 26; Penta D: 12, 13; Penta E: 5, 13; THO1: 9, 9.3; TPOX: 8, 11; vWA: 17, 18
Tumorigenic:	Yes, in nude mice; forms moderately well differentiated adenocarcinoma consistent with ovarian primary
Antigen expression:	Blood type B; Rh+
Isoenzymes:	PGM3, 1; PGM1, 1-2; ES-D, 1; Me-2, 1; AK-1, 1; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0311
Viruses:	Tested for SMR-Provirus: *env*-gene negative/*gag*-gene negative
ATCC number:	HTB-77
CLS number:	300342

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SK-UT-1, 100× Leica.



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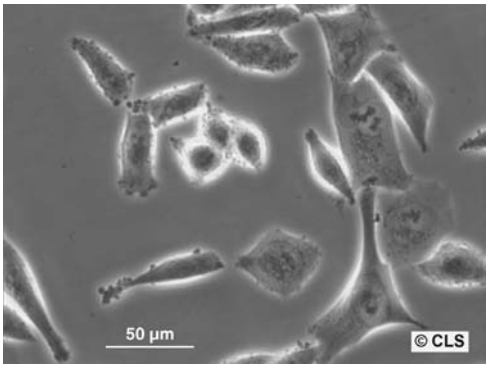

SK-UT-1, 400× Leica.

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S

SK-UT-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	75 years
Gender:	Female
Tissue:	Mixed mesodermal tumor; consistent with leiomyosarcoma (grade III); uterus
Morphology:	Epithelial
Growth properties:	Monolayer

Culture Conditions and Handling

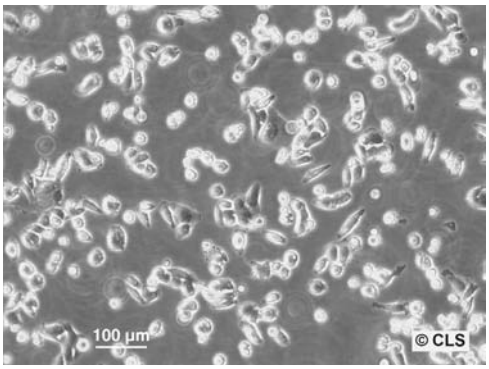
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS with nonessential amino acids and sodium pyruvate, 90%; fetal bovine serum, 10%
Subculture routine:	Remove medium, add fresh 0.025% trypsin solution for 1 min, remove trypsin, and let the culture sit at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks. Subculture every six to eight days
Split ratio:	A ratio of 1 : 2 is recommended
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

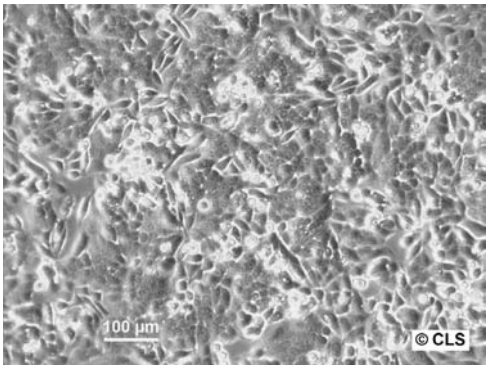
Karyotype:	(P8) hypodiploid to hyperdiploid
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 11, 13; D16S539: 13, 14; D18S51: 11, 16; D21S11: 29, 32.2; D3S1358: 15, 16; D5S818: 10, 11; D7S820: 9, 10; D8S1179: 13, 15; FGA: 22, 24; Penta D: 11, 15; Penta E: 17; THO1: 7; TPOX: 8; vWA: 15, 16
Tumorigenic:	Yes, in nude mice; forms spindle cell sarcoma
Antigen expression:	Blood type B; Rh+
Isoenzymes:	Me-2, 1-2; PGM3, 1; PGM1, 1; ES-D, 1; AK-1, 1; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0590
ATCC number:	HTB-144
CLS number:	300455

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SW-480, 100× Leica.



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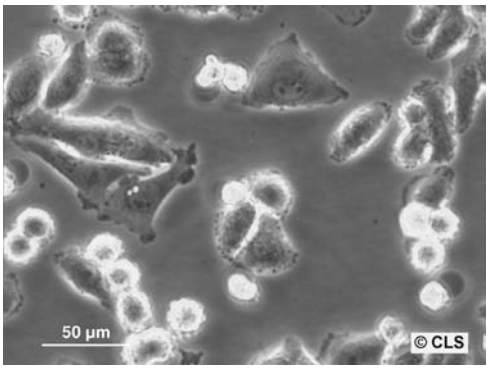

SW-480, 400× Leica.

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SW-480

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	51 years
Gender:	Male
Tissue, Cell type:	Colon, Adenocarcinoma (grade 4, Duke type B)
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The SW480 cell line originated from a surgical specimen of a primary tumor of a moderately differentiated colon adenocarcinoma

Culture Conditions and Handling

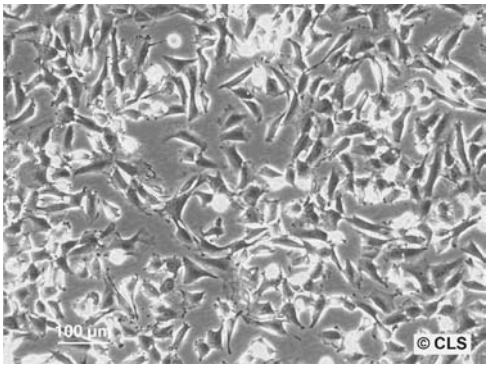
Culture medium:	Ham's F12 supplemented with 2 mM L-glutamine and 5% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Carefully resuspend the cells and dispense into new flasks
Split ratio:	A ratio of 1: 2 to 1: 8 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

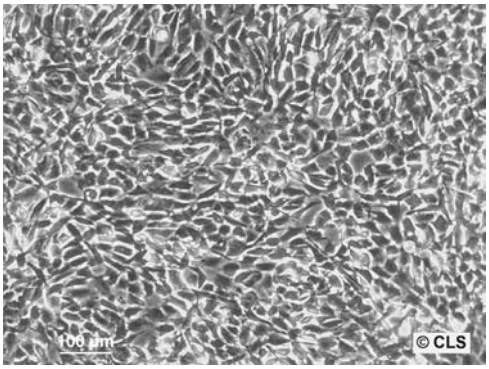
DNA profile (STR):	Amelogenin: X; D13S317: 12; D16S539: 13; D5S818: 13; D7S820: 8; TPOX: 11; vWA: 16; D3S1358: 15; D18S51: 13; Penta E: 10; D8S1179: 13; FGA: 24; D21S11: 30, 30.2; THO1: 8; Penta D: 9, 15; CSF1PO: 13, 14
Tumorigenic:	Yes, in nude mice
Oncogene:	myc +; myb +; ras +; fos +; sis +; p53 +; abl −; ros −; src −
Antigen expression:	HLA A2, B8, B17; blood type A; Rh+
Receptors expressed:	epidermal growth factor (EGF)
Isoenzymes:	G6PD, B; PGM1, 2; PGM3, 1; 6PGD, A; PEP-D, 1; ES-D, 1
Reverse transcriptase:	Negative
Virus susceptibility:	Human immunodeficiency virus (HIV, LAV)
Products:	CEA; keratin; TGF beta
ATCC number:	CCL-228
CLS number:	Cryovial: 300302

Further Reading

Melcher, R. *et al.* (2000) Spectral karyotyping of the human colon cancer cell lines SW480 and SW620. *Cytogenet. Cell Genet.*, **88**, 145–52.



SW-579, 100× Leica.



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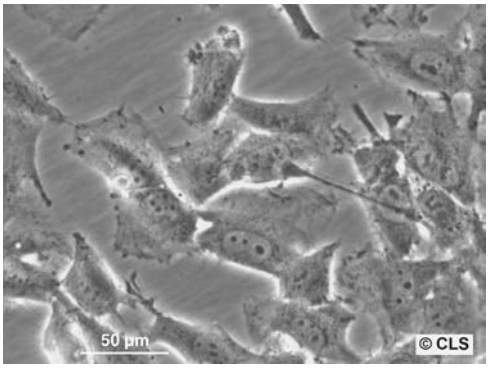

SW-579, 400× Leica.

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S

SW-579

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	59 years
Gender:	Male
Tissue:	Thyroid
Morphology:	Epithelial
Cell type:	Squamous cell carcinoma
Growth properties:	Monolayer

Culture Conditions and Handling

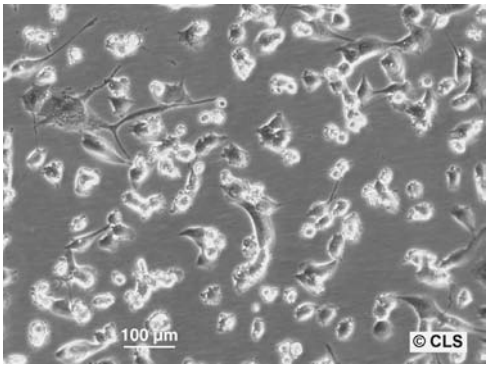
Culture medium:	RPMI 1640 supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1:5 up to 1:10 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

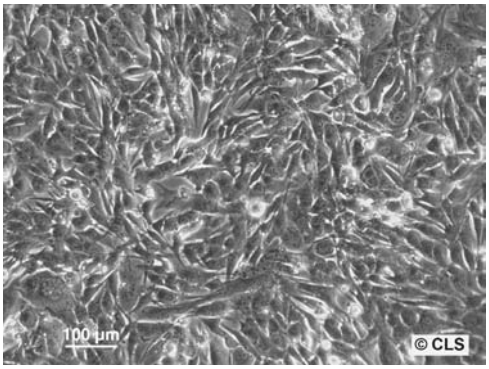
DNA profile (STR):	Amelogenin: X; CSF1PO: 13; D13S317: 13; D16S539: 11; D18S51: 15, 17, 18; D21S11: 29, 31; D3S1358: 15, 18; D5S818: 11; D7S820: 8, 9; D8S1179: 11, 13; FGA: 21, 24; Penta D: 9, 12; Penta E: 11, 12; THO1: 8, 9.3; TPOX: 8, 10; vWA: 14, 18
Tumorigenic:	Yes, produces a grade III malignant spindle and giant cell tumor in nude mice
Antigen expression:	Blood type O; Rh+
Isoenzymes:	Me-2, 1-2; PGM3, 1; PGM1, 1-2; ES-D, 1; AK-1, 1; GLO-1, 2; G6PD, B; Phenotype Frequency Product: 0.0209
ATCC number:	HTB-107
CLS number:	300346

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SW-684, 100× Leica.



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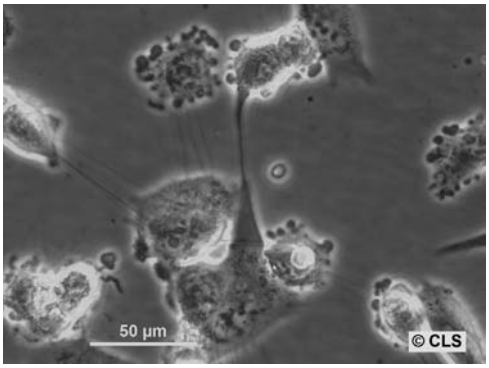

SW-684, 400× Leica.

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SW-684

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 68 years
Gender: Male
Tissue: Connective tissue
Morphology: Fibroblast
Cell type: Fibrosarcoma
Growth properties: Monolayer
Description: The SW 684 cell line was initiated by A. Leibovitz in 1974 at the Scott and White Clinic, Temple, Texas from a fibrosarcoma removed from a 68-year-old male Caucasian

Culture Conditions and Handling

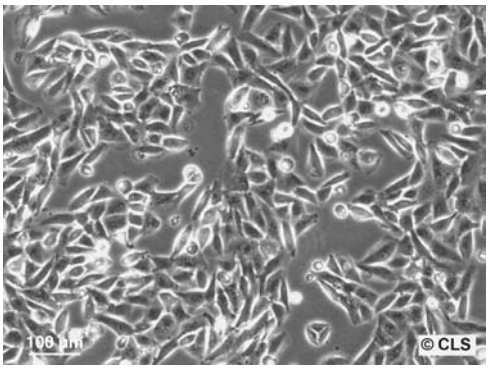
Culture medium: Leibovitz's L-15 medium supplemented with 5% fetal bovine serum
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin - 0.02% EDTA solution, and let the culture sit at room temperature for 2 min. Remove trypsin, and let the culture sit at 37 °C for 5 min. Add fresh medium to disperse the cells and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 5 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

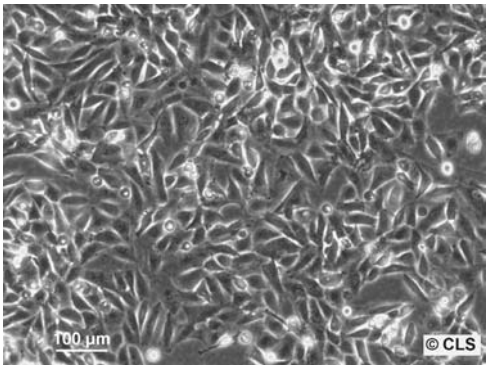
Karyotype: Hypertriploid; modal number = 73; range = 59 to 79. The rate of higher ploidies was 9.1%. A total of 11 markers were common to most cells. These include: der(2)t(2;6)(p13;q13), der(12)t(8;12)(q11;q24), t(15q21q), 19q+, t(8p21q?), and six others. Of these, the der(2) and t(8p21q?) were generally paired. A few cells had double minutes (DMs) (one per cell when present). There were four copies of N1, N18, N20, and N22 in most cells. Normal 15 and Y were absent. The X was paired in all cells
DNA Analysis (STR): Amelogenin: X, Y; CSF1PO: 12, 13; D3S1358: 15, 18; D5S818: 12; D7S820: 7, 10; D8S1179: 14; D13S317: 10, 13; D16S539: 11, 13; D18S51: 14, 19; D21S11: 30, 31.2; FGA: 20, 22; Penta D: 13; Penta E: 5, 12; THO1: 6, 9.3; TPOX: 11; vWA: 16, 17
Tumorigenic: Yes, produces tumors in nude mice consistent with fibrosarcoma
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1; AK-1, 1-2; GLO-1, 2; Phenotype Frequency Product: 0.0055
ATCC number: HTB-91
CLS number: 300422

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SW-872, 100× Leica.



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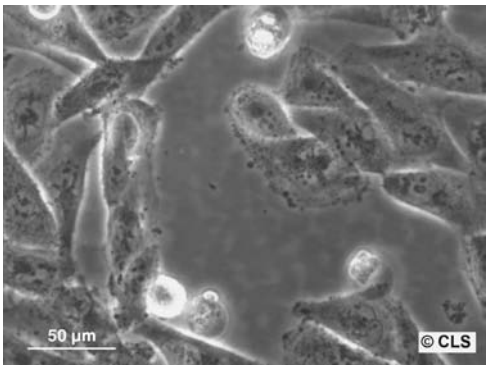

SW-872, 400× Leica.

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SW-872

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 36 years
Gender: Male
Tissue: Liposarcoma
Morphology: Fibroblast
Growth properties: Monolayer
Description: The SW 872 cell line was initiated by A. Leibovitz in 1974 at the Scott and White Clinic, Temple, Texas from a surgical specimen of a fibrosarcoma removed from a 36-year-old male Caucasian. The histopathology evaluation reported an undifferentiated malignant tumor consistent with liposarcoma

Culture Conditions and Handling

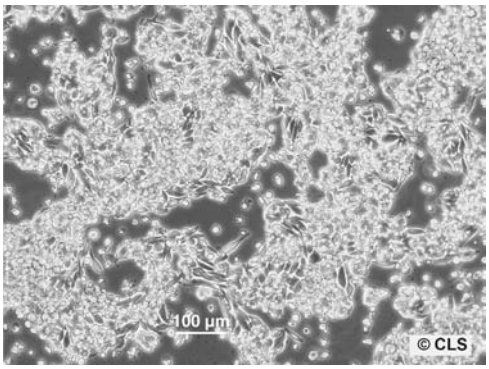
Culture medium: DMEM supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

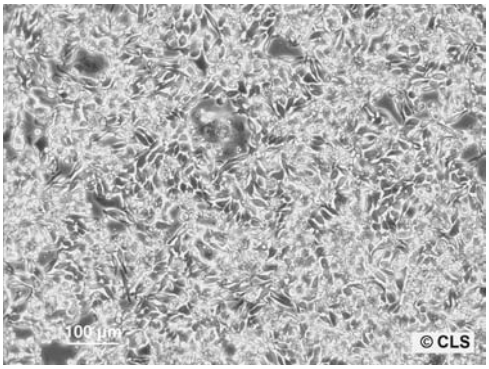
Karyotype: Hypertriploid; modal number = 80; range = 66 to 81. The rate of higher ploidies was 8.2%
DNA profile (STR): Amelogenin: X; CSF1PO: 10; D13S317: 11; D16S539: 9, 12; D18S51: 12, 16; D21S11: 27, 31.2; D3S1358: 16; D5S818: 12, 13; D7S820: 8, 11; D8S1179: 12, 15; FGA: 21.2, 23; Penta D: 9, 10; Penta E: 5, 10; THO1: 8, 10; TPOX: 8, 11; vWA: 17
Tumorigenic: Yes, produces spindle cell sarcoma in nude mice consistent with liposarcoma
Antigen expression: Blood type O+
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1; ES-D, 1; AK-1, 1; GLO-1, 1-2; Phenotype Frequency Product: 0.0708
ATCC number: HTB-92
CLS number: 300405

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SW-948, 100× Leica.



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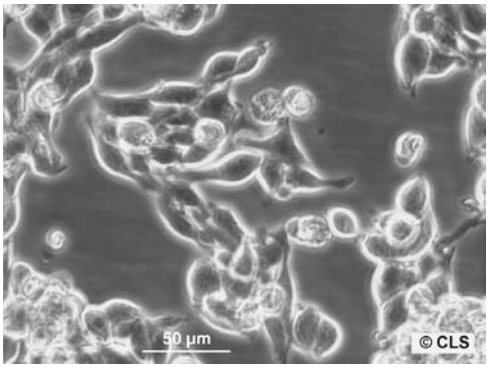


SW-948, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

SW-948

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	81 years; grade III; Dukes' type C
Gender:	Female
Tissue:	Adenocarcinoma, colorectal; colon
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

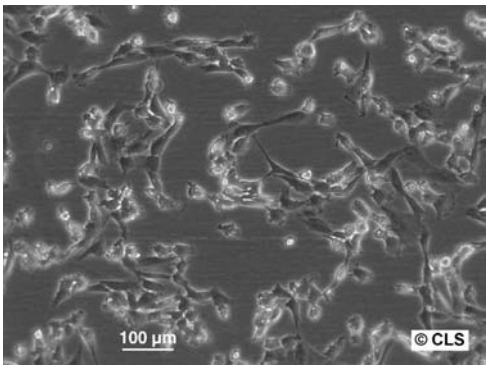
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, nonessential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium, add fresh 0.025% trypsin, 0.02% EDTA for 10–20 min at 37 °C. Add fresh medium, disperse cells, and centrifuge to pellet the cells. Resuspend in fresh medium and dispense into new flasks
Split ratio:	A ratio of 1: 2 to 1: 15 is recommended
Fluid renewal:	One to two times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

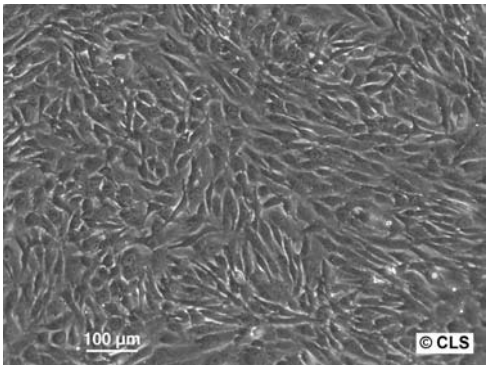
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 10, 11; D16S539: 11, 12; D18S51: 19; D21S11: 25.2, 29; D3S1358: 16, 17; D5S818: 11; D7S820: 9, 11; D8S1179: 12, 14; FGA: 24; Penta D: 12; Penta E: 13; THO1: 6, 9.3; TPOX: 8, 11; vWA: 16, 18
Tumorigenic:	Yes, in nude mice
Oncogene:	The line is positive for expression of c-myc, K-ras, H-ras, N-ras, myb and fos oncogenes. N-myc and sis expression were not detected
Antigen expression:	Blood type O; Rh+
Isoenzymes:	G6PD, B; PGM1, 1-2; PGM3, 1-2; 6PGD, A; PEP-D, 1; ES-D, 1
Reverse transcriptase:	Negative
Products:	Carcinoembryonic antigen (CEA) 7 ng/10^6 cells/10 days; colon specific antigen (CSAp) 750 units in 0.5 ml cell sonicate; keratin
ATCC number:	CCL-237
CLS number:	300347

Further Reading

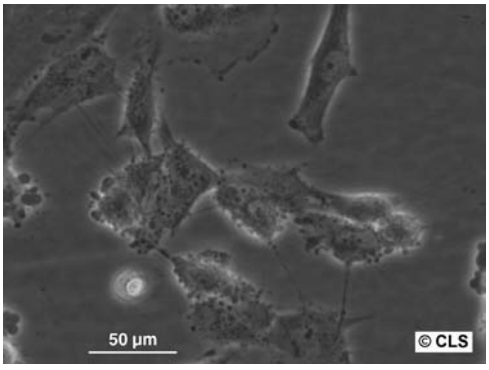
Leibovitz, A. *et al.* (1976) Classification of human colorectal adenocarcinoma cell lines. *Cancer Res.*, **36**, 4562–4569.



SW-982, 100× Leica.



SW-982, 100× Leica.



SW-982, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

SW-982

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 25 years
Gender: Female
Tissue: Synovium
Morphology: Mixed
Cell type: Synovial sarcoma; liposarcoma
Growth properties: Monolayer
Description: The SW-982 cell line was initiated by A. Leibovitz in 1974 at the Scott and White Clinic, Temple, Texas from a surgical specimen of a biphasic synovial sarcoma removed from a 25-year-old female Caucasian. The histopathology evaluation reported an undifferentiated malignant tumor consistent with liposarcoma

Culture Conditions and Handling

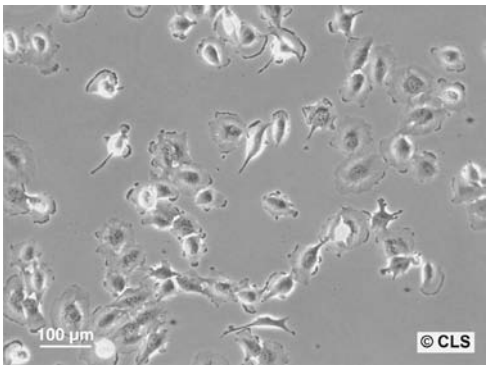
Culture medium: DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin/0.02% EDTA solution, and let the culture sit at room temperature for 2 min. Remove trypsin and let the culture sit at 37 °C for 5 min. Add fresh medium to disperse the cells and dispense into new flasks
Split ratio: A ratio of 1: 3 to 1: 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

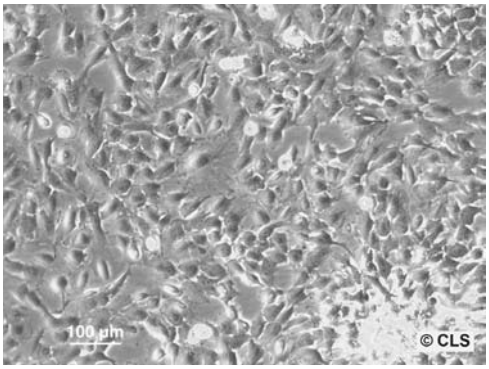
Karyotype: Hyperdiploid; modal number = 48; range = 42 to 58. The rate of higher ploidies was 1.6%
DNA profile (STR): Amelogenin: X, X; CSF1PO: 11, 12; D13S317: 8, 12, 13; D16S539: 11, 12; D5S818: 11, 13; D7S820: 9, 11; THO1: 9.3; TPOX: 9, 11; vWA: 19,20; D3S1358: 15; D21S11: 28, 30; D18S51: 16, 18; Penta E: 13, 15; Penta D: 10, 13; D8S1179: 11, 14; FGA: 21,24
Isoenzymes: G6PD, B; PGM1, 1-2; PGM3, 1-2; ES-D, 1; AK-1, 1; GLO-1, 1; Phenotype Frequency Product: 0.0192
ATCC number: HTB-93
CLS number: 300404

Further Reading

Fogh, J. *et al.* (1977) Absence of HeLa cell contamination in 169 cell lines derived from human tumors. *J. Natl. Cancer Inst.*, **58**, 209–214.



SW-1736, 100× Leica.



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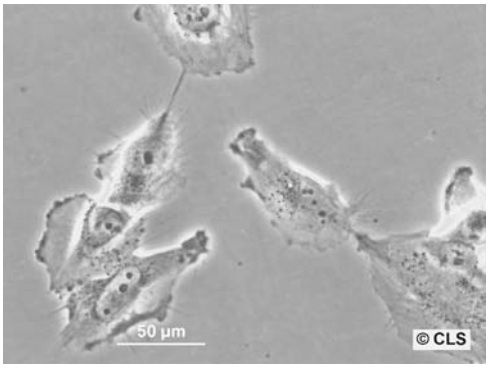

SW-1736, 400× Leica.

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SW-1736

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Anaplastic thyroid carcinoma; thyroid
Morphology: Epithelial
Growth properties: Monolayer

Culture Conditions and Handling

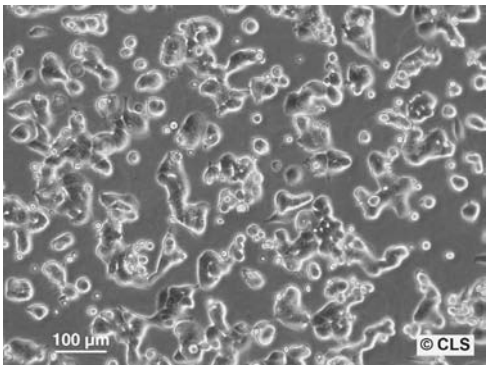
Culture medium: RPMI 1640 medium, 80%; fetal bovine serum, 20%
Subculture routine: Remove medium, rinse with fresh 0.025% trypsin solution, remove trypsin, and let the culture sit at room temperature (or at 37 °C) until the cells detach (about 10 min). Add fresh medium, aspirate, and dispense into new flasks
Split ratio: A ratio of 1 : 5 to 1 : 10 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

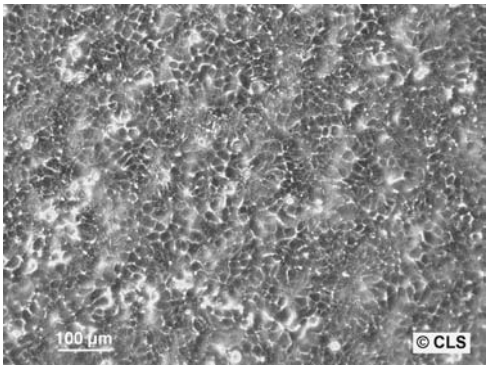
DNA profile (STR): Amelogenin: X; CSF1PO: 12; D13S317: 11, 12; D16S539: 11, 12; D18S51: 14; D21S11: 29, 31; D3S1358: 16, 17; D5S818: 12, 13; D7S820: 8, 11; D8S1179: 13; FGA: 22; Penta D: 12; Penta E: 11, 17; THO1: 6; TPOX: 11; vWA: 16, 19
ATCC number: Not available
CLS number: 300453

Further Reading

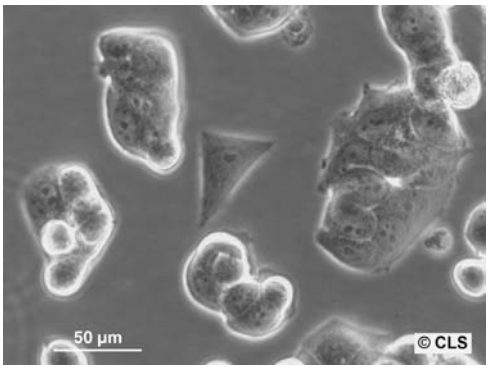
Heldin, N.E. *et al.* (1988) Aberrant expression of receptors for platelet-derived growth factor in an anaplastic thyroid carcinoma cell line. *Proc. Natl. Acad. Sci. USA*, **85**, 9302–9306.



T-46D, 100× Leica.



T-46D, 100× Leica.



T-46D, 400× Leica.

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T-47D

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: 54 years
Gender: Female
Tissue: Breast; mammary gland (pleural effusion)
Morphology: Epithelial
Cell type: Ductal carcinoma
Growth properties: Monolayer
Description: The T-47 line was isolated by I. Keydar from the pleural effusion of an infiltrating ductal carcinoma of the breast. The differentiated epithelial substrain T-47D reportedly contains cytoplasmic junctions, receptors to 17-β-estradiol, other steroids, and calcitonin. It will form colonies in soft agar

Culture Conditions and Handling

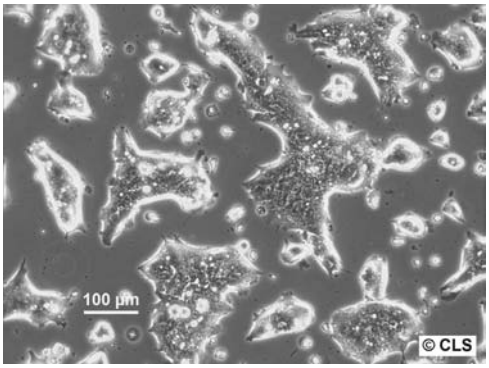
Culture medium: DMEM:Ham's F12 media (1: 1, vol/vol) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove media and rinse with 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) solution, swirl gently, remove trypsin, and let the culture sit at 37 °C until the cells detach. Add fresh media, resuspend the cells, and dispense into new flasks
Split ratio: A ratio of 1: 3 to 1: 5 is recommended
Fluid renewal: Two to three times weekly
Doubling time: 32 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

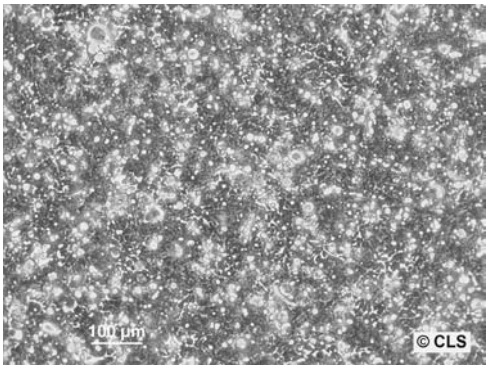
Karyotype: Mode = 66; dicentric and extra long submetacentric chromosomes
Tumorigenic: Yes, in nude mice
Oncogene: wnt3 +; wnt7h +; wnt7b+
DNA profile (STR): Amelogenin: X, X; CSF1PO: 11, 13; D13S317: 12; D16S539: 10; D5S818: 12, D7S820: 11, TH01: 7, 6; TPOX: 11; vWA: 14; D3S1358: 15, 17; D21S11: 28, 31; D18S51: 17; Penta E: 7, 14; Penta D: 10, 12; D8S1179: 13; FGA: 23
Receptors expressed: Estradiol; steroids; calcitonin; androgen; progesterone; glucocorticoid; prolactin; estrogen
Isoenzymes: G6PD, B; PGM1, 1; PGM3, 1; ES-D, 2; Ak-1, 1; GLO-1, 1-2
ATCC number: HTB-133
CLS number: 300353

Further Reading

Keydar, I. *et al.* (1979) Establishment and characterization of a cell line of human breast carcinoma origin. *Eur. J. Cancer*, **15**, 659–670.



T84, 100× Leica.



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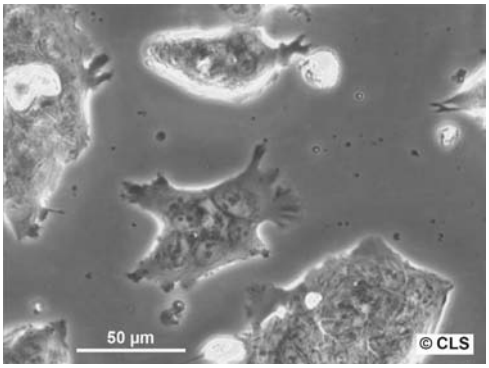

T84, 400× Leica.

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T84

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Age:	72 years
Gender:	Male
Tissue:	Colon (from metastatic site: lung)
Cell type:	Epithelial; colorectal carcinoma
Growth properties:	Monolayer
Description:	This line exhibits tight junctions and desmosomes between adjacent cells. The cells should be maintained at high density (at least 1/4 confluency)

Culture Conditions and Handling

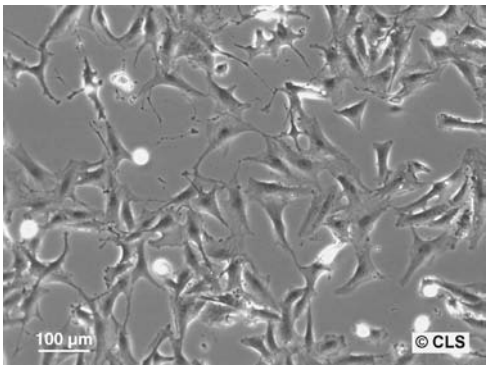
Culture medium:	DMEM:Ham's F12 media (1: 1 mixture) supplemented with 2.5 mM L-glutamine and 5% fetal bovine serum
Subculture routine:	Remove medium and rinse with EDTA (versene). Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach. Add fresh medium, centrifuge to remove trypsin, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1: 2 to 1: 4 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

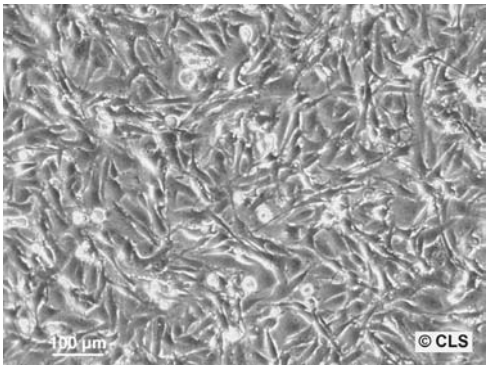
Karyotype:	The stemline modal chromosome number is 56, occurring at 28% with polyploidy at 12.4%. A total of 18 markers are common to most metaphases examined. Normal X and chromosome 13 were absent; chromosomes 2, 4 and 22 were single-copied, and chromosome 12 was 4-copied. No Y chromosome was detected by Q band observation. DM occurred in nearly 50% of the cells
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 9; D16S539: 10, 11; D18S51: 17; D21S11: 31; D3S1358: 19; D5S818: 12; D7S820: 8, 10; D8S1179: 15; FGA: 24; Penta D: 9; Penta E: 14; THO1: 6, 9; TPOX: 8; vWA: 17, 18
Tumorigenic:	Yes, in nude mice
Immunology:	Keratin + (Immunoperoxidase staining)
Receptors expressed:	Peptide hormone; neurotransmitter
Isoenzymes:	G6PD, B; PGM1, 1; PGM3, 1; ES-D, 1; Me-2, 1-2; AK-1, 1; GLO-1, 1-2
Products:	carcinoembryonic antigen (CEA), keratin
A1TCC number:	CCL-248
CLS number:	300354

Further Reading

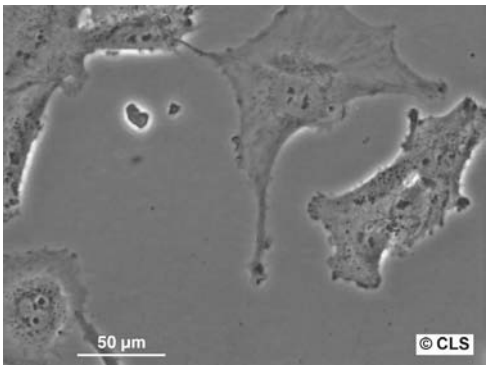
Murakami, H. *et al.* (1980) Hormonal control of human colon carcinoma cell growth in serum-free medium. *Proc. Natl. Acad. Sci. USA*, **77**, 3464–3468.



T-406, 100× Leica.



T-406, 100× Leica.



T-406, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

T-406

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Tissue: Brain
Morphology: Fibroblast
Cell type: Glioblastoma
Growth properties: Monolayer

Culture Conditions and Handling

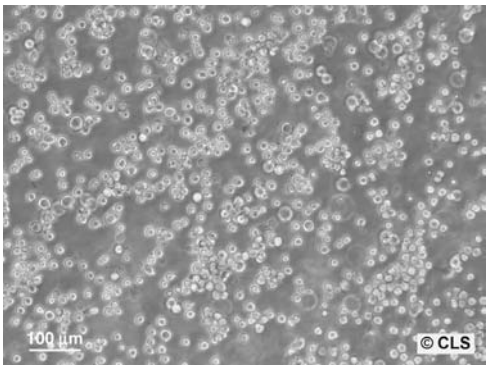
Culture medium: Dulbecco's modified Eagle's medium supplemented with glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1: 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

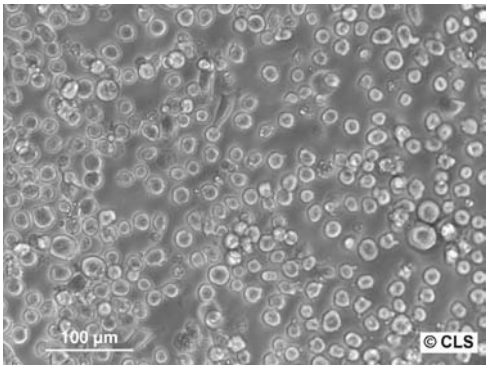
DNA profile (STR): Amelogenin: X; CSF1PO: 12, 14; D13S317: 9, 9; D16S539: 11, 11; D18S51: 13, 18; D21S11: 28, 30; D3S1358: 14, 16; D5S818: 10, 13; D7S820: 10, 12; D8S1179: 14, 14; FGA: 23, 26; Penta D: 11, 11; Penta E: 7, 10; THO1: 7, 7; TPOX: 11, 11; vWA: 17, 17
ATCC number: Not available
CLS number: 300361

Further Reading

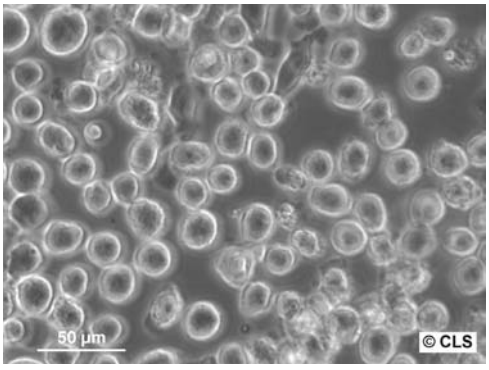
Henn, W. *et al.* (1986) Polysomy of chromosome 7 is correlated with overexpression of the erbB oncogene in human glioblastoma cell line. *Hum. Genet.*, **74**, 104–106.



TF-1, 100× Leica.



TF-1, 200× Leica.



TF-1, 400× Leica.

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TF-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Japanese
Age:	35 years
Gender:	Male
Tissue:	Bone marrow
Morphology:	Lymphoblast
Cell type:	Erythroleukemia; erythroblast
Growth properties:	Suspension
Description:	The TF-1 cell line has been established by T. Kitamura in October 1987 from a heparinized bone marrow aspiration sample from a 35-year-old Japanese male with severe pancytopenia. TPA induces a dramatic differentiation into macrophage-like cells; Hemin and delta-aminolevulinic acid induce hemoglobin synthesis

Culture Conditions and Handling

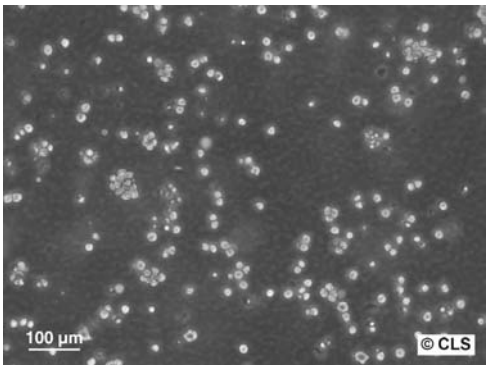
Culture medium:	RPMI 1640 medium supplemented with 1–5 ng/ml GM-CSF and 10% fetal bovine serum [for long term culture, TF-1 cells need interleukin 3 (IL-3, GM-CSF) in the culture medium].
Subculture routine:	Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Culture at 37 °C/5% CO_2. Split by transferring an aliquot of the cell suspension into a new cell culture flask already containing an appropriate amount of fresh cell culture medium
Fluid renewal:	Every two to three days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

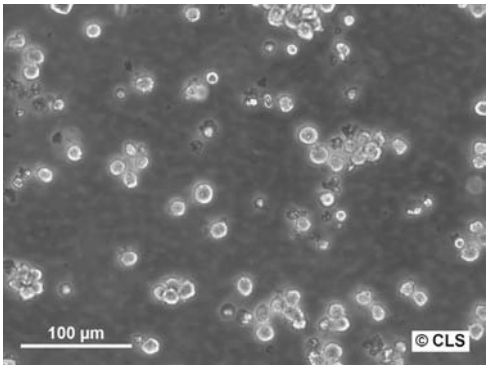
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 13, 13; D13S317: 8, 9; D16S539: 9, 12; D18S51: 13; D3S1358: 15; D5S818: 13; D7S820: 12; D8S1179: 11, 15; D21S11: 30; Penta D: 10, 13; Penta E: 5, 17; TH01: 7, 9; TPOX: 8; vWA: 15, 17; FGA: 18, 19
Receptors expressed:	TF-1 cells do not express glycophorin A or carbonyl anhydrase I.
Applications:	The TF-1 cell line can be applied in various systems due to their responsiveness to multiple cytokines. They provide a good system to investigate the proliferation and differentiation of myeloid progenitor cells.
ATCC number:	CRL-2003
CLS number:	Cryovial: 300434

Further Reading

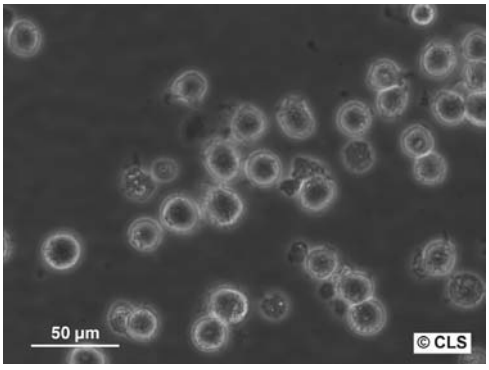
Kitamura, T. *et al.* (1989) Establishment and characterization of a unique human cell line that proliferates dependently on GM-CSF, IL-3, or erythropoietin. *J. Cell Physiol.*, **140**, 323–334.



THP-1, 100× Leica.



THP-1, 200× Leica.



THP-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

THP-1

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: One year
Gender: Male
Tissue: Blood
Morphology: Round cells
Cell type: Monocyte; acute monocytic leukemia
Growth properties: Suspension
Description: THP-1 cells show alpha-naphtyl butyrate esterase activity, phagocytose latex particles as well as sensitized sheep erythrocytes and have the ability to restore T-lymphocyte response to Con A. When incubating with TPA or DMSO the cells can be differentiated into macrophage-like cells

Culture Conditions and Handling

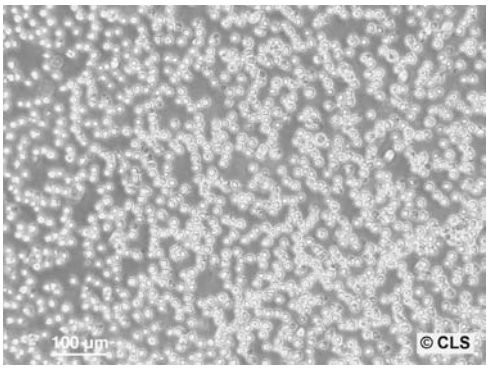
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10–20% fetal bovine serum
Subculture routine: Start the culture from the frozen state in centrifuging immediately to remove any traces of the freeze medium, resuspend in fresh culture medium, and dispense into cell culture flasks. Subculturing into new culture flasks is recommended. Start cultures at 1×10^5 cells/ml and do not allow the cell concentration to exceed 1×10^6 cells/ml
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

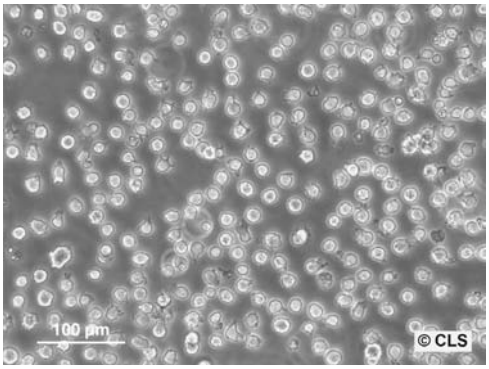
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 13; D13S317: 13; D16S539: 11, 12; D18S51: 13, 14; D21S11: 30, 31.2; D3S1358: 15, 17; D5S818: 11, 12; D7S820: 10; D8S1179: 10, 14; FGA: 24, 25; Penta D: 10, 12; Penta E: 11, 15; THO1: 8, 9.3; TPOX: 8, 11; vWA: 16
Immunology: HLA haplotypes: HLA-A2, -A9, -B5, -DRw1, -DRw2
Receptors expressed: Fc; C3b
Products: Lysozyme
ATCC number: TIB 202
CLS number: 300356

Further Reading

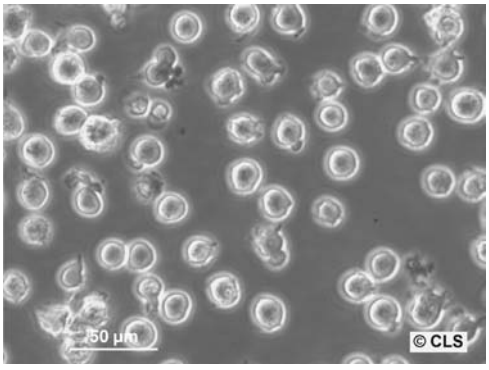
Tsuchiya, S. *et al.* (1980) Establishment and characterization of a human acute monocytic leukemia cell line (THP-1). *Int. J. Cancer,* **26**, 171–176.



TK-6, 100× Leica.



TK-6, 200× Leica.



TK-6, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

TK-6

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Age: Five years
Gender: Male
Tissue: Spleen (hereditary spherocytosis)
Morphology: Round cells
Cell type: Lymphoblast
Growth properties: Suspension
Description: This line is a derivative of the WIL-2 cell line. The cells are heterozygous at the thymidine kinase (TK) locus, and can be used to quantitatively detect forward mutation at three loci (resistance to trifluorothymidine (tk locus). The cells are resistant to thioguanine (hprt locus) and to ouabain (Na/K ATPase)

Culture Conditions and Handling

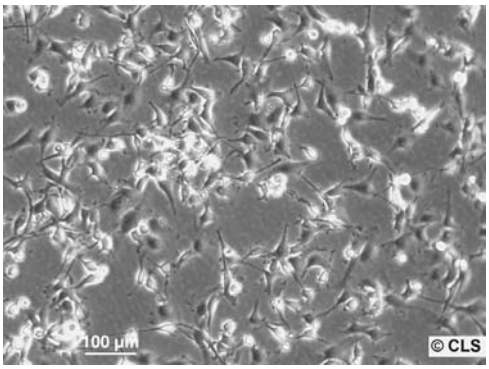
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Subculture by transferring an aliquot of the cell suspension into a new cell culture flask already containing an appropriate amount of fresh cell culture medium. Culture at 37 °C/5% CO_2
Fluid renewal: Every two to three days or as necessary to maintain the cell concentration between 2×10^5 and 1×10^6 cells/ml
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

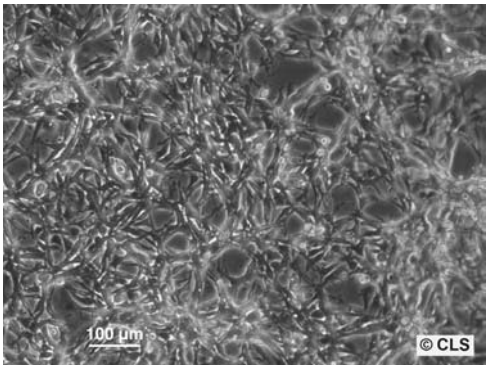
DNA profile (STR): Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 11, 11; D16S539: 11, 12; D18S51: 11, 16; D21S11: 29, 29; D3S1358: 16, 16; D5S818: 12, 13; D7S820: 9, 11; D8S1179: 10, 13; FGA: 22, 24; Penta D: 11, 12; Penta E: 5, 7; THO1: 8, 9.3; TPOX: 8, 11; vWA: 17, 20
ATCC number: Not available
CLS number: 300357

Further Reading

Levy, J.A. *et al.* (1968) Human lymphoblastoid lines from lymph node and spleen. *Cancer*, **22**, 517–524.



U-87MG, 100× Leica.



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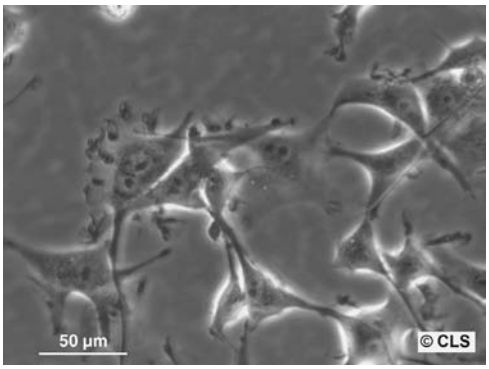


U-87MG, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

U-87MG

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	44 years
Gender:	Female
Tissue:	Brain
Morphology:	Epithelial
Cell type:	Gliomblastoma (grade IV)
Growth properties:	Monolayer
Description:	This is one of a number of cell lines derived from malignant gliomas which have been isolated by J. Ponten and associates from 1966 to 1969

Culture Conditions and Handling

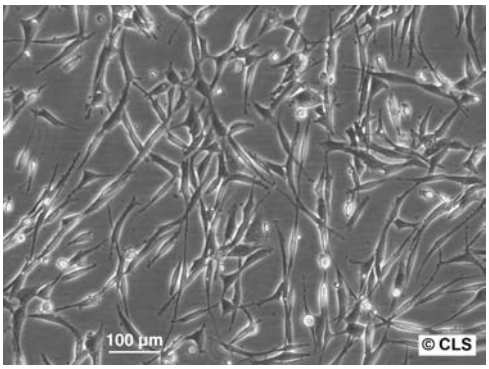
Culture medium:	EMEM (EBSS) supplemented with 2 mM L-glutamine, 0.1 mM non-essential amino acids (NEAA), 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 5 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

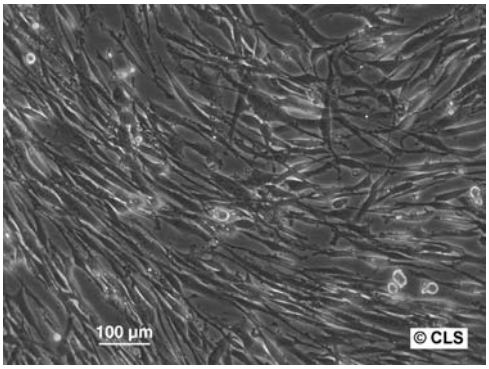
DNA Profile (STR):	Amelogenin: X; CSF1PO: 10, 11; D13S317: 8, 11; D16S539: 12; D18S51: 13; D21S11: 28, 32.2; D3S1358: 16, 17; D5S818: 11, 12; D7S820: 8, 9; D8S1179: 10, 11; FGA: 18, 24; Penta D: 9, 14; Penta E: 7, 14; THO1: 9.3; TPOX: 8; vWA: 15, 17
Tumorigenic:	Yes, in nude mice inoculated subcutaneously with 10^7 cells
Antigen expression:	Blood type A, Rh+
Isoenzymes:	Me-2, 1; PGM3, 1; PGM1, 2; ES-D, 1; AK-1, 1; GLO-1, 1; G6PD, B; Phenotype Frequency Product: 0.0017
CLS number:	300367

Further Reading

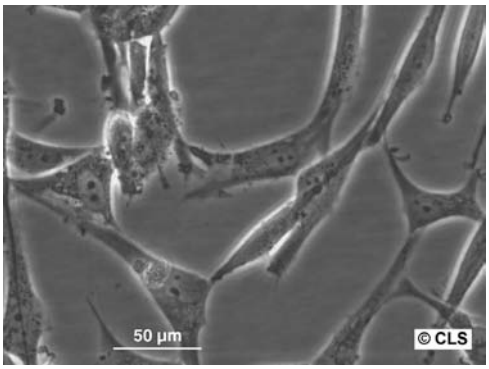
Ponten, J. *et al.* (1968) Long term culture of normal and neoplastic human glia. *Acta. Path Microbiol. Scand.*, **74**, 465–486.



U-118 MG, 100× Leica.



U-118 MG, 100× Leica.



U-118 MG, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

U-118 MG

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	50 years
Gender:	Male
Tissue:	Brain
Morphology:	Mixed
Cell type:	Glioblastoma (grade III)
Growth properties:	Monolayer, adherent
Description:	This is one of a number of cell lines derived from malignant gliomas by J. Ponten and associates from 1966 to 1969

Culture Conditions and Handling

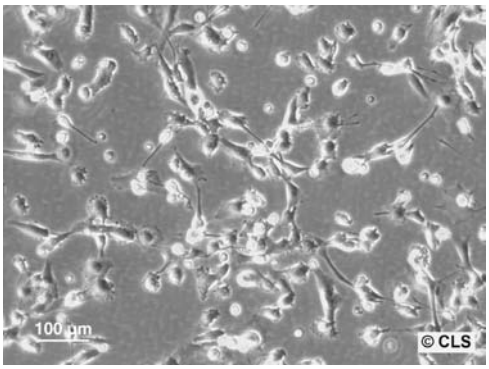
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with nonessential amino acids, L-glutamine, 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution for 3 to 5 minutes, remove trypsin and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

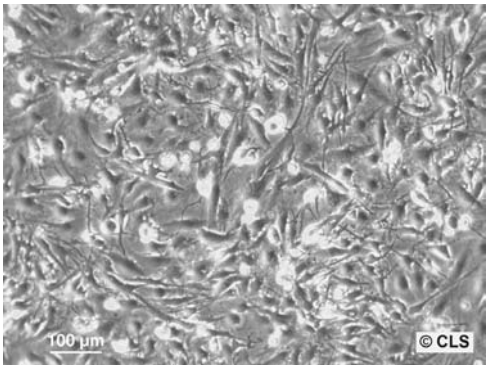
Karyotype:	The line has a near pentaploid chromosome number and a wide range of chromosome number distribution (40% of the cells had numbers ranging from 110 to 115)
Tumorigenic:	Yes, in nude mice
DNA profile (STR):	Amelogenin: X,Y; CSF1PO: 11,12; D13S317: 9, 11; D16S539: 12, 13; D5S818: 11; D7S820: 9; THO1: 6; TPOX: 8; vWA: 18; D3S1358: 15; D21S11: 27, 32.2; D18S51: 13; Penta E: 7; Penta D: 13; D8S1179: 14, 15; FGA: 23
Antigen expression:	Blood type A, Rh + ; HLA Aw24, A28, B12, Bw47
Isoenzymes:	Me-2, 1; PGM3, 2; PGM1, 2; ES-D, 1; AK-1, 1-2; GLO-1, 1-2; G6PD, B; Phenotype Frequency Product: 0.0001
ATCC number:	HTB-15
CLS number:	300362

Further Reading

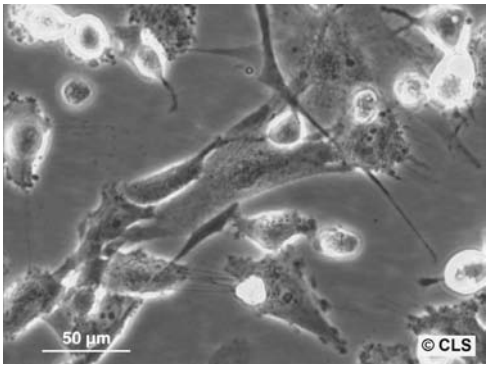
Ponten, J. *et al*. (1968) Long term culture of normal and neoplastic human glia. *Acta Pathol. Microbiol. Scand*, **74**, 465–486.



U-251 MG, 100× Leica.



U-251 MG, 100× Leica.



U-251 MG, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

U-251 MG (formerly known as U-373 MG)

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	61 years
Gender:	Male
Tissue:	Brain
Morphology:	Epithelial
Cell type:	Glioblastoma (grade III/grade IV)
Growth properties:	Monolayer
Description:	This is one of a number of cell lines derived from malignant gliomas by J. Ponten and associates from 1966 to 1969

Culture Conditions and Handling

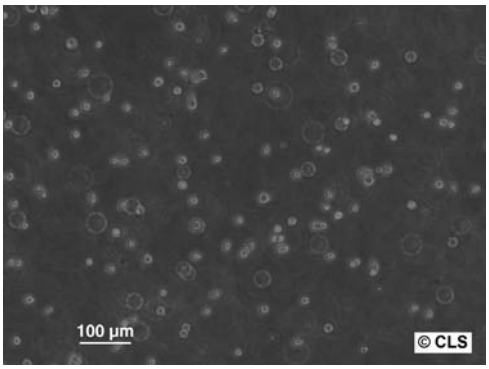
Culture medium:	Minimum essential medium Eagle supplemented with 2 mM L-glutamine, 0.1 mM nonessential amino acids, 1.0 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

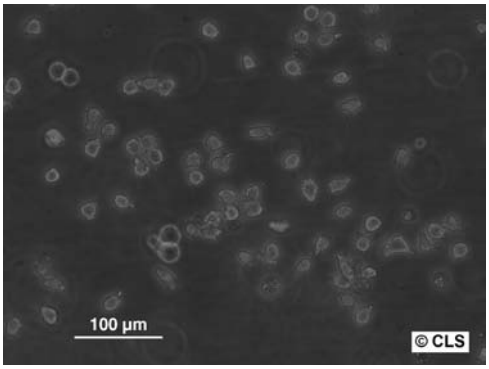
Karyotype:	The stemline chromosome number is hypotriploid (S = 67) with the 2S component occurring at 12.8%
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11, 12; D13S317: 10, 11; D16S539: 12; D18S51: 13; D21S11: 29, 30; D3S1358: 16, 17; D5S818: 11, 12; D7S820: 10, 12; D8S1179: 13, 15; FGA: 21, 25; Penta D: 10, 12; Penta E: 7, 10; THO1: 9, 3; TPOX: 8; vWA: 16,18
Tumorigenic:	Yes, in nude mice; Grade III astrocytomas are formed
Antigen expression:	Blood type A; Rh+
Isoenzymes:	PGM3, 1; PGM1, 1; ES-D, 1; G6PD, B; AK-1, 1; GLO-1, 1; Phenotype Frequency Product: 0.0426
CLS number:	300366

Further Reading

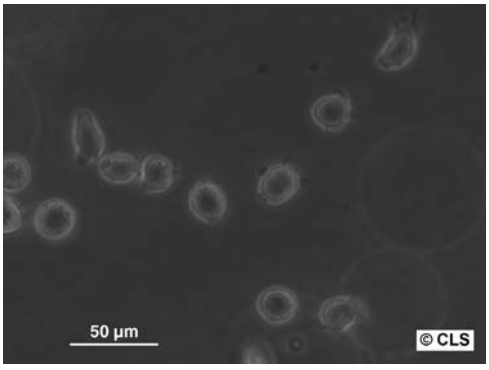
Ponten, J. *et al.* (1968) Long term culture of normal and neoplastic human glia. *Acta Pathol. Microbiol. Scand*, **74**, 465–486.



U-937, 100× Leica.



U-937, 200× Leica



U-937, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

U-937

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	37 years
Gender:	Male
Tissue:	Lymphoma, histiocytic
Morphology:	Round cells
Cell type:	Monocyte-macrophage; histiocyte
Growth properties:	Suspension

Culture Conditions and Handling

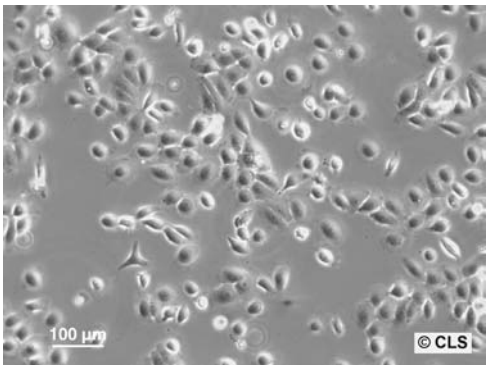
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Subculture by diluting appropriate aliquots of the suspension into new cell culture flasks already containing fresh medium. Establish new cultures at $0.5–1 \times 10^5$ viable cells/ml. Maximum cell density at $1–2 \times 10^6$ cells/ml
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

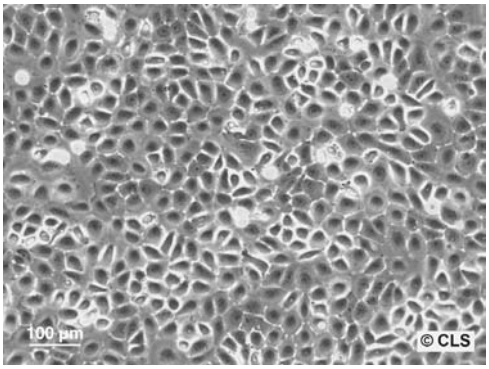
DNA profile (STR):	Amelogenin: X; CSF1PO: 12; D13S317: 10, 12; D16S539: 12; D18S51: 13, 14; D21S11: 27, 29; D3S1358: 16; D5S818: 12; D7S820: 9, 11; D8S1179: 12, 13; FGA: 22, 25; Penta D: 12, 13; Penta E: 13; THO1: 6, 9.3; TPOX: 8, 11; vWA: 14,15
Receptors expressed:	Immunoglobulin (Fc); complement (C3)
Products:	Lysozyme; beta-2-microglobulin (beta 2 microglobulin); tumor necrosis factor (TNF), also known as tumor necrosis factor alpha (TNF-alpha, TNF alpha), after stimulation with phorbol myristic acid (PMA)
ATCC number:	CRL-1593.2
CLS number:	300368

Further Reading

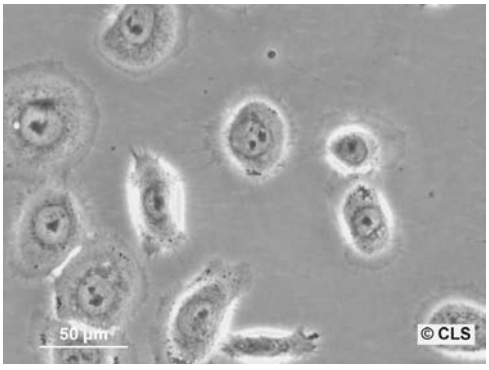
Sundstrom, C. *et al.* (1976) Establishment and characterization of a human histiocytic lymphoma cell line (U-937). *Int. J. Cancer*, **17**, 565–577.



UM-SCC-14C, 100× Leica.



UM-SCC-14C, 100× Leica.



UM-SCC-14C, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

UM-SCC-14C

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Gender:	Male
Tissue:	Mouth
Morphology:	Epithelial
Cell type:	Squamous cell carcinoma
Growth properties:	Monolayer

Culture Conditions and Handling

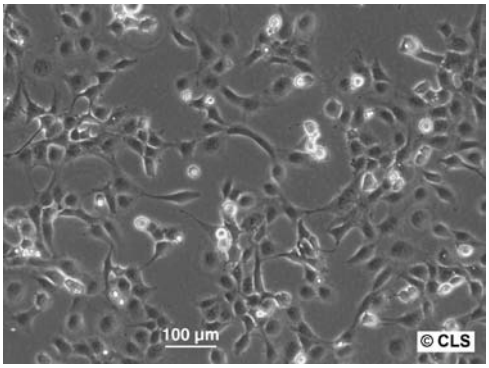
Culture medium:	DMEM:Ham's F12 (1: 1, vol:vol) medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and wash once with 0.02% EDTA (versene) solution. Add fresh 0.025% trypsin/0.02% EDTA (versene) solution and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal:	Thrice weekly
Freeze medium:	CM-1 (CLS · Cell Lines Service)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

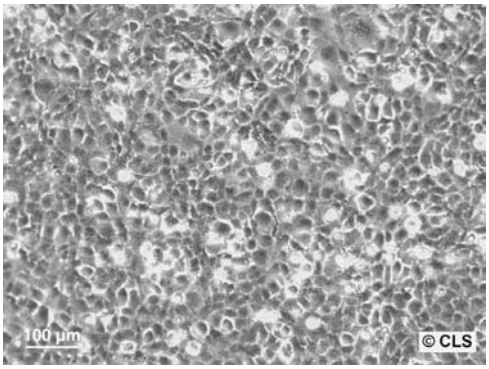
DNA profile (STR):	Amelogenin: X; CSF1PO: 10; D13S317: 12; D16S539: 12; D18S51: 15; D21S11: 29; D3S1358: 15; D5S818: 11, 14; D7S820: 9, 10; D8S1179: 8, 13; FGA: 20, 21; Penta D: 12, 16; Penta E: 7; THO1: 6, 8; TPOX: 8; vWA: 14, 18
Tumorigenic:	Yes, in nude mice
Reverse transcriptase:	Negative
Viruses:	Negative: Sendai, Ektromelia, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B.piliformis
Products:	Keratin
ATCC number:	Not available
CLS number:	300370

Further Reading

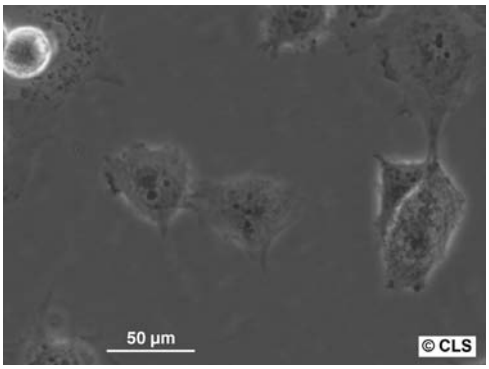
Grenman, R. *et al.* (1989) Clonogenic cell assay for anchorage-dependent squamous carcinoma cell lines using limiting dilution. *Int. J. Cancer*, **44**, 131–136.



Wi38 VA13 subline 2RA, 100× Leica.



Wi38 VA13 subline 2RA, 100× Leica.



Wi38 VA13 subline 2RA, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Wi38 VA13 subline 2RA

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Synonym(s):	Wi38 VA13 subline 2RA
Ethnicity:	Caucasian
Age:	Three months gestation
Gender:	Female
Tissue:	Lung
Morphology:	Epithelial
Cell type:	Epithelial-like
Growth properties:	Adherent
Description:	This cell line is a SV40-transformed variant of the Wi38 cell line

Culture Conditions and Handling

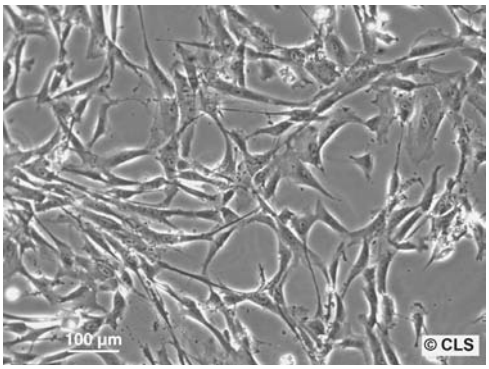
Culture medium:	Minimum essential medium (Eagle) in Hanks' BSS with 1% nonessential amino acids (NEAA), 1 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution for 3 to 5 minutes, remove trypsin and incubate at 37 °C until the cells detach. Add fresh medium, remove trypsin by centrifugation and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 10 is recommended
Fluid renewal:	Twice per week
Biosafety level:	2 (contain Papovavirus)1

Special Features of the Cell Line and Recommended Use

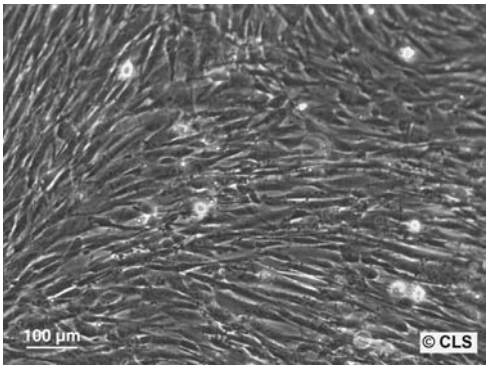
DNA-profile (STR):	Amelogenin: X; CSF1PO: 10,12; D3S1358: 16,17; D5S818: 10; D7S820: 9,11; D8S1179: 14; D13S317: 11; D16S539: 11,12; D18S51: 16,18; D21S11: 30,30.2; FGA: 22,24; Penta D: 13; Penta E: 13,14; THO1: 9.3; TPOX: 8; vWA: 19,20
Isoenzymes:	G6PD, B
Reverse transcriptase:	Negative
Virus susceptibility:	Herpes simplex; vesicular stomatitis (Indiana); poliovirus 2
CLS number:	300421

Further Reading

Jensen, F. *et al.* (1964) Autologous and homologous implantation of human cells transformed *in vitro* by simian virus 40. *J. Natl. Cancer Inst.*, **32**, 917–937.



WS-1, 100× Leica.



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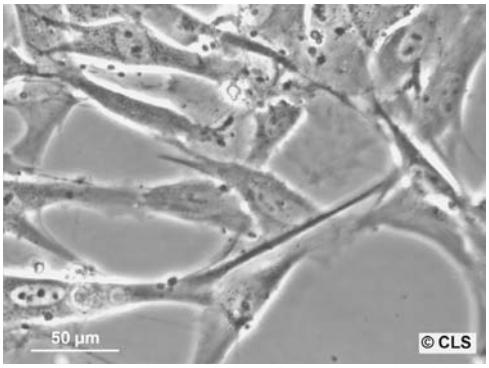


Ws-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

WS-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Black
Age:	Embryonic skin, 12 week gestation
Gender:	Female
Tissue:	Skin
Cell type:	Fibroblastoid
Description:	WS1 cells have a doubling potential of 67 population doublings

Culture Conditions and Handling

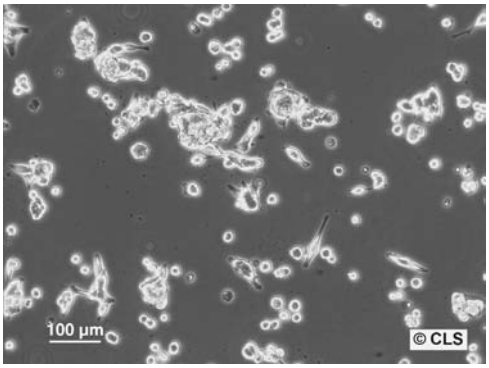
Culture medium:	Minimum essential medium (Eagle) in Earle's BSS supplemented with 1% non-essential amino acids, 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium and magnesium. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 3 is recommended
Fluid renewal:	Two to three times per week

Special Features of the Cell Line and Recommended Use

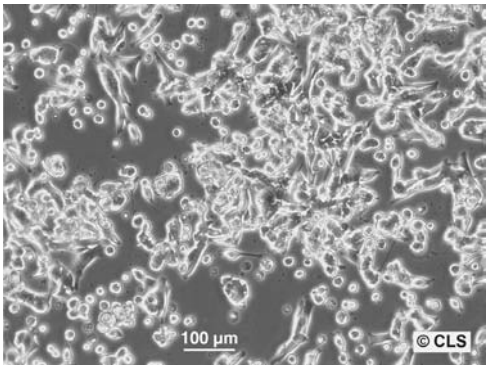
DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 13; D13S317: 12; D16S539: 10, 11; D18S51: 15/19; D21S11: 28, 29; D3S1358: 15, 17; D5S818: 13; D7S820: 9, 10; D8S1179: 12, 13; FGA: 22, 27; Penta D: 12; Penta E: 11/12; THO1: 8,10; TPOX: 8,9; vWA: 17, 18
Tumorigenic:	No
ATCC number:	CRL-2029
CLS number:	300344

Further Reading

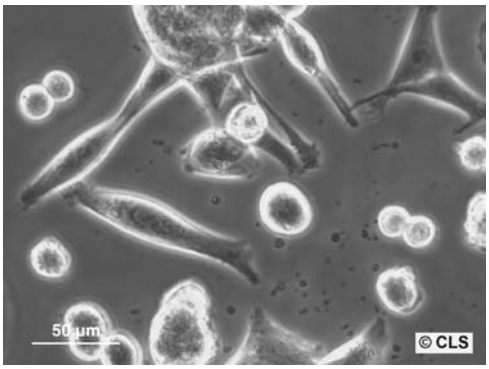
Corfield, V.A. *et al.* (1978) Effects of cystine or glutamine restriction on human diploid fibroblasts in culture. *In Vitro*, **14**, 787–794.



WS1-CLS, 100× Leica.



WS1-CLS, 100× Leica.



WS1-CLS, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

WS1-CLS

Origin and General Characteristics

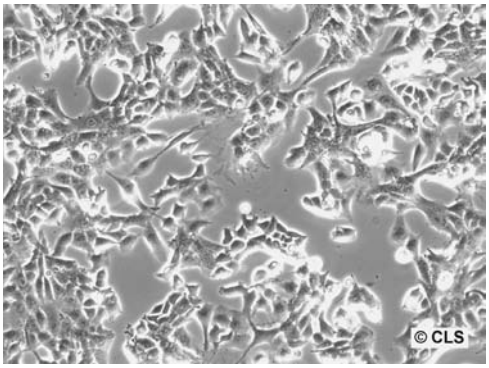
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	36 years
Gender:	Male
Tissue:	Sarcoma (sole of the foot)
Morphology:	Fibroblast
Growth properties:	Monolayer
Description:	*In vitro* established from the primary skin sarcoma (sole of the foot)

Culture Conditions and Handling

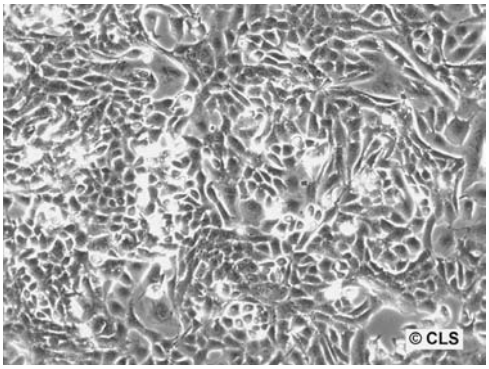
Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio:	A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

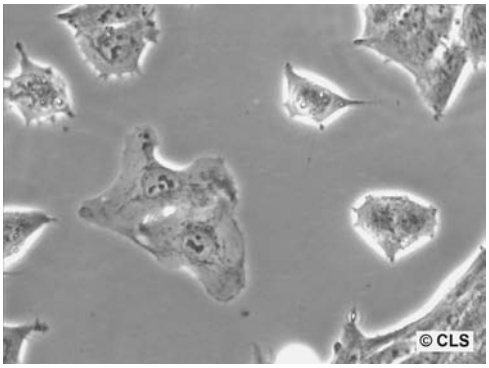
DNA profile (STR):	Amelogenin: X, Y; CSF1PO: 11; D13S317: 11, 12; D16S539: 11, 12; D18S51: 12, 17; D21S11: 29, 31.2; D3S1358: 15, 18; D5S818: 12; D7S820: 9, 10; D8S1179: 13; FGA: 20, 23; Penta D: 9, 13; Penta E: 12, 20; THO1: 8, 9.3; TPOX: 8, 11; vWA: 16, 17
Tumorigenic:	Yes, in athymic mice
ATCC number:	Not available
CLS number:	300378



WT-CLS1, 100× Leica.



WT-CLS1, 100× Leica.



WT-CLS1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

WT-CLS1

Origin and General Characteristics

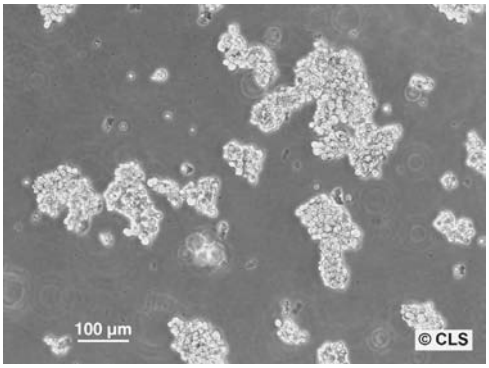
Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	5 years
Gender:	Female
Tissue:	Wilms' tumor
Morphology:	Epithelial
Growth properties:	Monolayer
Description:	Established from a primary Wilms' tumor. WT-CLS1 was tested negative for HIV-1, HBV, HCV

Culture Conditions and Handling

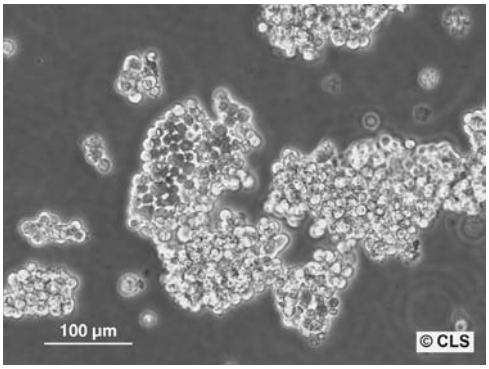
Culture medium:	Iscove's medium supplemented with 2 mM L-glutamine and 15% fetal bovine serum
Subculture routine:	Remove medium and rinse with calcium and magnesium free PBS. Add fresh 0.025% trypsin solution for 3 to 5 minutes at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two times weekly
Freeze medium:	CM-1 (CLS)
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

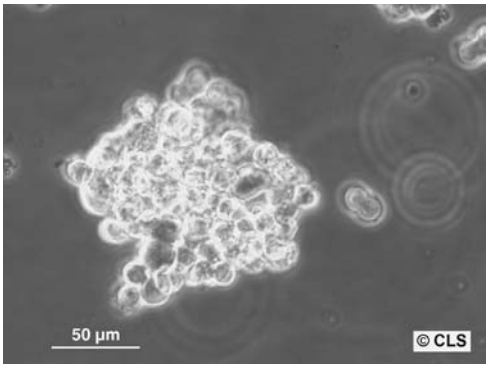
DNA profile (STR):	Amelogenin: X; CSF1PO: 11, 13; D3S1358: 14, 19; D5S818: 11, 12; D7S820: 8, 10; D8S1179: 13, 14; D13S317: 9, 11; D16S539: 9, 11; D18S51: 13, 15; D21S11: 30, 31.2; FGA: 22, 25; Penta D: 9; Penta E: 9, 12; TH01: 9, 9.3; TPOX: 8; vWA: 15, 19
Tumorigenic:	Yes, in nude mice; forms tumor with small cells consistent with Wilms' tumor
ATCC number:	Not available
CLS number:	300378



Y-79, 100× Leica.



Y-79, 200× Leica.



Y-79, 400× Leica.

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Y-79

Origin and General Characteristics

Organism: *Homo sapiens* (human)
Ethnicity: Caucasian
Age: 2.5 years
Gender: Female
Tissue: Retina
Morphology: Multicellular clusters
Cell type: Retinoblastoma
Growth properties: Suspension
Description: The Y79 line was isolated by T.W. Reid and associates in January 1971 by explant culture of a primary tumor from the right eye obtained immediately after enucleation. The donor had a strong maternal family history of retinoblastoma. Ultrastructural features including nuclear membrane infoldings, triple membrane structures, microtubules, large coated vesicles, centrioles, basal bodies, and annulate lamellae were reportedly similar to those of the original tumor

Culture Conditions and Handling

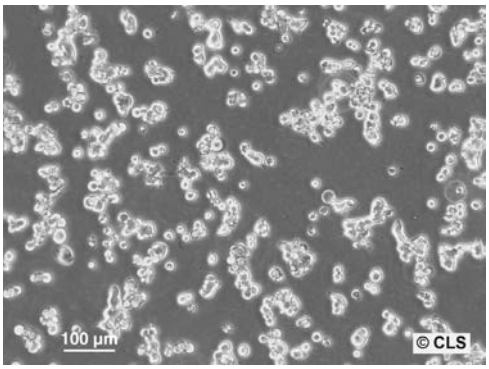
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Allow aggregates to settle to the bottom of the flask. Remove supernatant and discard. Add fresh medium, collect the cells, and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice per week
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

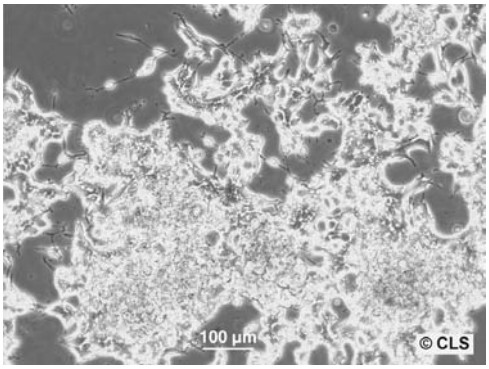
Karyotype: Hypertriploid, with abnormalities including dicentrics, breaks, pulverizations, and minutes
DNA profile (STR): Amelogenin: X; CSF1PO: 11, 12; D13S317: 11, 12; D16S539: 13, 14; D18S51: 13, 16; D21S11: 30, 32; D3S1358: 15, 16; D5S818: 11, 12; D7S820: 8, 9; D8S1179: 13, 16, FGA: 22; Penta D: 12; Penta E: 13, 18; THO1: 6, 9, 3; TPOX: 8; vWA: 15, 18
Isoenzymes: PGM1, 1; G6PD, B; ES-D, 1; AK-1, 1; GLO-1, 2; Phenotype Frequency Product: 0.1373
Reverse transcriptase: Negative
ATCC number: Not available
CLS number: 300382

Further Reading

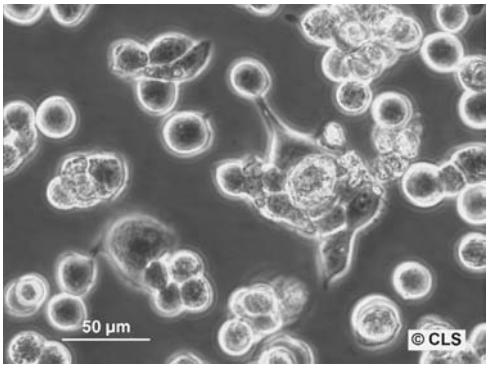
Reid, T.W. *et al.* (1974) Characteristics of an established cell line of retinoblastoma. *J. Natl. Cancer Inst.*, **53**, 347–360.



ZR-75-1, 100× Leica.



ZR-75-1, 100× Leica.



ZR-75-1, 400× Leica.

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ZR-75-1

Origin and General Characteristics

Organism:	*Homo sapiens* (human)
Ethnicity:	Caucasian
Age:	63 years
Gender:	Female
Tissue:	Breast (mammary gland); metastatic site: ascites
Morphology:	Epithelial
Cell type:	Ductal carcinoma
Growth properties:	Adherent
Description:	The cells produce high levels of MUC-1 mucin mRNA, low levels of MUC-2 mRNA but do not express the MUC-3 gene

Culture Conditions and Handling

Culture medium:	RPMI 1640 medium supplemented with 2 mM L-glutamine, 1 mM Na-pyruvate, and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with fresh 0.02% EDTA (versene) solution. Add 0.025% trypsin/0.02% EDTA (versene) solution and let the culture sit at room temperature for 5–10 min. Add fresh medium, collect the cells, remove trypsin by centrifugation, and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Two to three times weekly
Doubling time:	About 80 h
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

DNA profile (STR):	Amelogenin: X; CSF1PO: 10, 11; D13S317: 9; D16S539: 11; D18S51: 13, 14; D21S11: 31; D3S1358: 15, 16; D5S818: 13; D7S820: 10, 11; D8S1179: 11, 13; FGA: 20, 22; Penta D: 14; Penta E: 7, 14; THO1: 7, 9.3; TPOX: 8; vWA: 16, 18
Tumorigenic:	Yes, forms tumors in nude mice
Immunology:	HLA-A2 positive
Receptors expressed:	Estrogen-receptor +; steroid
Isoenzymes:	G6PD, B
Products:	Mucin (apomucin, MUC-1, MUC-2)
ATCC number:	CCL-227
CLS number:	300163

Further Reading

Engel, L.W. *et al.* (1978) Establishment and characterization of three new continuous cell lines derived from human breast carcinomas. *Cancer Res.*, **38**, 3352–3364.

4.2
Animal Cell Lines

4.2.1
Rat

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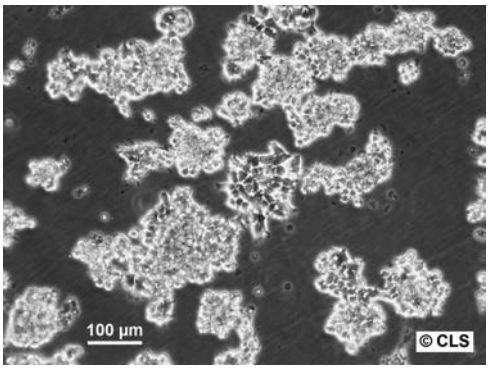
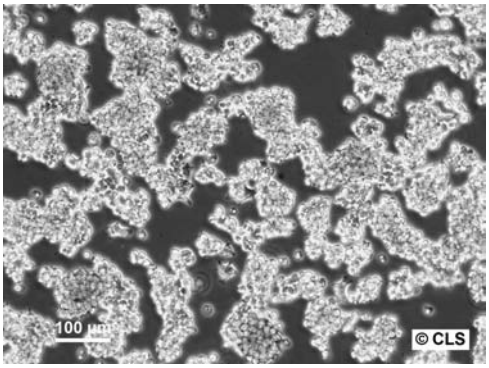
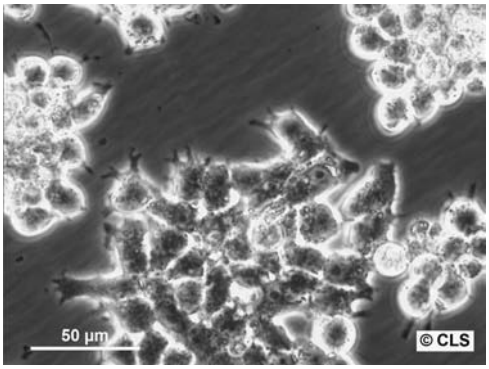


AR42J, 100× Leica.



AR42J, 100× Leica.



AR42J, 400× Leica.

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AR42J

Origin and General Characteristics

Organism: *Rattus norvegicus* (rat), Wistar
Tissue: Pancreas tumor, exocrine
Morphology: Pancreas cells
Growth properties: Cells grow in hollow spheroid colonies that can attach loosely
Description: The cells tend to pile up and appear refractile. Secretory activity is inducible by glucocorticoid stimulation and is accompanied by extensive reorganization of the endoplasmic reticulum

Culture Conditions and Handling

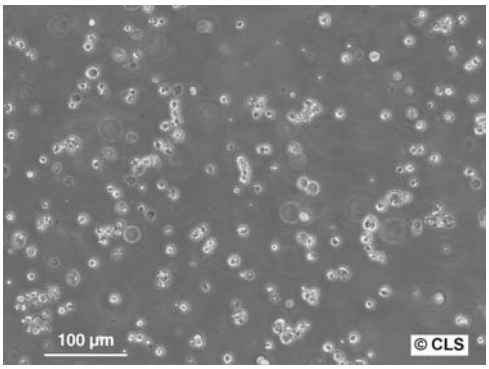
Culture medium: Ham's F12 medium with 2 mM L-glutamine supplemented with L-glutamine and 10–20% fetal bovine serum
Split ratio: Split cultures 1:2 every 48 h into fresh flasks, maintain cultures between 1–9 × 100 000 cells/ml. Adherent cells should be dislodged using 0.2% EDTA
Fluid renewal: Two to three times per week SubCulturing
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

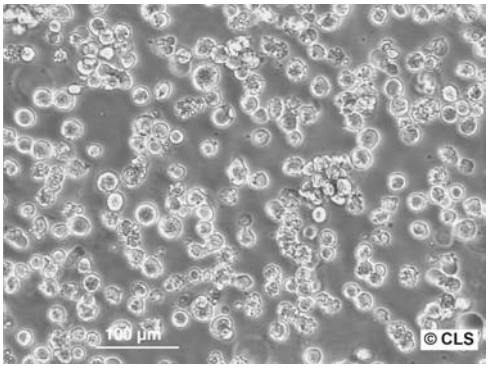
Species: Rat origin was confirmed by Real-time PCR
Tumorigenic: Yes, in athymic mice
Receptors expressed: Insulin; glucocorticoid
Products: amylase and other exocrine enzymes
ATCC number: CRL-1492
CRL number: 500478

Further Reading

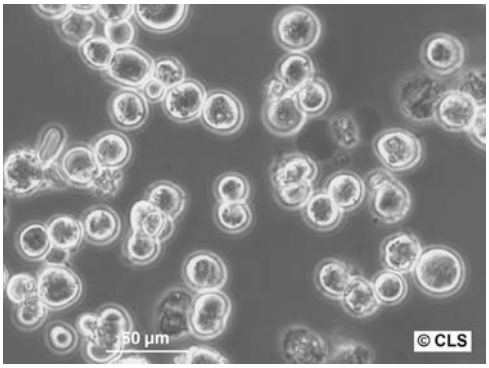
Longnecker, D.S. *et al.* (1977) Effect of age on nodule induction by azaserine and DNA synthesis in rat pancreas. *J. Natl. Cancer Inst.*, **58**, 1769–1775.



AS-30-D, 100× Leica.



AS-30-D, 200× Leica.



AS-30-D, 400× Leica.

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AS-30-D

Origin and General Characteristics

Organism:	Rat
Age/stage:	16-month-old rat
Gender:	Female; Sprague-Dawley rat
Tissue:	Hepatoma
Morphology:	Hepatoma
Growth properties:	Monolayer/suspension
Description:	Established *in vitro* from the AS-30-D tumor ascites (CLS), RAP-Test negative

Culture Conditions and Handling

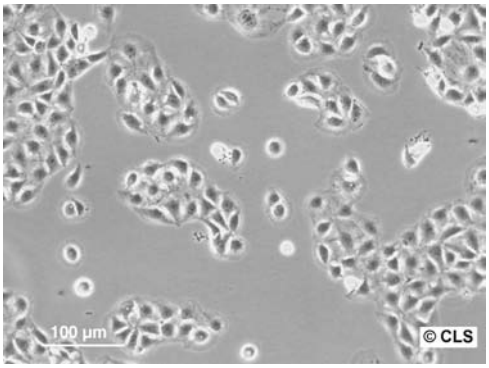
Culture medium:	RPMI 1640 medium supplemented with L-glutmamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with PBS free of calcium and magnesium. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal:	Every Three to five days
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

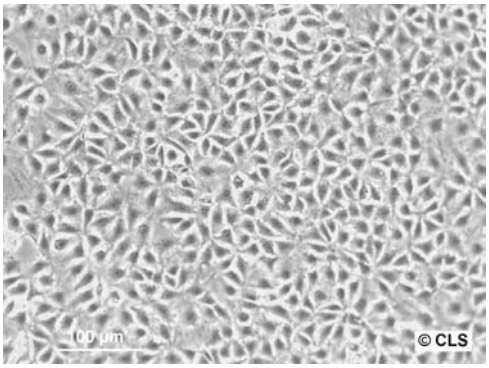
Species:	Rat origin was confirmed by Real-time PCR
Karyotype:	Hypodiploid rat karyotype with 12% tetraploidy; 38 (35–41)
Tumorigenic:	Yes, in Cörli and Sprague-Dawley rat
ATCC number:	Not available
CLS number:	500116

Further Reading

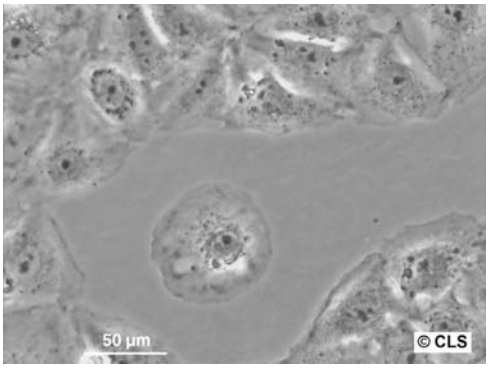
Smith, D.F. and Walborg, E.F. Jr. (1972) Isolation and chemical characterization of cell surface sialoglycopeptide fractions during progression of rat ascites hepatoma AS-30D. *Cancer Res.*, **32**, 543–549.



BRL-3A, 100× Leica.



BRL-3A, 100× Leica.



BRL-3A, 400× Leica.

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BRL-3A

Origin and General Characteristics

Organism: *Rattus norvegicus* (rat)
Strain: Buffalo
Growth properties: Monolayer
Description: The serum-free conditioned supernatant of this cell line is a source of MSA factors (Multiple Stimulating Activity)

Culture Conditions and Handling

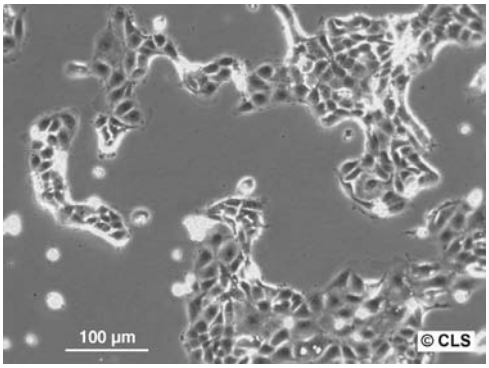
Culture medium: Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Rinse the adherent cells with 0.02% EDTA solution, diluted in Dulbecco's phosphate buffered saline without calcium and magnesium. Detach the cells using trypsin at 0.25% concentration under microscopic observation. As soon as the cells have detached, add serum-containing cell culture medium
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

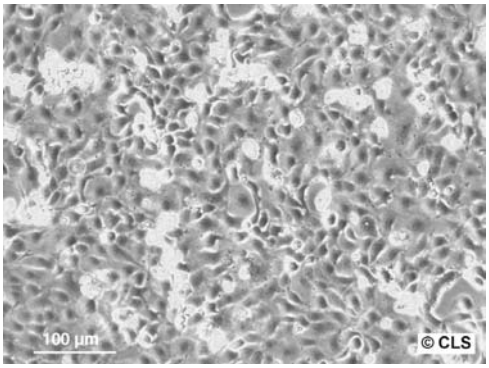
Species: Rat origin was confirmed by Real-time PCR
Products: Somatomedin-like multiplication stimulating activity (MSA)
ATCC number: Not available
CLS number: 500129

Further Reading

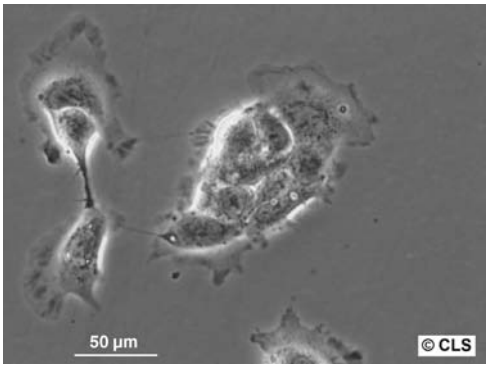
Coon, H.G. and Weiss, M.C. (1969) A quantitative comparison of formation of spontaneous and virus-produced viable hybrids. *Proc. Natl. Acad. Sci. USA*, **62**, 852–859.



DSL-6A-C1, 100× Leica.



DSL-6A-C1, 100× Leica.



DSL-6A-C1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

D

DSL-6A-C1

Origin and General Characteristics

Organism: Rat
Strain: Lewis
Gender: Male
Tissue: Pancreatic cell carcinoma; pancreas; azaserine induced
Morphology: Epithelial
Growth properties: Monolayer
Description: DSL-6A/C1 is a pancreatic ductal cell line derived from the DSL-6 transplantable acinar cell carcinoma. The DSL-6 tumor was established in 1986 from a primary acinar cell carcinoma of the pancreas which developed in a male Lewis rat(DSL-101-79) that was given azaserine intraperitoneally. The cultured DSL-6A/C1 tumor cells initially produced amylase, but production of exocrine enzymes ceased after one to two weeks in culture. The cell line also lost structural and immunohistochemical acinar cell markers while acquiring duct cell markers during culture and regrafting. The DSL-6A/C1 cell line expresses the ductal marker cystic fibrosis transmembrane regulator (CFTR)

Culture Conditions and Handling

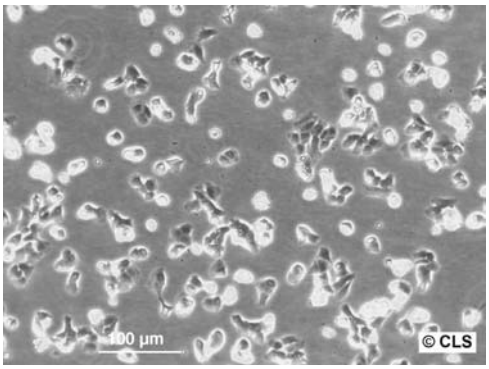
Culture medium: Waymouth medium supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium and magnesium. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: a ratio of 1 : 3 to 1 : 4 is recommended
Fluid renewal: Two times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

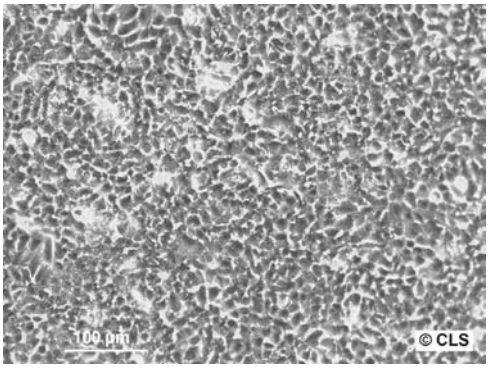
Species: Rat origin was confirmed by Real-time PCR
Tumorigenic: Yes, in Lewis rats the cells produce solid tumors composed of duct-like structures surrounded by dense fibrous tissue
ATCC number: CRL-2132
CLS number: 500166

Further Reading

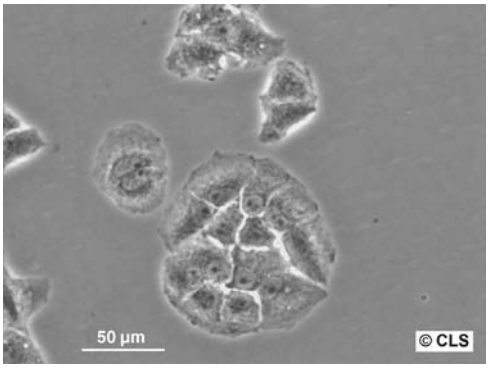
Pettengill, O.S. *et al.* (1993) Derivation of Ductlike Cell Lines from a Transplantable Acinar Cell Carcinoma of the Rat Pancreas. *Am. J. Pathol.*, **143**, 292–303.



FRTL-5, 100× Leica.



FRTL-5, 100× Leica.



FRTL-5, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

FRTL-5

Origin and General Characteristics

Organism: Rat
Strain: Fischer 344
Morphology: Epithelial
Tissue: Thyroid, normal
Growth properties: Clumps with raised centers
Description: FRTL-5 is a derivative of the FRTL cell line; the cells require TSH for growth. For studies involving responses to TSH the cells should be placed in medium without TSH. The cells tend to grow one above another, forming three-dimensional structures rather than expanding into a monolayer

Culture Conditions and Handling

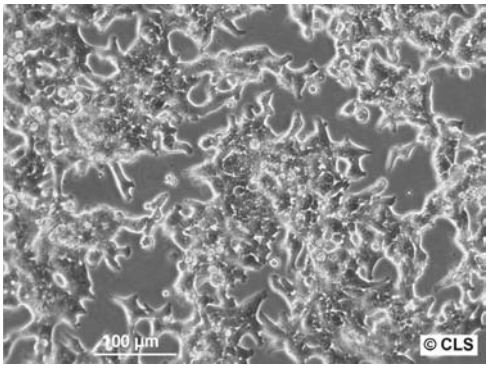
Culture medium: Coon's modified Ham's F12 medium supplemented with 10 μg/ml insulin, 10 nM hydrocortisone, 5 μg/ml transferrin, 10 ng/ml somatostatin, 10 ng/ml glycyl-L- histidyl-L-lysine acetate, 10 mUnits/ml TSH and 5% bovine calf serum (According to Ambesi-Impiombato: Proc. Natl. Acad. Sci. USA 77:3455–3459, 1980)
Subculture routine: Rinse the cell layer with PBS free of calcium and magnesium. Add Accutase and incubate at 37 °C for 10 minutes. Collect the cells by adding fresh medium, resuspend and dispense into new flasks. A general trypsin procedure may also be applied
Split ratio: A ratio of 1 : 10 is recommended
Fluid renewal: Every four days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

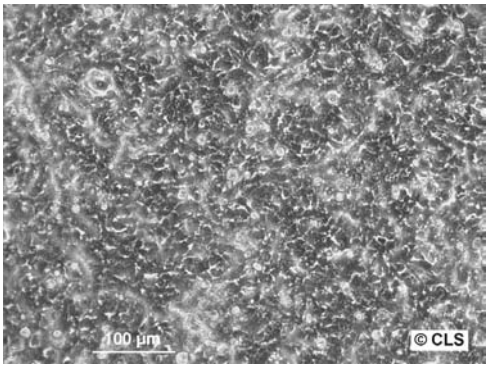
Species: Rat origin was confirmed by Real-time PCR
Immunology: IFN-γ induced expression of HLA-DR
Receptors expressed: Thyroid stimulating hormone (TSH)
Products: Thyroglobulin
ATCC number: CRL-1468
CLS number: 500407

Further Reading

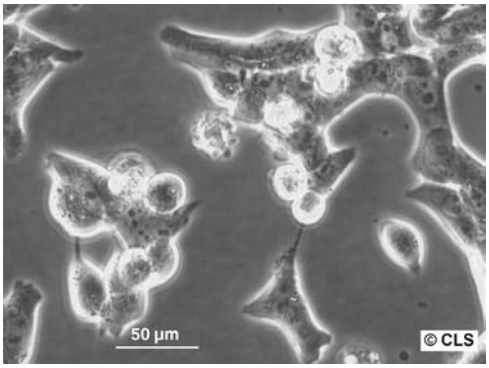
Ambesi-Impiombato, F.S. (1983) Living, fast-growing thyroid cell strain, FRTL-5. U.S. Pat. 4,608,341.



MH-3924A, 100× Leica.



MH-3924A, 100× Leica.



MH-3924A, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MH-3924A

Origin and General Characteristics

Organism: Rat
Age/stage: 16-month-old rat
Gender: ACI-rat
Tissue: Hepatoma
Morphology: Epitheloid
Growth properties: Monolayer
Description: *in vitro* established from the ACI-rat hepatoma (Cell lines Service), RAP-Test negative

Culture Conditions and Handling

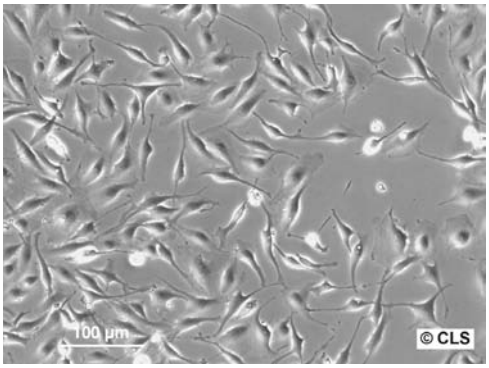
Culture medium: Dulbecco's MEM medium supplemented with L-glutamin and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Every three to five days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

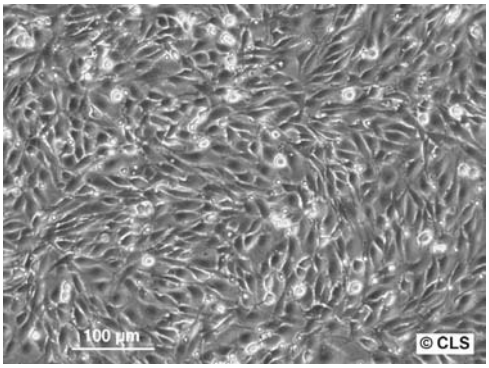
Species: Rat origin was confirmed by Real-time PCR
Tumorigenic: Yes, in ACI-rat
ATCC number: Not available
CLS number: 500286

Further Reading

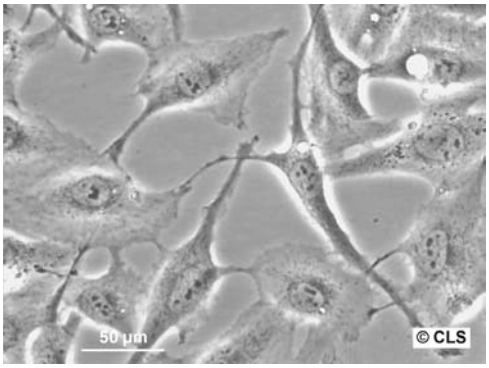
Chang, L.O. *et al*. (1968) Comparative incorporation of tritiated thymidine and cytidine into the mitochondrial and nuclear DNA and RNA of two transplantable hepatomas (3924A and h-35tc2) and host livers. *Cancer Res.*, **28**, 2164–2167.



NRK-49F, 100× Leica.



NRK-49F, 100× Leica.



NRK-49F, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

NRK-49F

Origin and General Characteristics

Organism: Rat
Strain: Osborne-Mendel (OM)
Tissue: Normal kidney
Morphology: Fibroblast-like cells
Cell type: Fibroblast
Growth properties: Monolayer
Description: As NRK-52E cells, this cell line originated from the same mixed culture of normal rat kidney cells but has distinct characteristics. The cells exhibit contact inhibition and are very sensitive to viral or chemical transformation, including proteins such as SGF. NRK-49F cells are used for TGF-β bioassays

Culture Conditions and Handling

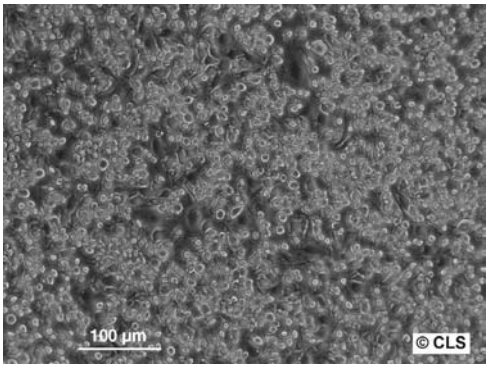
Culture medium: Minimum essential medium (Eagle) with Earle's BSS supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks. Do not leave any trypsin/EDTA solution in the medium! The cells should be maintained sub-confluent, otherwise they will transform
Split ratio: A ratio of 1 : 3 to 1 : 4 is recommended; minimum seeding density 2–4×10^4 cells/cm^2
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

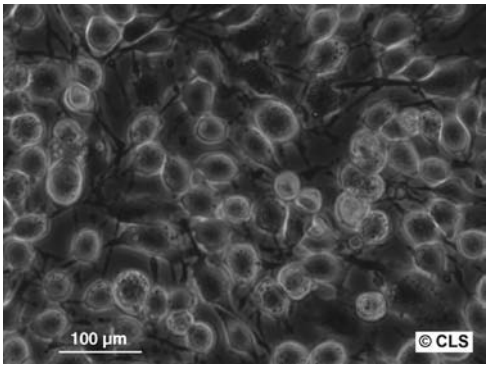
Species: Rat origin was confirmed by Real-time PCR
Receptors expressed: epidermal growth factor (EGF); multiplication stimulating activity (MSA)
ATCC number: CRL-1570
CLS number: 500427

Further Reading

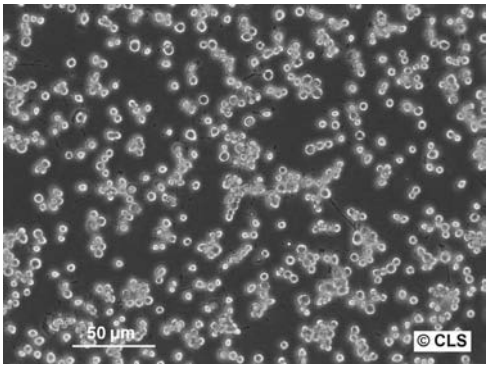
Huu, D. *et al.* (1966) Persistent infection of a rat kidney cell line with Rauscher murine leukemia virus. *J. Bacteriol.*, **92**, 1133–1140.



O-342, 100× Leica.



O-342, 100× Leica.



O-342, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

O-342

Origin and General Characteristics

Organism: Rat
Tissue: Ovary carcinoma
Morphology: Elongated adherent cells and loosely attached
Growth properties: Monolayer

Culture Conditions and Handling

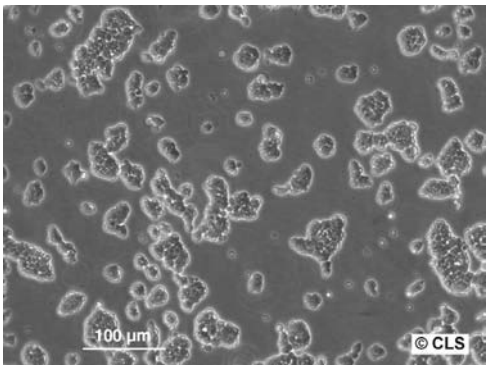
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with L-glutamine, 1% non-essential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

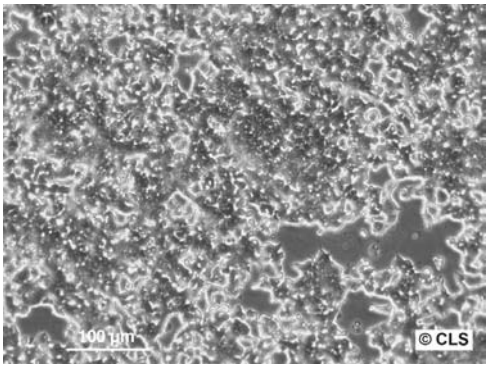
Species: Rat origin was confirmed by Real-time PCR
CLS number: Cryovial: 500305

Further Reading

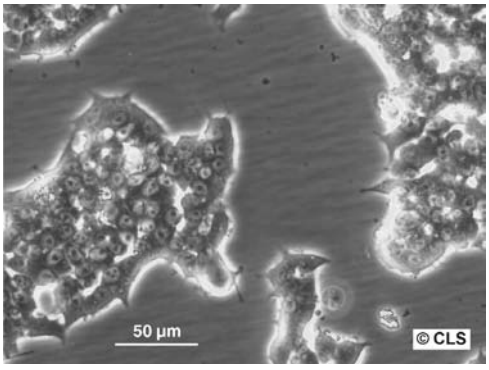
Chen, G. *et al.* (1989) Determination of intracellular reduced gluthadione and glutathione related enzyme activities in cisplatin-sensitive and resistant experimental ovarian carcinoma cell lines. *Cancer Lett.*, **46**, 207–211.



PC-12, 100× Leica.



PC-12, 100× Leica.



PC-12, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

PC-12

Origin and General Characteristics

Organism: Rat
Gender: Male
Tissue: Adrenal gland
Morphology: Polygonal
Cell type: Pheochromocytoma
Growth properties: Small clusters in suspension, poorly adherent; patches on collagen
Description: The PC-12 cell line was derived from a transplantable rat pheochromocytoma. The cells respond reversibly to NGF by induction of a neuronal phenotype. The cells do not synthesize epinephrine. PC-12 adheres poorly to plastic and tends to grow in small clusters. Attachment is improved by using collagen-coated flasks

Culture Conditions and Handling

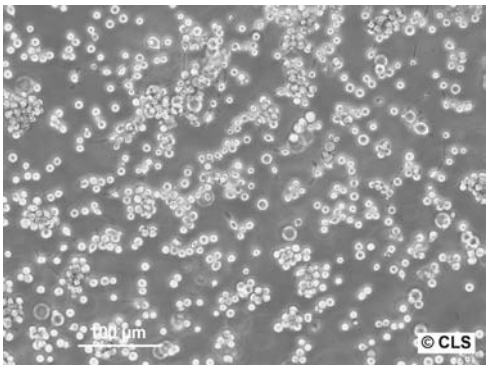
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine, 10% horse serum, and 5% fetal bovine serum
Subculture routine: Suspension cells: Remove cells from substrate by pipetting with fresh medium. To obtain single cells, pass the suspension several times through a 22 gage needle and dispense into new flasks. Growing on collagen: To remove adherent cells, use a standard trypsinization procedure
Split ratio: A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal: Every two to three days
Doubling time: 92 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

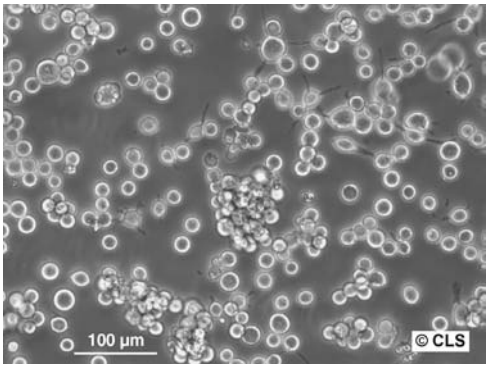
Species: Rat origin was confirmed by Real-time PCR
Karyotype: 40 chromosomes; 38 autosomes plus XY
Tumorigenic: Yes, in New England Deaconess Hospital strain rats
Receptors expressed: Nerve growth factor (NGF)
Products: Catecholamines; dopamine; norepinephrine
ATCC number: CRL-1722
CLS number: 500311

Further Reading

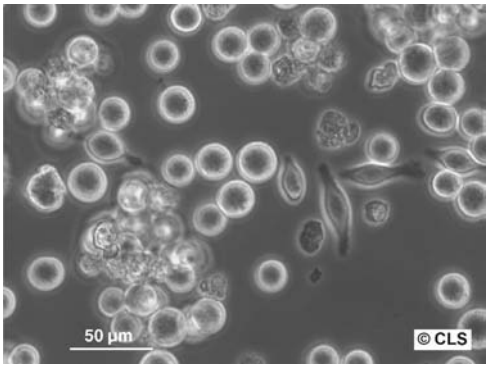
Greene, L.A. *et al*. (1976) Establishment of a noradrenergic clonal line of rat adrenal pheochromocytoma cells which respond to nerve growth factor. *Proc. Natl. Acad. Sci. USA*, **73**, 2424–2428.



RBL-1, 100× Leica.



RBL-1, 200× Leica.



RBL-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RBL-1

Origin and General Characteristics

Organism: Rat
Strain: Wistar
Tissue: Blood (chemically induced leukemia)
Cell type: Lymphoblast, basophil
Growth properties: Suspension/monolayer
Description: The line exhibits various characteristics of basophil differentiation including histamine release and surface receptors for IgE

Culture Conditions and Handling

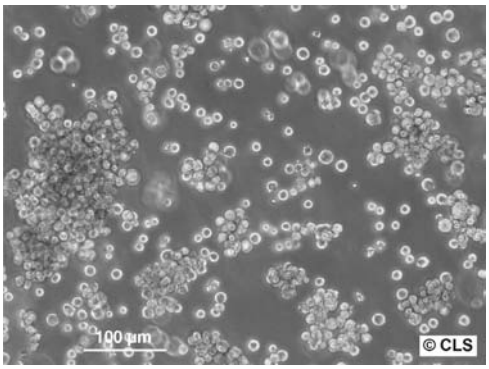
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 1% nonessential amino acids (NEAA), 1 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Start cultures at 3×10^5 cells/ml and maintain between 1 to 2×10^6 cells/ml. Split the cells by collecting an appropriate amount of the cell suspension and place it into new cell culture flasks already containing fresh cell culture media
Fluid renewal: Twice weekly
Freeze medium: CM-1 (CLS)
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

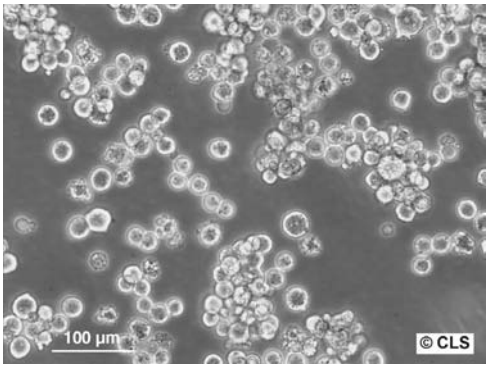
Species: Rat origin was confirmed by Real-time PCR
Receptors expressed: Fc of IgE
Products: Histamine
ATCC number: CRL-1378
CLS number: 500389

Further Reading

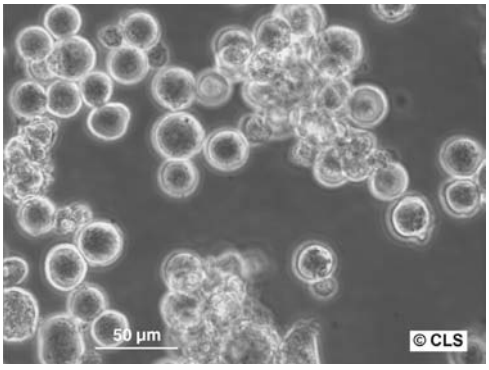
Eccleston, E. *et al.* (1973) Basophilic leukemia in the albino rat and a demonstration of the basopoietin. *Nat. New Biol.*, **244**, 73–76.



Walker-256, 100× Leica.



Walker-256, 200× Leica.



Walker-256, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Walker-256

Origin and General Characteristics

Organism: *Rattus norvegicus* (rat)
Tissue: Carcinoma
Morphology: Epithelial
Growth properties: Suspension/monolayer
Description: The Walker cell line has been established from the Walker 256 rat tumor that has been maintained *in vivo* for over 60 years

Culture Conditions and Handling

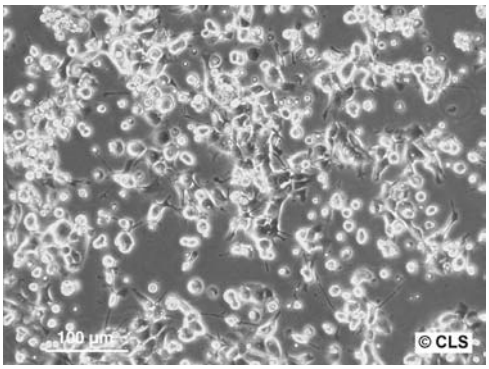
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Dilute in fresh medium to approx. 5×10^4 cells/ml
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

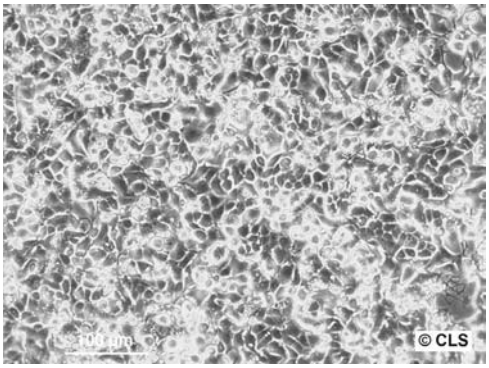
Tumorigenic: Yes, in Cörli rats
Viruses: MAP-test negative for: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD vii, toolan's H-1, MHV, LDV, RCV/SDA, M- Adenovirus and B.piliformis
ATCC number: Not available
CLS number: 500375

Further Reading

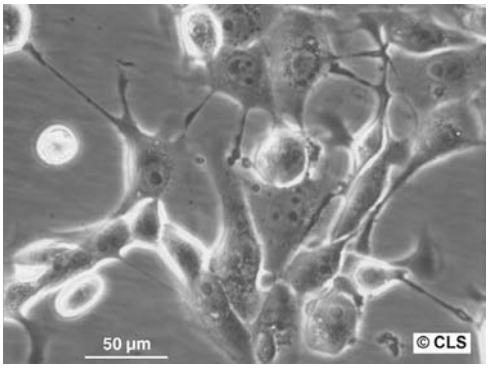
Shetlar, M.R. *et al.* (1950) Serum polysaccharide levels in rats bearing the Walker 256 tumor. *Cancer Res.*, **10**, 445–447.



Zajdela-Hepatoma, 100× Leica.



Zajdela-Hepatoma, 100× Leica.



Zajdela-Hepatoma, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Zajdela-Hepatoma

Origin and General Characteristics

Organism: Rat
Age/stage: 11-months-old rat
Gender: Sprague-Dawley rat
Tissue: Liver
Morphology: Hepatoma
Growth properties: Monolayer
Description: *In vitro* established from the Zajdela-Ascites-Hepatoma (Cell lines Service), RAP-Test negative

Culture Conditions and Handling

Culture medium: DMEM medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA (versene) solution. Add 0.025% trypsin/0.02% EDTA (versene) solution and let the culture sit at room temperature for 5–10 min. Add fresh medium, collect the cells, remove trypsin by centrifugation, and dispense into new flasks.
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Every three to five days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

Species: Rat origin was confirmed by Real-time PCR
Tumorigenic: Yes, in Cörli-rat
ATCC number: Not available
CLS number: 500306

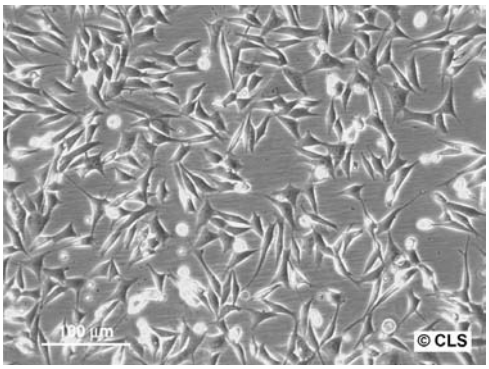
Further Reading

Wintzerith, M. *et al.* (1962) Comparative study of free uridylic nucleotides in the normal liver, the regenerating liver and in the Zajdela hepatoma. *C.R. Seances Soc. Biol. Fil.*, **156**, 2114–2118.

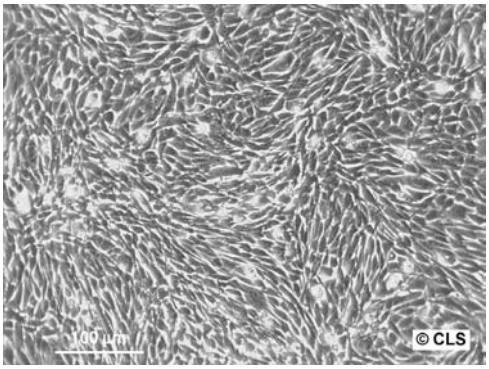
Wieser, O. *et al.* (1968) Heterotransplantation of Zajdela hepatoma of the rat to golden hamsters, mice, and Chinese hamsters. *Verh. Dtsch. Ges. Pathol.*, **52**, 421–425.

4.2.2
Mouse

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



3T3-Swiss Albino, 100× Leica.



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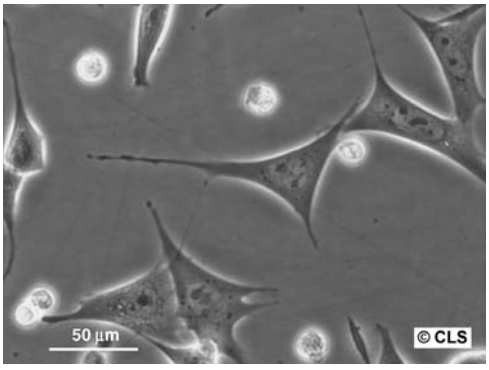


3T3-Swiss Albino, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

3T3-Swiss Albino

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Embryo
Tissue: Embryo
Morphology: Fibroblast
Growth properties: Monolayer
Description: The 3T3 cell line was established from 17 to 19 days old mouse embryos. The cells are contact inhibited. A confluent monolayer yields 40.000 cells/cm^2. The cells should be grown in plastic flasks; they do not grow well on some types of glass surfaces. A saturation density of approximately 50.000 cells/cm^2 can be reached

Culture Conditions and Handling

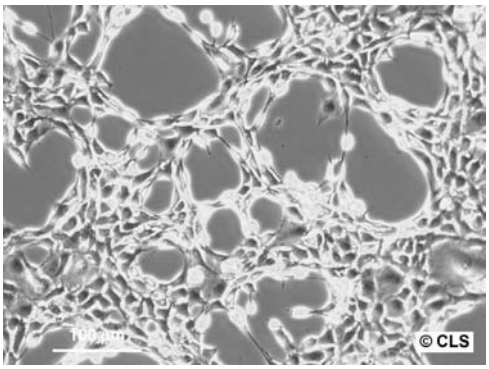
Culture medium: DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Never allow culture to become completely confluent. Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 5–10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. For 75 sq cm flasks use 4 × 10 exp 5 cells per flask. A standard trypsinisation protocol may be used
Fluid renewal: Twice weekly
Doubling time: 18 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

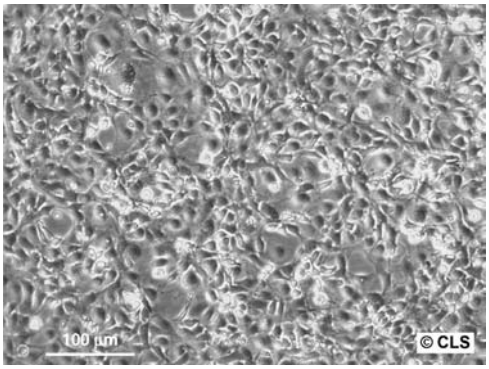
Species: Mouse origin was confirmed by Real-time PCR
Reverse transcriptase: Negative
Viruses: Tested and found negative for ectromelia virus (mousepox)
Virus susceptibility: Polyomavirus; SV40
Products: Lysophosphatidylcholine (lyso-PC) induces AP-1 activity and c-jun N-terminal kinase activity (JNK1) by a protein kinase C-independent pathway
ATCC number: CCL-92
CLS number: 400301

Further Reading

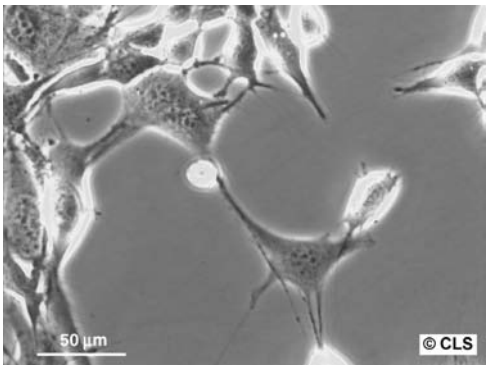
Vogt, M. and Dulbecco, R. (1962) Studies on cells rendered neoplastic by polyoma virus: the problem of the presence of virus-related materials. *Virology*, **16**, 41–51.



3T6-Swiss Albino, 100× Leica.



3T6-Swiss Albino, 100× Leica.



3T6-Swiss Albino, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

3T6-Swiss Albino

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Embryo
Morphology: Fibroblastoid
Growth properties: Monolayer
Description: The 3T6 cell line was established from 17 to 19 days old mouse embryos

Culture Conditions and Handling

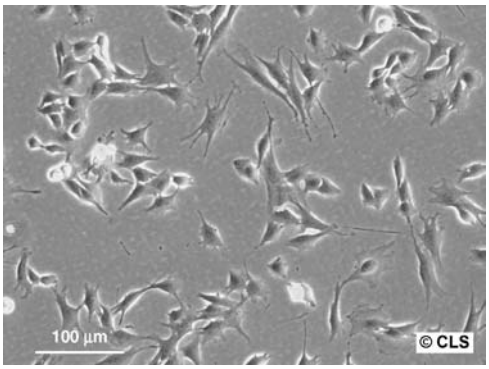
Culture medium: Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Rinse the culture flask with 0.02% EDTA. Add 0.025% trypsin/0.02% EDTA solution and incubate cultures at 37 °C until the cells detach. Deactivate trypsin by adding fresh medium, centrifuge, and aspirate and dispense into new flasks.
Split ratio: A ratio of 1 : 2 to 1 : 10 is recommended
Fluid renewal: One to two times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

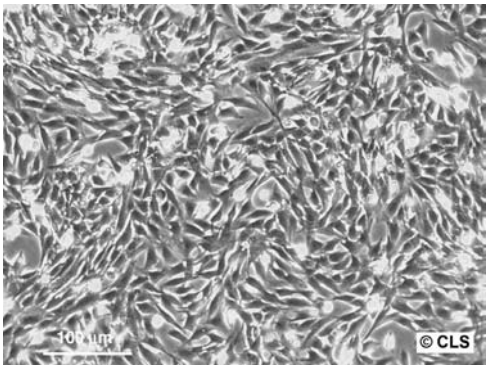
Species: Mouse origin was confirmed by Real-time PCR
Reverse transcriptase: Negative
Viruses: Tested and found negative for Ectromelia virus (mousepox).
Virus resistance: Poliovirus 2
Virus susceptibility: Herpes simplex; vaccinia; pseudorabies; vesicular stomatitis (Indiana)
Products: collagen; hyaluronic acid
ATCC number: CCL-96
CLS number: 400104

Further Reading

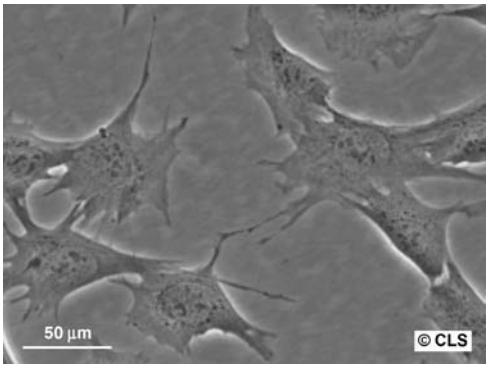
Vogt, M. and Dulbecco, R. (1962) Studies on cells rendered neoplastic by polyoma virus: the problem of the presence of virus-related material. *Virology*, **16**, 41–51.



C2C12, 100× Leica.



C2C12, 100× Leica.



C2C12, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

C2C12

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: C3H
Tissue: Muscle
Morphology: Fibroblast
Cell type: Myoblast
Growth properties: Monolayer
Description: The C2C12 cell line is a subclone from a myoblast line established from normal adult C3H mouse leg muscle. The cells differentiate rapidly and produce extensive contracting myotubes expressing characteristic muscle proteins

Culture Conditions and Handling

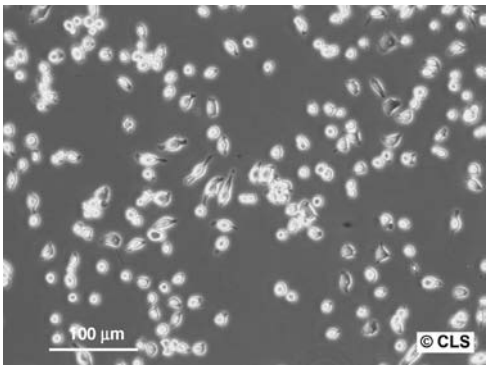
Culture medium: RPMI 1640 supplemented with L-glutamine and 10% fetal bovine serum. Media for differentiation (Starving medium): RPMI 1640 supplemented with 2 mM L-glutamine and 2% horse serum
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

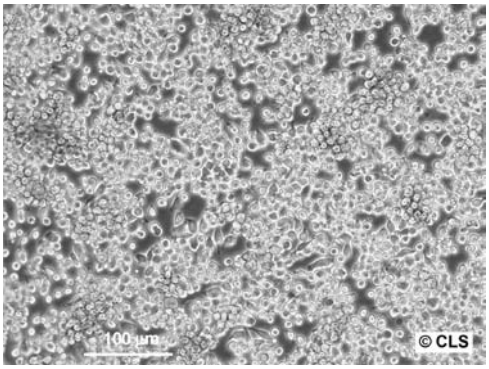
ATCC number: CRL 1772
CLS number: 400476

Further Reading

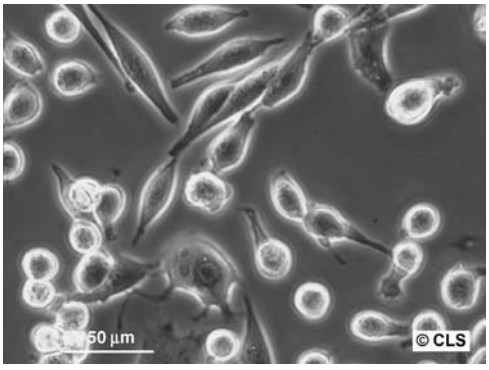
Yaffe, D. and Saxel, O. (1977) Serial passaging and differentiation of myogenic cells isolated from dystrophic mouse muscle. *Nature*, **270**, 725–727.



CaD2, 100× Leica.



CaD2, 100× Leica.



CaD2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CaD2

Origin and General Characteristics

Organism: *Mus musculus* (mouse), DBA
Age/atage: Six months
Strain: C3H
Gender: Female
Tissue: Carcinoma
Morphology: Round to elongated, macrophage-like
Growth properties: Adherent, monolayer
Description: *In vitro* established from the CaD2 carcinoma, tested and found negative for MAP test

Culture Conditions and Handling

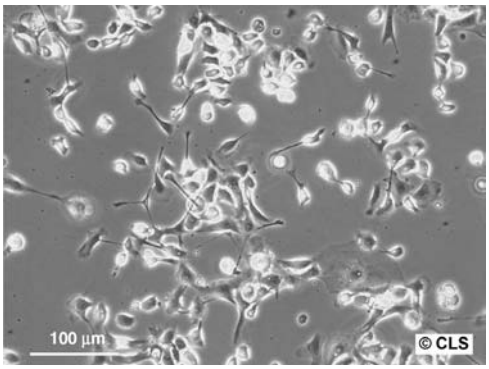
Culture medium: DMEM high glucose (4.5 g/L) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium and magnesium. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 3 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

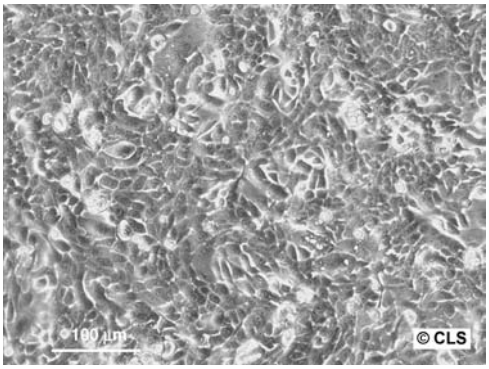
Species: Mouse origin was confirmed by Real-time PCR
Viruses: MAP-TEST negative: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, Toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B. piliformis
ATCC number: Not available
CLS number: 400138

Further Reading

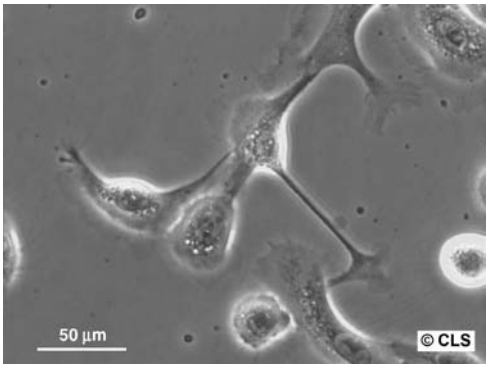
Babiarz-Tracy, P. *et al.* (1980) Esters of chlorohydroxyacetone in chemotherapy of murine tumors. *Cancer Res.*, **40 (9)**, 3274–3280.



CLS-103, 100× Leica.



CLS-103, 100× Leica.



CLS-103, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-103

Origin and General Characteristics

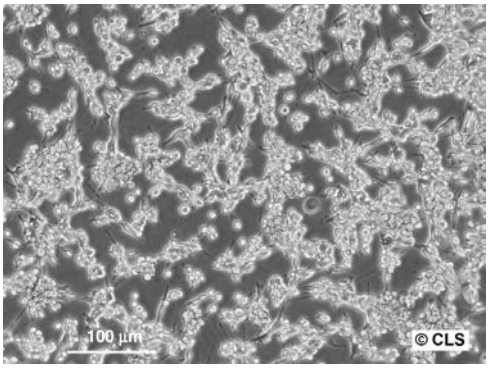
Organism: *Mus musculus* (mouse)
Strain: NMRI
Morphology: Epithelial
Growth properties: Monolayer
Description: The CLS-103 cell line was established from the primary squamous cell carcinoma of NMRI mice. These tumors were induced in NMRI-mice by single oral application of DMBA

Culture Conditions and Handling

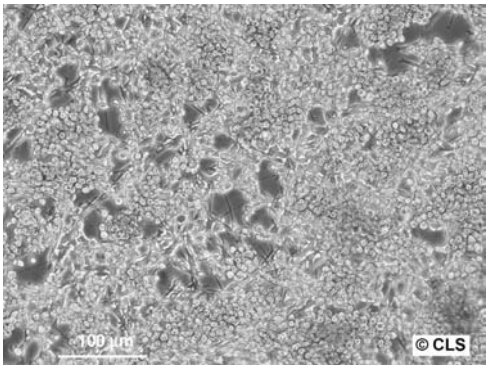
Culture medium: RPMI 1640 medium supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. Start cultures at 5 × 10exp4 cells/sqare cm. A standard trypsinisation protocol may be used
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

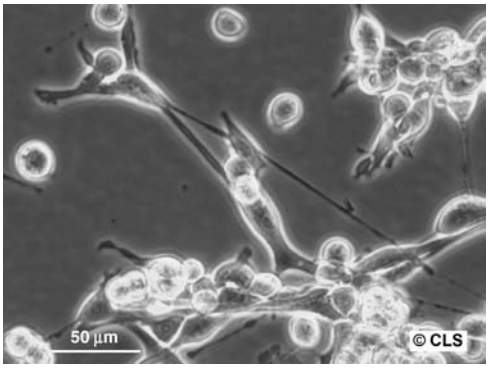
ATCC number: Not available
CLS number: 400176
Viruses: SMRV negative, as confirmed by Real-time PCR



CLS-138, 100× Leica.



CLS-138, 100× Leica.



CLS-138, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CLS-138

Origin and General Characteristics

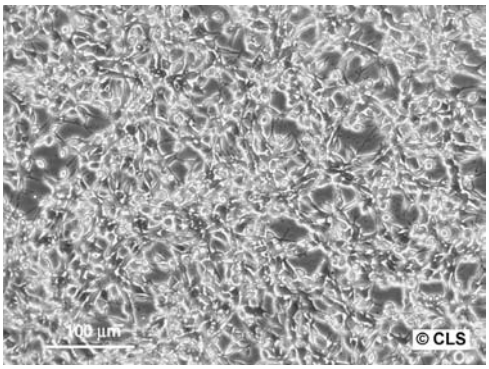
Organism: *Mus musculus* (mouse)
Age/stage: Adult
Strain: NMRI
Tissue: Spindel cells
Morphology: Fibroblastoid
Cell type: Spindel cell sarcoma
Growth properties: Monolayer
Description: Established from the primary spindel cell sarcoma of female NMRI-mice, these tumors were induced in female NMRI mice by single injection of Benzpyrene

Culture Conditions and Handling

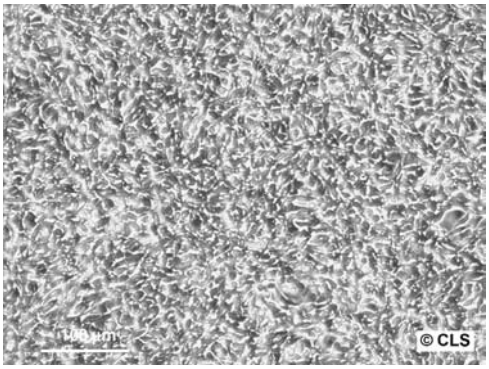
Culture medium: Dulbecco's modified Eagle's medium supplemented with L-glutamine, 4.5 g/L glucose and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Every three to five days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

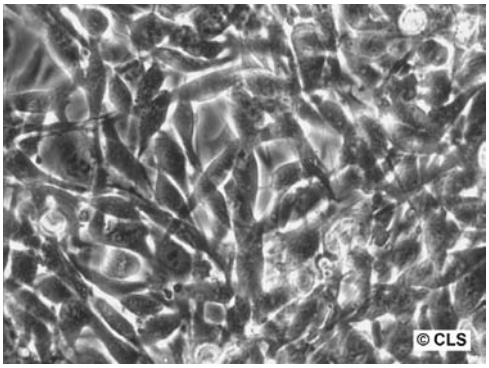
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes, in mice
CLS number: 400177



Colon-26, 100× Leica.



Colon-26, 100× Leica.



Colon-26, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Colon-26

Origin and General Characteristics

Organism: *Mus musculus* (mouse) Balb/C
Gender: Female
Tissue: Colon
Morphology: Epithelial
Cell type: Adenocarcinoma
Growth properties: Monolayer
Description: Established "*in vitro*" from the colon-26 tumor of female mice. This tumor was induced in Balb/c mice by single rectal application of N-Nitroso-N-Methylurethan (NMU)

Culture Conditions and Handling

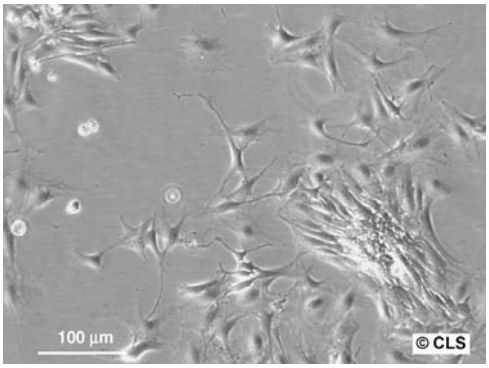
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin for 2–3 min, remove trypsin and let the culture sit at room temperature until the cells detach. Add fresh medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

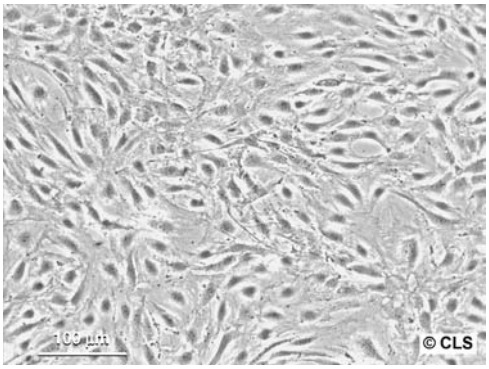
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes, in Balb/c mice
Viruses: MAP-TEST negative: Sendai, Ektromelie, Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, Toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B.piliformis
ATCC number: Not available
CLS number: 400156

Further Reading

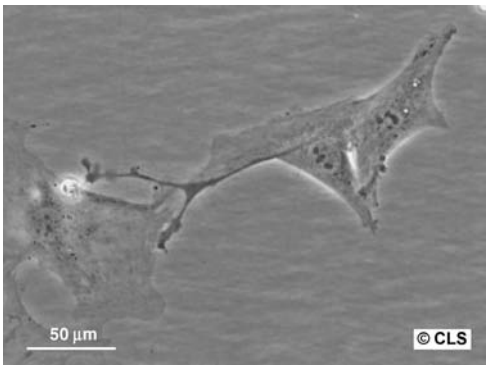
Alison, D.C., Ridolpho, P.F., Anderson, S., and Bose, K. (1985) Variations in the [^{3}H]thymidine labeling of S-phase cells in solid mouse tumors. *Cancer Res.*, **45**, 6010–6016.



E11, 100× Leica.



E11, 100× Leica.



E11, 400× Leica.

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E11

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Adult
Strain: Immorto-Mouse H-2k^b-tsA58
Tissue: Kidney
Cell type: Podocyte
Growth properties: Monolayer
Description: The E11 cell line has been cloned from the outgrowth of glomeruli, which were isolated from H-2k^b-tsA58 transgenic mice. The mice carry a temperature-sensitive variant of the SV40 large T antigen under control of the IFN-g-inducible H-2k^b promoter. Cells proliferate at 33 °C, and they differentiate at 38 °C. At present, the cells have been cultured successfully for more than 40 passages without noting phenotypic changes

Culture Conditions and Handling

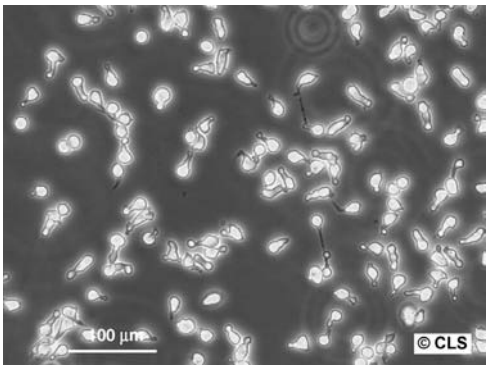
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 2 to 1 : 3 (38 °C) or 1 : 5 (33 °C) is recommended
Fluid renewal: Three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

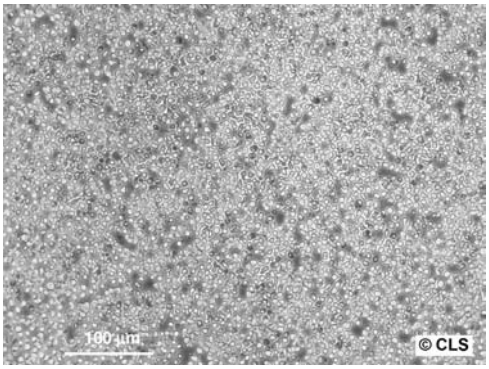
Species: Mouse origin was confirmed by Real-time PCR
Protein expression: WT-1, Lmx1b, nephrin, NEPHI, FAT, P-cadherin, CD2AP, ZO-I, podocalyxin, podoplanin
CLS number: 400494

Further Reading

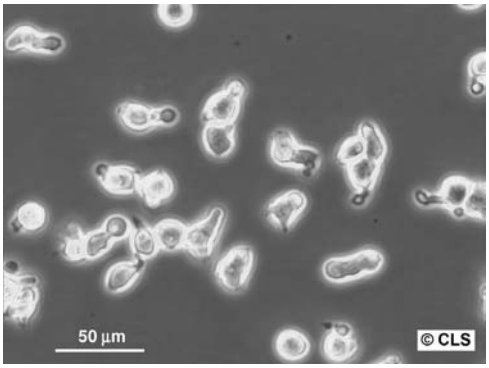
Schiwek, D. *et al.* (2004) Stable expression of nephrin and localization to cell-cell contacts in novel murine podocyte cell lines. *Kidney International*, **66**, 91–101.



EL4.IL-2, 100× Leica.



EL4.IL-2, low attachment surface_100× Leica.



EL4.IL-2, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

EL4.IL-2

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: C57BL/6
Tissue: Thymus
Morphology: Lymphoblast
Cell type: Lymphoma
Growth properties: Suspension
Description: This is a subline of EL4 (ATCC TIB-39) that produces IL-2 in response to phorbol-12-myristate-13-acetate (PMA). The line is capable of producing 2500 units/ml of IL-2 after 24 h in culture with PMA. Tested and found negative for ectromelia virus (mousepox)

Culture Conditions and Handling

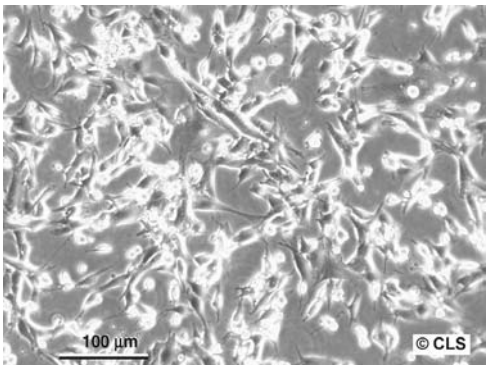
Culture medium: DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% horse serum. Alternatively, DMEM supplemented with 2 mM L-glutamine, 50 mM 2-mercaptoethanol and 10% fetal bovine serum may be used
Subculture routine: Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Split the cells by collecting an appropriate amount of the cell suspension and place it into new cell culture flasks already containing fresh cell culture media
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

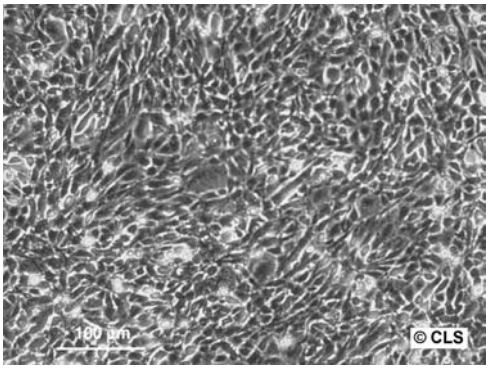
Products: Interleukin-2 (IL-2)
ATCC number: TIB-181
CLS number: 400425

Further Reading

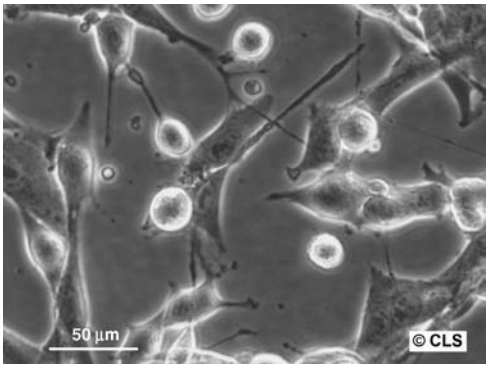
Farrar, J.J. *et al.* (1980) Thymoma production of T cell growth factor (interleukin-2). *J. Immunol.*, **125**, 2555–2558.



FS-C3H, 100× Leica.



FS-C3H, 100× Leica.



FS-C3H, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

FS-C3H

Origin and General Characteristics

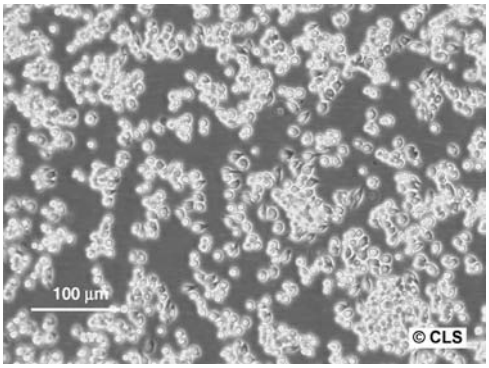
Organism: *Mus musculus* (mouse)
Strain: C3H
Tissue: Fibrosarcoma; (methylcholanthrene induced)
Morphology: Fibroblastoid
Growth properties: Adherent
Description: *In vitro* established from the primary Sarcoma of the C3H-mice.

Culture Conditions and Handling

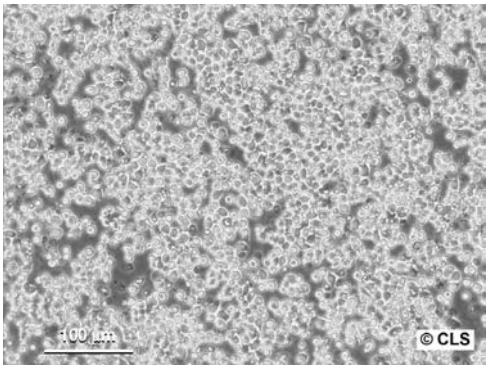
Culture medium: RPMI 1640 medium supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 5 to 1 : 20 is recommended
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

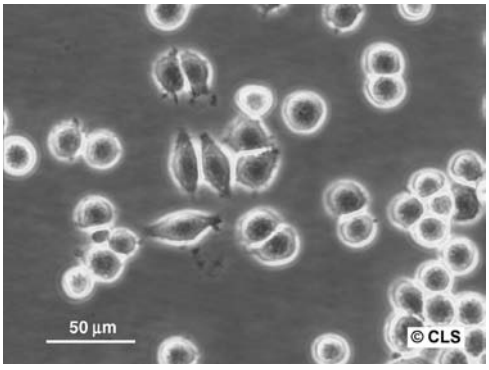
Species: Mouse origin was confirmed by Real-time PCR
CLS number: 400418



J-774A.1, 100× Leica.



J-774A.1, 100× Leica.



J-774A.1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

J-774A.1

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: BALB/c
Gender: Female
Tissue: Blood
Morphology: Round to elongated cells
Cell type: Monocyte/macrophage
Growth properties: Monolayer
Description: 774A.1 cells are active in antibody dependent phagocytosis. Their growth is inhibited by dextran sulfate, PPD, and LPS.

Culture Conditions and Handling

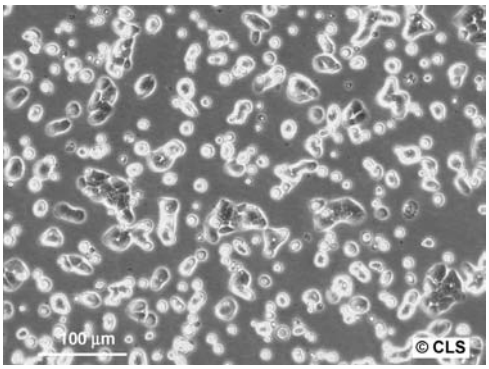
Culture medium: DMEM:F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Subcultures are prepared by scraping before confluence is reached; otherwise, the cells will round up and detach. The detachment is facilitated when the monolayer is washed once with PBS and incubated with TrypleExpress (Invitrogen, Germany) for 15min at 37 °C. Centrifuge the cell suspension, discard the supernatant, resuspend the cells in fresh cell culture medium and dispense into new flasks. Using trypsin for detachment is not recommended
Split ratio: A ratio of 1 : 3 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

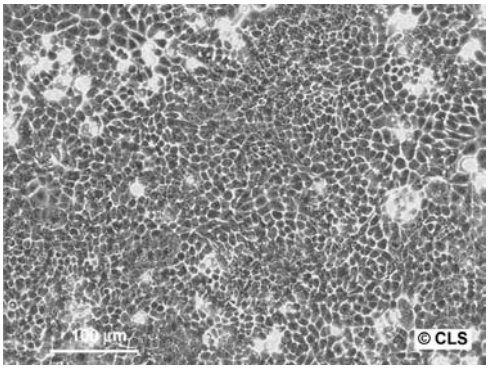
Species: Mouse origin was confirmed by Real-time PCR
Receptors expressed: Immunoglobulin (Fc); complement (C3)
Products: Interleukin-1 (interleukin 1, IL-1, LAF); lysozyme
ATCC number: TIB-67
CLS number: 400220

Further Reading

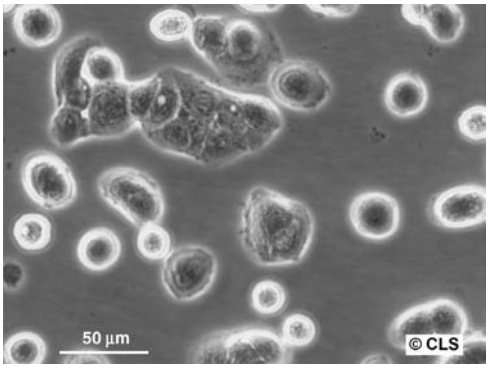
Ralph, P. *et al.* (1975) Reticulum cell sarcoma: an effector cell in antibody-dependent cell-mediated immunity. *J. Immunol.*, **114**, 898–905.



KERA-308, 100× Leica.



KERA-308, 100× Leica.



KERA-308, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

KERA-308

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: Balb/c
Cell type: Epidermal keratinocytes
Growth properties: Monolayer
Description: Established from adult Balb/c mouse back skin, initiated *in vivo* with DMBA

Culture Conditions and Handling

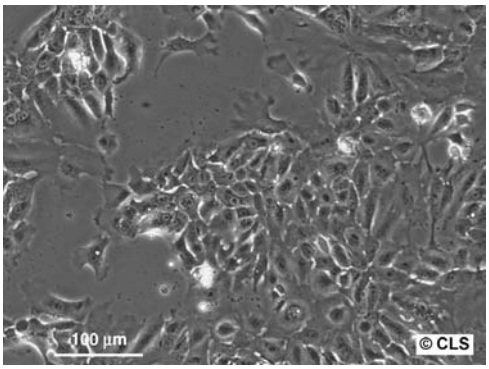
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium and magnesium. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks. Subculture every 6 to 8 days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

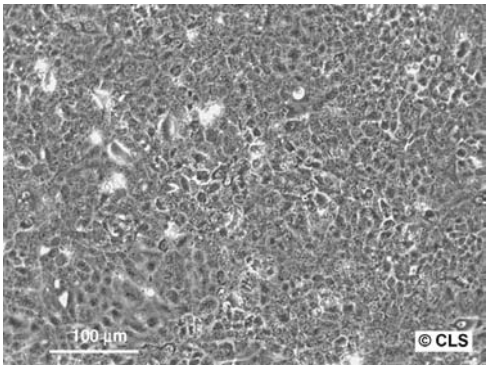
Species: Mouse origin was confirmed by Real-time PCR
ATCC number: Not available
CLS number: 400429

Further Reading

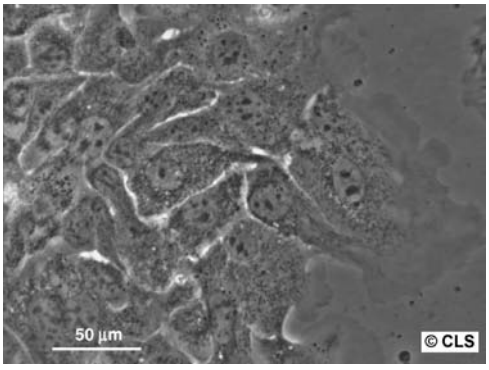
Strickland, J.E., Greenhalgh, D.A., Koceva-Chyla, A., Hennings, H., Restrepo, C., Balaschak, M., and Yuspa, S.H. (1988) Development of murine epidermal cell lines which contain an activated rasHa oncogene and form papillomas in skin grafts on athymic nude mouse hosts. *Cancer Res.*, **48** (1), 165–169.



KERA-SP1, 100× Leica.



KERA-SP1, 100× Leica.



KERA-SP1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

KERA-SP1

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: Sencar mice
Cell type: Keratinocyte
Growth properties: Monolayer
Description: The KERA-SP1 cell line was established from DMBA/TPA induced papillomas of Sencar mice

Culture Conditions and Handling

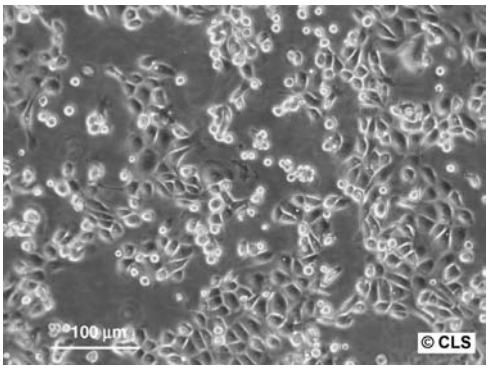
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse 0.02% EDTA solution. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks. Subculture every 6 to 8 days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

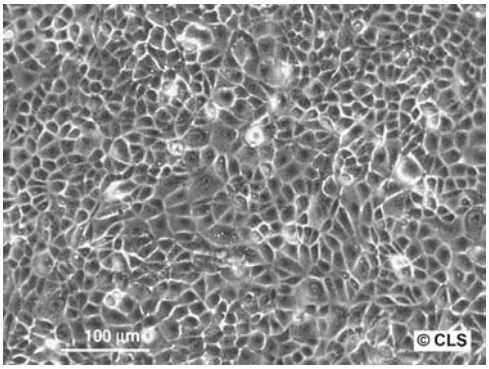
ATCC number: Not available
CLS number: 400430

Further Reading

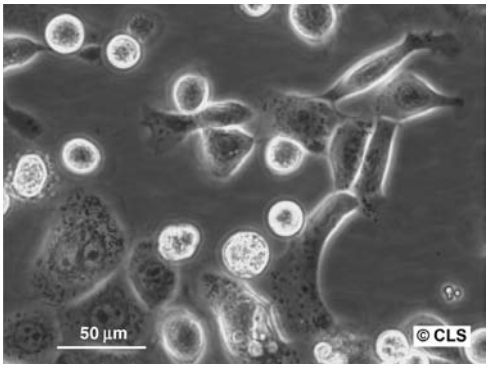
Strickland, J.E., Greenhalgh, D.A., Koceva-Chyla, A., Hennings, H., Restrepo, C., Balaschak, M., and Yuspa, S.H. (1988) Development of murine epidermal cell lines which contain an activated rasHa oncogene and form papillomas in skin grafts on athymic nude mouse hosts. *Cancer Res.*, **48** (1), 165–169.



KLN-205, 100× Leica.



KLN-205, 100× Leica.



KLN-205, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

KLN-205

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: DBA/2
Tissue: Lung
Cell type: Squamous cell carcinoma
Growth properties: Adherent
Description: KLN 205 cells form metastatic lesions in lungs after inoculation into mice. Tested and found negative for ectromelia virus (mousepox)

Culture Conditions and Handling

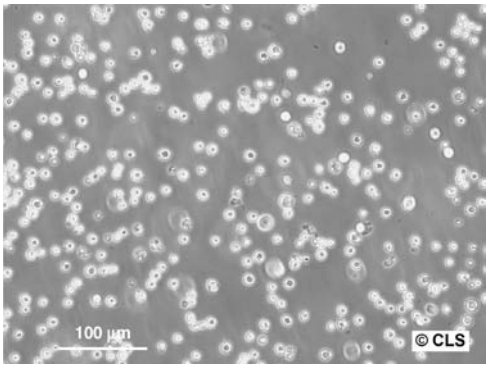
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at 37 °C until the cells detach. Add fresh medium supplemented with serum, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 5 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

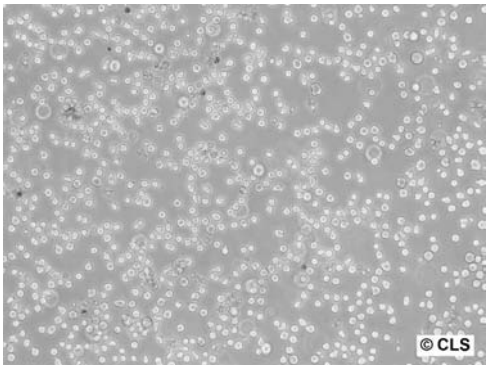
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes, in DBA/2 and BDF1 mice
ATCC number: CRL-1453
CLS number: 400419

Further Reading

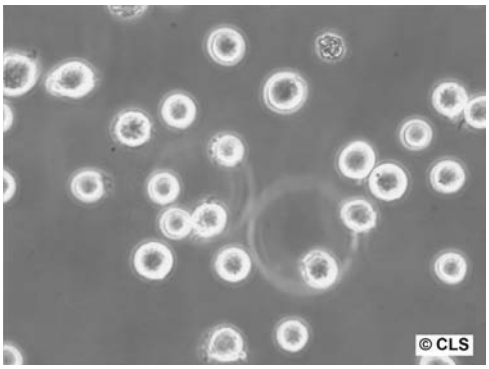
Kaneko, T. *et al.* (1978) Growth characteristics and drug responses of a murine lung carcinoma *in vitro* and *in vivo*. *Cancer Res.*, **38**, 2084–2090.



L-138, 100× Leica.



L-138, 100× Leica.



L-138, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

L-138 (M138)(M-24)

Origin and General Characteristics

Organism: Mouse (B cell); mouse (myeloma)
Strain: (B cell); BALB/c (myeloma)
Tissue: B lymphocyte; hybridoma
Morphology: Lymphoblast
Growth properties: Suspension
Description: Animals were immunized with normal human cutaneous melanocytes. The antibody reacts with the M-24 antigen system

Culture Conditions and Handling

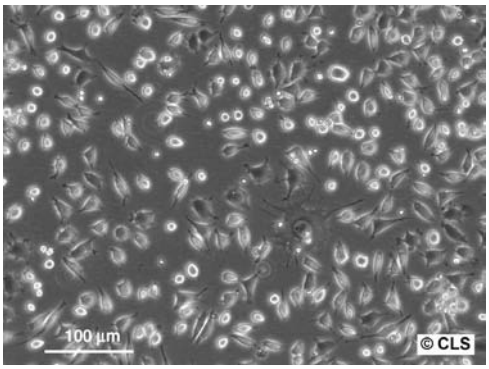
Culture medium: RPMI 1640 medium supplemented with L-glutamine, 1% non-essential amino acids and 10%; fetal bovine serum
Subculture routine: Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Split the cells by collecting an appropriate amount of the cell suspension and place it into new cell culture flasks already containing fresh cell culture media
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

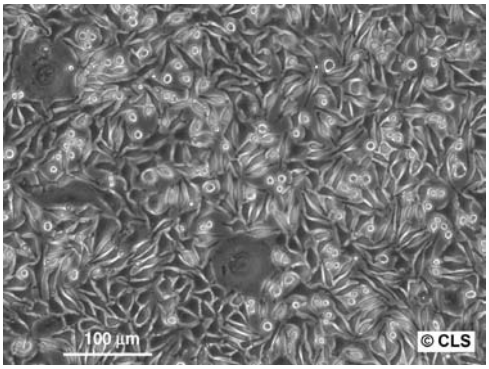
Species: Mouse origin was confirmed by Real-time PCR
Isotype: IgG1
Products: Monoclonal antibody (Immunoglobulin) against human cutaneous melanocytes (M-24 antigen system).
ATCC number: Not available
CLS number: 400384

Further Reading

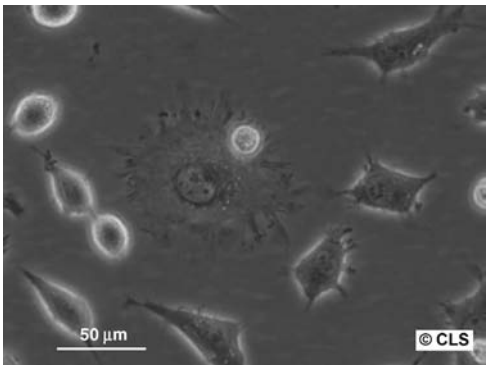
Houghton, A.N. *et al.* (1982) Surface antigens of melanocytes and melanomas. Markers of melanocyte differentiation and melanoma subsets. *J. Exp. Med.*, **156**, 1755–1766.



L-929, 100× Leica.



L-929, 100× Leica.



L-929, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

L-929

Origin and General Characteristics

Organism:	*Mus musculus* (mouse)
Strain:	C3H/An
Gender:	Male
Age/stage:	100 days
Tissue:	Connective tissue; normal; subcutaneous; areolar, and adipose
Cell type:	Fibroblastoid
Growth properties:	Monolayer

Culture Conditions and Handling

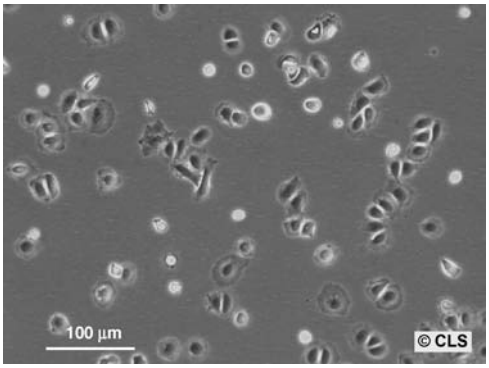
Culture medium:	DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

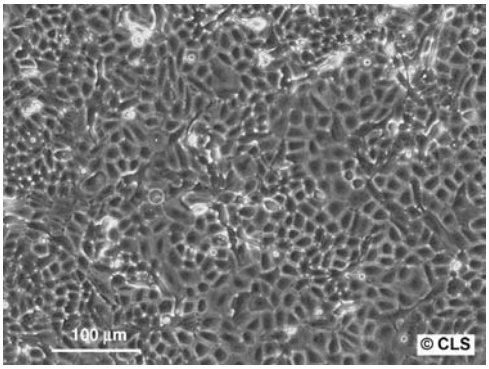
Species:	Mouse origin was confirmed by Real-time PCR
Tumorigenic:	Yes, in immunosuppressed mice
Antigen expression:	H-2k
Reverse transcriptase:	Positive
Viruses:	Tested and found negative for ectromelia virus (mousepox).
Virus resistance:	Poliovirus 1, 2, 3; coxsackievirus B5; polyomavirus
ATCC number:	CCL 1
CLS number:	400260

Further Reading

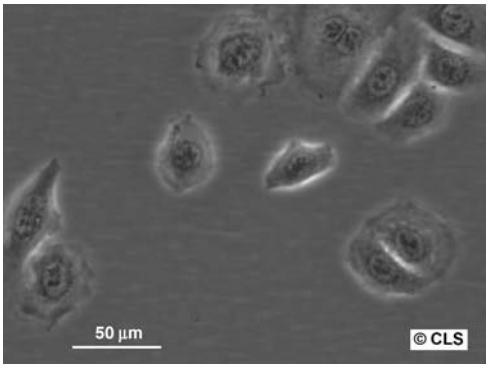
Earle, W.R. (1943) Production of malignancy *in vitro* IV. The mouse fibroblast cultures and changes seen in the living cells. *J. Natl. Cancer Inst.*, **4**, 165–212.



MCA-3D, 100× Leica.



MCA-3D, 100× Leica.



MCA-3D, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MCA-3D

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: Primary epidermal keratinocytes of neonatal Balb/c mice
Morphology: Keratinocyte
Cell type: Keratinocyte
Growth Properties: Monolayer
Description: The cell line MCA-3D was selected in normal serum medium after DMBA/TPA treatment of primary epidermal cultures of neonatal Balb/c mice

Culture Conditions and Handling

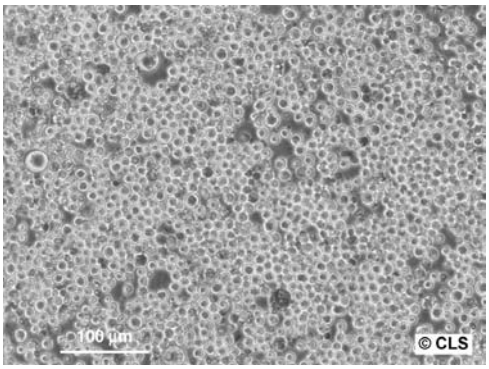
Culture medium: MDCB 153 media (alternatively, EMEM) supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add TrypLE Express and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety Level: 1

Special Features of the Cell Line and Recommended Use

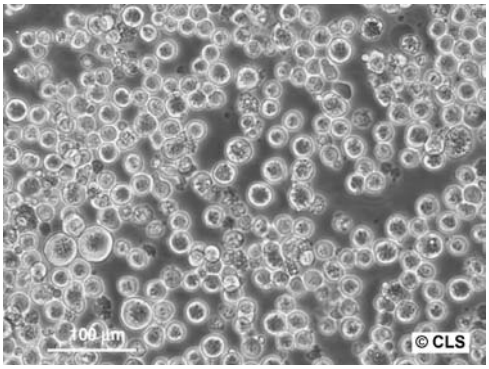
Species: Mouse origin was confirmed by Real-time PCR
CLS number: 400437

Further Reading

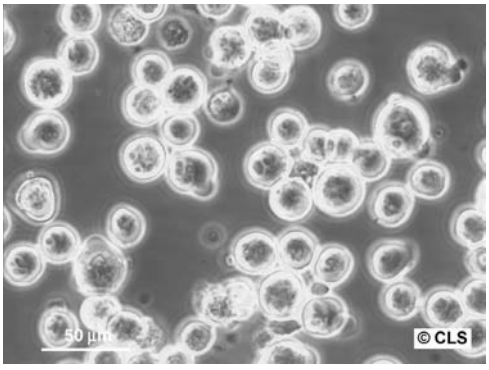
Kulesz-Martin, M. *et al.* (1983) Properties of carcinogen altered mouse epidermal cells resistant to calcium-induced terminal differentiation. *Carcinogenesis*, **4**, 1367–1377.



Meth-A-Sarcoma, 100× Leica.



Meth-A-Sarcoma, 200× Leica.



Meth-A-Sarcoma, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Meth-A-Sarcoma

Origin and General Characteristics

Organism: Mouse, Balb/c
Age/stage: Adult
Tissue: Sarcoma; fibrosarcoma
Morphology: Round cells forming aggregates
Growth properties: Suspension

Culture Conditions and Handling

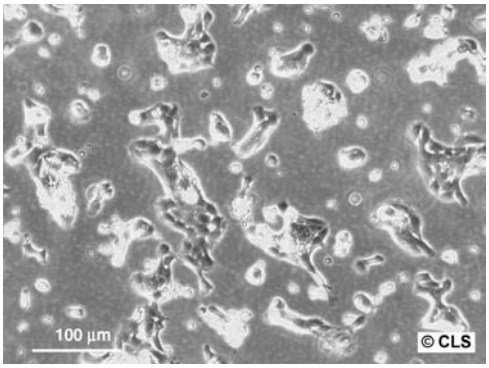
Culture medium: Dulbecco's modified Eagle's medium with 4.5 g/l glucose, 90%; fetal bovine serum, 10%
Subculture routine: Allow cell aggregates to settle to the bottom of the flask, discard the supernatant medium, disperse the cells with gentle pipetting and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Every two to four days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

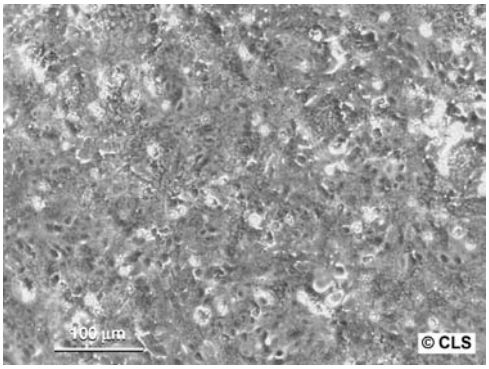
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes
ATCC number: Not available
CLS number: 400284

Further Reading

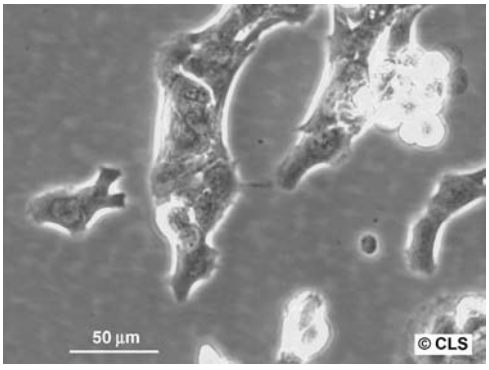
Chang, H.L. *et al*. (1993) Increased transforming growth factor beta expression inhibits cell proliferation in vitro, yet increases tumorigenicity and tumor growth of Meth A sarcoma cells. *Cancer Res.*, **53**, 4391–4398.



MSC-P5, 100× Leica.



MSC-P5, 100× Leica.



MSC-P5, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MSC-P5

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Cell type: Keratinocyte
Growth properties: Keratinocyte

Culture Conditions and Handling

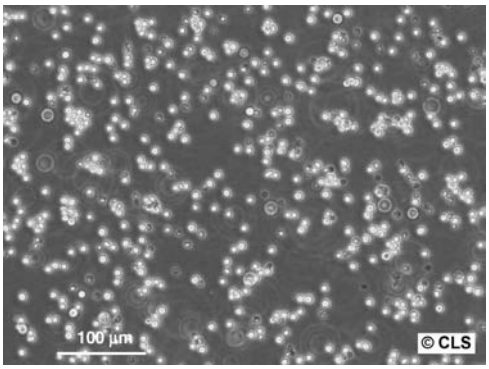
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

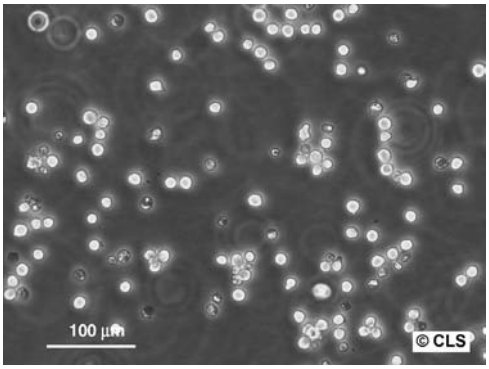
ATCC number: Not available
CLS number: 400294

Further Reading

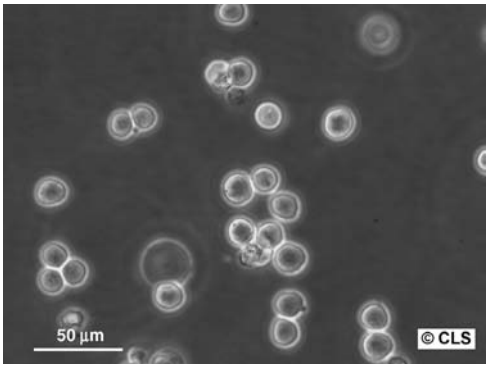
Scholz, K. *et al.* (1995) Differential expression of prostaglandin-H synthase isoenzymes in normal and activated keratinocytes *in vivo* and *in vitro*. *Biochem. J.*, **309** (Pt 1), 263–269.



NSF-60, 100× Leica.



NSF-60, 200× Leica.



NSF-62, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

NFS-60

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Tissue: Blood
Morphology: Lymphoblast
Cell type: Leukemia, myeloid
Growth properties: Suspension
Description: A murine myeloblastic cell line established from leukemic cells obtained after infection of (NFS X DBA/2) F1 adult mice with Cas Br-M murine leukemia virus. NFS-60 cells are dependent on IL3 for growth and maintenance of viability *in vitro*. These cells are used to assay murine and human G-CSF. This bipotential murine hematopoietic cell line is responsive to IL-3, GM-CSF, G-CSF, and erythropoietin

Culture Conditions and Handling

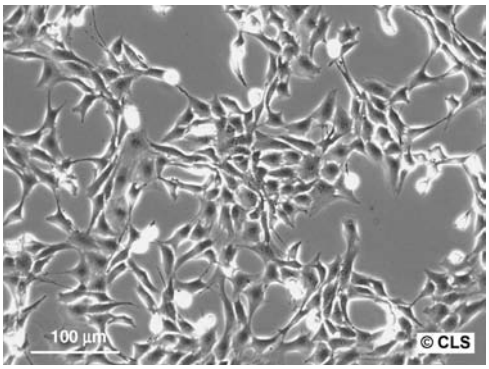
Culture medium: RPMI 1640 medium supplemented with 5.1 ml L-glutamine (200 mM), 1 mM Na-pyruvate, 10% fetal bovine serum and 33 IU/ml mIL-3. As source of cytokines, CLS-conditioned medium supplement (order-No. KMG-2), 1 ml/100 ml culture medium may be used as an alternative
Subculture routine: Subculture by transferring an appropriate amount of the cell suspension into new cell culture flasks already containing fresh cell culture media. Start cultures at 5×10^4 viable cells/ml
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

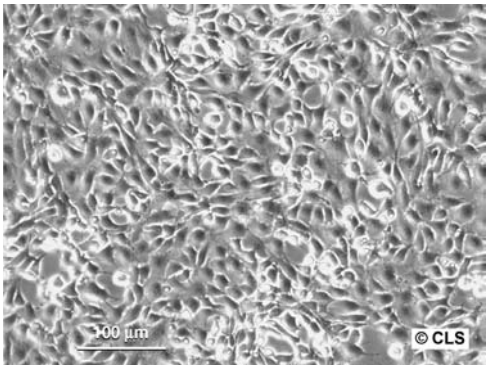
Species: Mouse origin was verified by the PCR technique using the Mouse cox I and Mouse J01420 primer
ATCC number: CRL-1838
CLS number: 400301

Further Reading

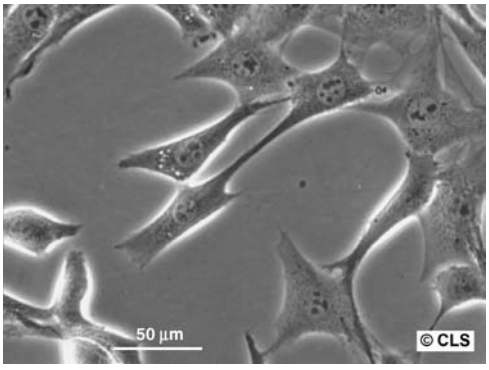
Weinstein, Y. *et al.* (1986) Truncation of the c-myb gene by a retroviral integration in an interleukin 3-dependent myeloid leukemia cell line. *Proc. Natl. Acad. Sci. USA*, **83**, 5010–5014.



NIH-3T3, 100× Leica.



NIH-3T3, 100× Leica.



NIH-3T3, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

NIH-3T3

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Embryo
Strain: NIH/Swiss
Tissue: Embryo
Morphology: Fibroblastoid
Cell type: Fibroblast
Growth properties: Monolayer
Description: These cells are useful for DNA transfection and transformation studies. Tested and found negative for MAP-test

Culture Conditions and Handling

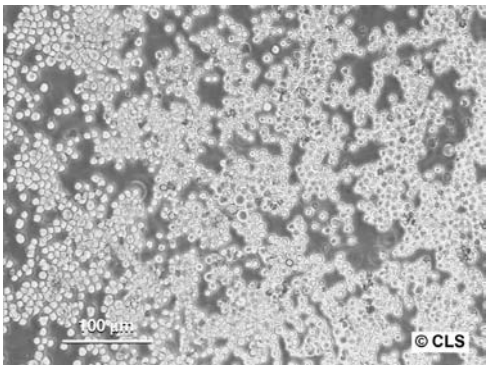
Culture medium: Minimum essential medium Eagle with Earle's BSS, supplemented with 2 mM L-glutamine, 0.1 mM nonessential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin in phosphate buffered saline for 3–5 min, remove trypsin and let the culture sit at 37 °C for 10–15 min. Add fresh medium, aspirate and dispense into new flasks. Do not allow the cells to become confluent, subculture once per week
Split ratio: For plates use an inoculum of 1000 to 10 000 cells per 100 mm dish
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

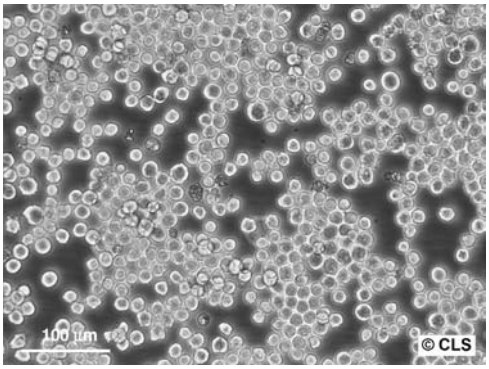
ATCC number: CRL-1658
CLS number: 400101

Further Reading

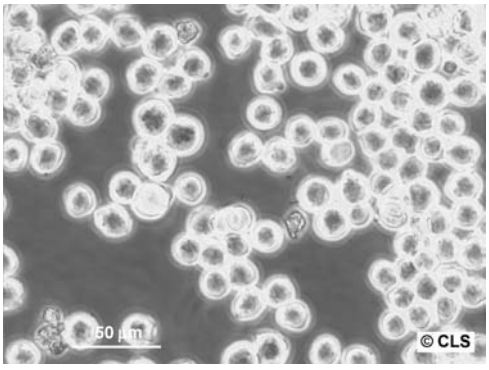
Jainchill, J.L. *et al.* (1969) Murine sarcoma and leukemia viruses: assay using clonal lines of contact-inhibited mouse cells. *J. Virol.*, **4**, 549–553.



P3X63Ag8.653, 100× Leica.



P3X63Ag8.653, 200× Leica.



P3X63Ag8.653, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

P3X63Ag8.653

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: BALB/c
Tissue: Plasmacytoma; B lymphoblast
Cell type: Myeloma
Morphology: Lymphoblast
Growth properties: Suspension/adherent
Description: The cells are resistant to 8-azaguanine and are HAT sensitive. They can be used as fusion partners for producing hybridomas. The cells do not secrete immunoglobulin. The cells have been reported to be cholesterol auxotroph due to a deficiency in 3-ketosteroid reductase activity

Culture Conditions and Handling

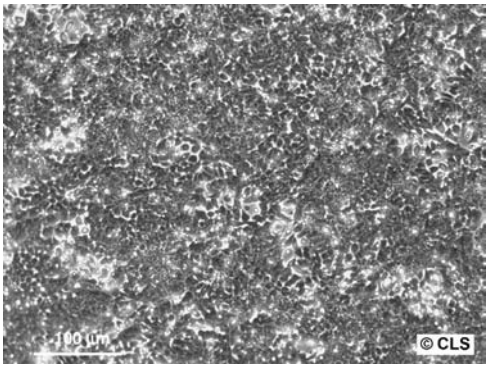
Culture medium: RPMI 1640 supplemented with L-glutamin and 10% FBS.
Subculture routine: Subculture by collecting any floating cells in a centrifuge tube. Any adherent cells can be loosened when applying 0.02% EDTA and short incubation at 37 °C. As alternative, Accutase may be applied for the smooth detachment within 5 min at 37 °C. Combine all cells, and start new cultures at 4×10^5 cells/ml. The cell density should not exceed 2×10^6 cells/ml
Fluid renewal: Every three to four days; collect floating cells, centrifuge and add to the flask together with fresh medium.
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

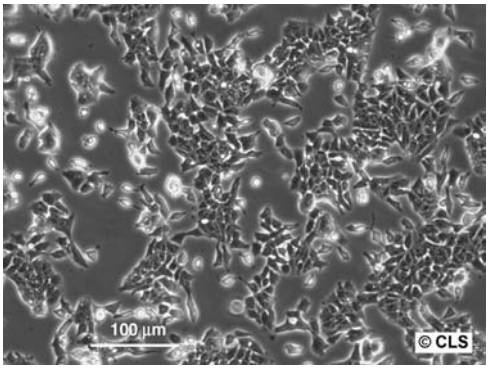
Species: Mouse origin was confirmed by Real-time PCR
Viruses: Tested negative for ectromelia virus (mouse pox)
ATCC number: CRL-1597
CLS number: 400118

Further Reading

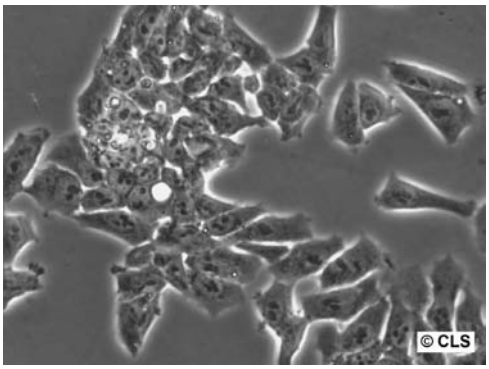
Kearney, J.F. *et al.* (1979) A new mouse myeloma cell line that has lost immunoglobulin expression but permits the construction of antibody-secreting hybrid cell lines. *J. Immunol.*, **123**, 1548–1550.



P-19, 100× Leica.



P-19, 100× Leica.



P-19, 400× Leica.

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P-19

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: C3H/He
Gender: Male
Tissue: Testicle
Morphology: Fibroblast
Cell type: Feratocarcinoma; embryonal carcinoma
Growth properties: Monolayer
Description: The P19 line was derived form an embryonal carcinoma induced in a C3H/He mouse. The line can be cloned at high efficiency in medium containing 0.1 mM 2-mercaptoethanol. The cells are pluripotential. The cell can be induced to differentiate into neural and glial like cells in the presence of 500 nM retinoic acid. In the presence of 0.5–1.0% dimethylsulfoxide (DMSO) the cells differentiate to form cardiac and skeletal muscle-like elements, but do not form neural or glial like cells. In the presence of both DMSO and retinoic acid, the cells differentiate as in the presence of retinoic acid alone

Culture Conditions and Handling

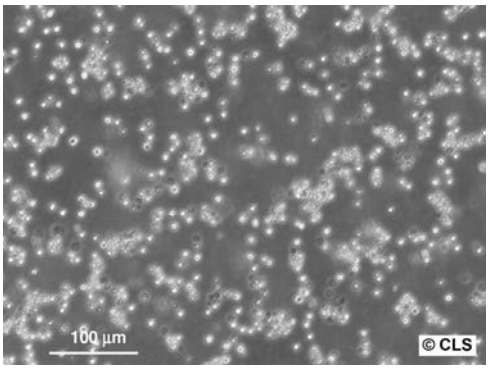
Culture medium: DMEM supplemented with L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse using 0.02% EDTA solution. Add fresh 0.025% trypsin/0.03% EDTA solution and incubate for 5 min at 37 °C. Resuspend the cells in the trypsin - EDTA solution with vigorous pipetting, and dispense the cells into new flasks containing culture media at 1×10^5 viable cells/ml. Do not allow the cells to get confluent
Split ratio: Subculture at 1 : 10 at least every 48 h
Fluid renewal: At least every 48 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

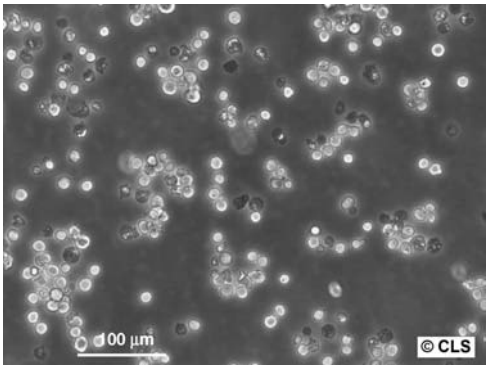
Species: Mouse origin was confirmed by Real-time PCR
Karyotype: $n = 40$; XY
ATCC number: Not available
CLS number: 400416

Further Reading

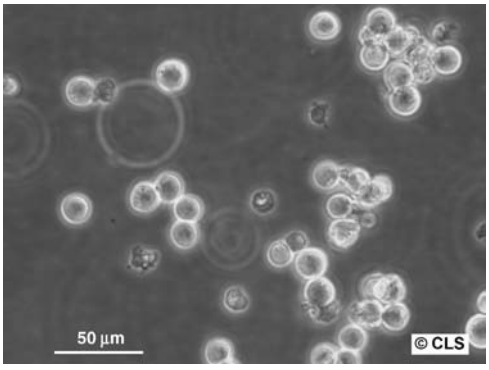
McBurney, M.W. *et al.* (1982) Isolation of male embryonal carcinoma cells and their chromosome replication patterns. *Dev. Biol.*, **89**, 503–508.



P388-D1, 100× Leica.



P388-D1, 200× Leica.



P388-D1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

P388-D1

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: DBA/2
Tissue: Lymphoid neoplasma
Morphology: Lymphoblast
Growth properties: Suspension
Description: A subclone of this line [P388 D1(IL-1)] produces high levels of interleukin-1 (IL-1).

Culture Conditions and Handling

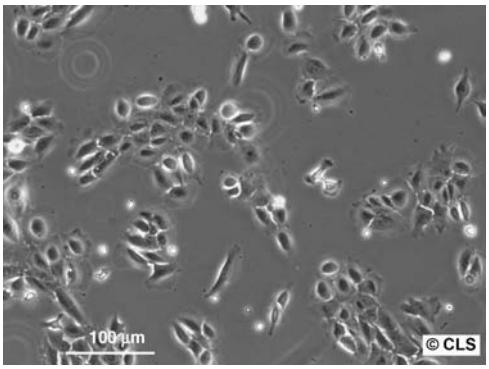
Culture medium: DMEM supplemented with 2 mM L-glutamine, 4.5 g/l glucose and 10% horse serum
Subculture routine: The optimum cell density is at about 6×10^5 cells/ml. Replace medium every other day
Split ratio: Subculture at 1×10^5 viable cells/ml
Doubling time: 10 to 12 h
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

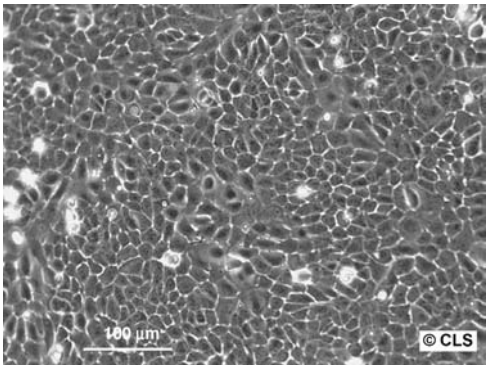
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes, in nude mice
Antigen expression: H-2d
Receptors expressed: Positive
Viruses: MAP-TEST negative: Sendai, Ektromelie (mousepox), Polyoma, K-Virus, Kilham, Reo 3, PVM, LCM, M.pulmonis, MVM, Theiler's GD VII, Toolan's H-1, MHV, LDV, RCV/SDA, M-Adenovirus, B. piliformis
CLS number: 400308

Further Reading

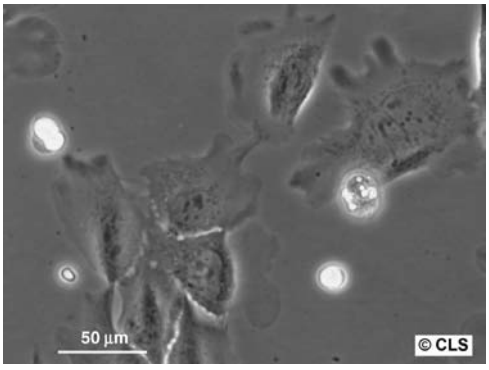
Bodel, P. (1978) Spontaneous pyrogen production by mouse histiocytic and myelomonocytic tumor cell lines *in vitro*. *J. Exp. Med.*, **147**, 1503–1516.



PDV, 100× Leica.



PDV, 100× Leica.



PDV, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

PDV

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: C3H mice
Cell type: Keratinocytes of neonatal C3H mice
Growth properties: Monolayer
Description: The PDV cell line was derived in normal serum medium after DMBA treatment of primary epidermal keratinocytes of neonatal C3H mice

Culture Conditions and Handling

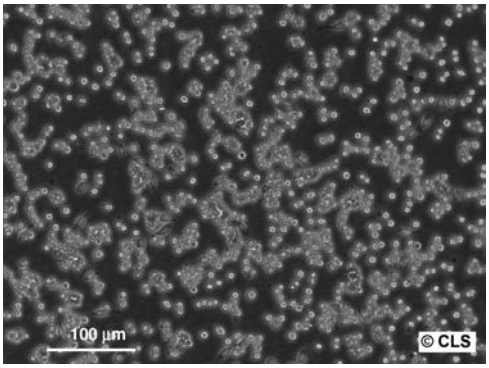
Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 2 mM L-glutamine, 1% nonessential amino acids and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add TrypLE Express and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

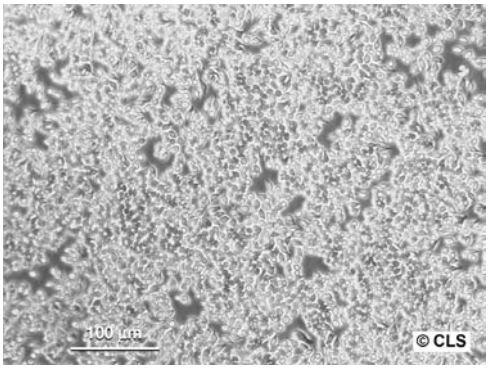
ATCC number: Not available
CLS number: 400314

Further Reading

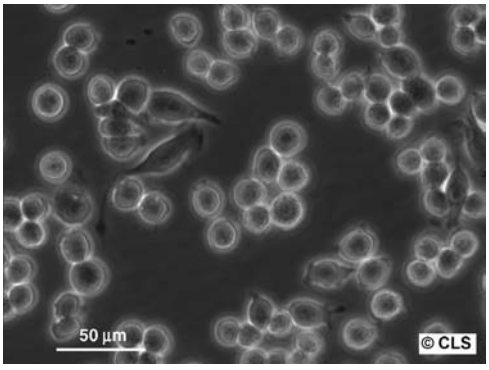
Fusenig, N.E. *et al.* (1983) Growth and differentiation characteristics of transformed keratinocytes from mouse and human skin *in vitro* and *in vivo*. *J. Invest. Dermatol.*, **81**, 168s–175s.



RAW-264.7, 100× Leica.



RAW-264.7, 100× Leica.



RAW-264.7, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RAW-264.7

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: BALB/c
Gender: Male
Tissue: Ascites
Cell type: Macrophage
Growth properties: Monolayer
Description: The RAW 264.7 cell line was established from a tumor induced by the Abelson murine leukemia virus. The cells will pinocytose neutral red and will phagocytose latex beads and zymosan. They are capable of antibody dependent lysis of sheep erythrocytes and tumor cell targets. LPS or PPD treatment for two days stimulates lysis of erythrocytes but not tumor cell targets. The cells do not produce detectable retrovirus

Culture Conditions and Handling

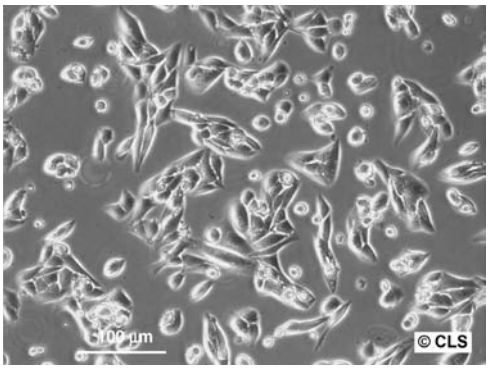
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS solution. Add Accutase, 2 ml into 25 cm^2 cell culture flasks, 4 ml into 75 cm^2 cell culture flasks, and incubate at 37 °C for 20–30 min. Detach remaining adherent cells by scraping with a rubber policeman or by knocking off of the bottom. Dispense the cells into new flasks containing cell culture medium. This method of detachment will result in 85–90% viable cells
Split ratio: A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: It is recommended to handle RAW-264.7 under BSL2. (Hartley *et al.*, 2008)

Special Features of the Cell Line and Recommended Use

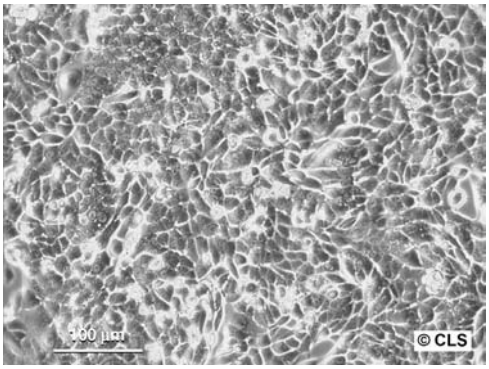
Species: Mouse origin was confirmed by Real-time PCR
Antigen Expression: H-2d
Immunology: Surface immunoglobulin (sIg), Ia and Thy-1.2 negative
Receptors expressed: Immunoglobulin (Fc); complement (C3)
Viruses: Negative for ectromelia virus (mousepox)
Products: Lysozyme
ATCC number: TIB-71
CLS number: 400319

Further Reading

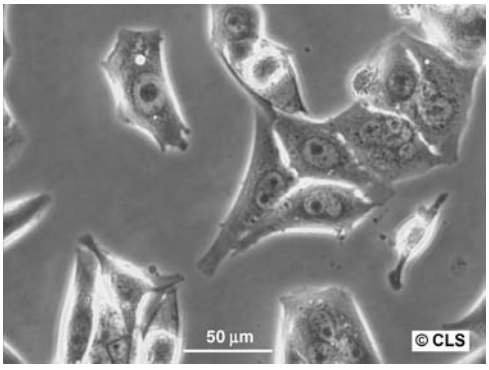
Ralph, P. *et al.* (1977) Antibody-dependent killing of erythrocyte and tumor targets by macrophage-related cell lines: enhancement by PPD and LPS. *J. Immunol.*, **119**, 950–954.
Raschke, W.C. *et al.* (1978) Functional macrophage cell lines transformed by Abelson leukemia virus. *Cell*, **15**, 261–267.
Hartley, J.W. *et al.* (2008) Expression of infectious murine leukemia viruses by RAW264.7 cells, a potential complication for studies with a widely used mouse macrophage cell line. *Retrovirology* **5,1**.



RenCa, 100× Leica.



RenCa, 100× Leica.



RenCa, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

RenCa

Origin and General Characteristics

Organism: *Mus musculus* (mouse), Balb/c
Tissue: Kidney
Cell type: Carcinoma
Growth properties: Monolayer
Description: The RenCa cell line has been established from the murine transplantable renal adenocarcinoma of spontaneous origin

Culture Conditions and Handling

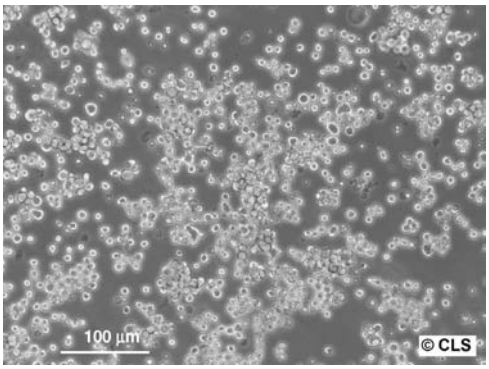
Culture medium: RPMI 1640 medium supplemented with 2 mM L-Glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 1–2 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every four to six days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

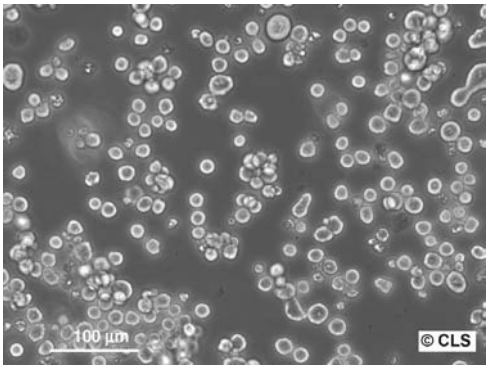
Species: Mouse origin was confirmed by Real-time PCR
Tumorigenic: Yes, in syngeneic mice
Virus susceptibility: MAP testing negative (Sendai, Ektromelie, Polyoma, K-Virus, Kilham, LCM, M.pulmonis, MVM, Theiler's GD VII, toolan's H-1, MHV, RCV/SDA, M-Adenovirus)
ATCC number: CRL-2947
CLS number: 400321

Further Reading

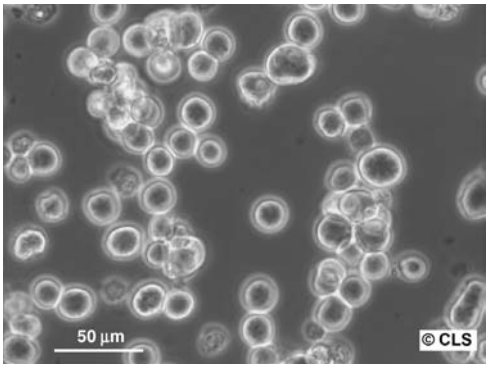
Murphy, G.P. *et al.* (1973) A murine renal cell carcinoma. *J. Natl. Cancer Inst.*, **50**, 1013.



Sp2/O-Ag14, 100× Leica.



Sp2/O-Ag14, 200× Leica.



Sp2/O-Ag14, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

Sp2/O-Ag14

Origin and General Characteristics

Organism: *Mus musculus* (mouse), Balb/c
Tissue: Hybridoma
Morphology: Lymphoblast
Cell type: B cell hybridoma
Growth properties: Suspension
Description: The line was formed by fusing Balb/c spleen cells (from mouse immunized with sheep RBCs) with the P3X63Ag8 myeloma cell line. The cells do not secrete immunoglobulin, are resistant to 8-azaguanine at 20 μg/ml and are HAT sensitive. Sp2/O-Ag14 cells can be used as fusion partners for B cells in the production of hybridomas

Culture Conditions and Handling

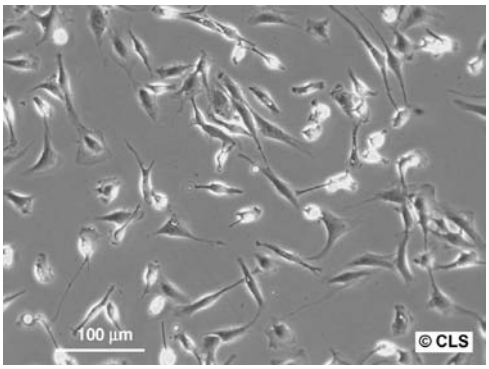
Culture medium: DMEM supplemented with 4 mM L-glutamine, 4.5 g/l glucose and 10% fetal bovine serum
Subculture routine: Maintain cell density between 5×10^4 and 5×10^5 viable cells/ml. Split by diluting one vol of cell suspension with the appropriate vol of fresh cell culture medium in new cell culture flasks
Fluid renewal: Replace spent medium every two to four days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

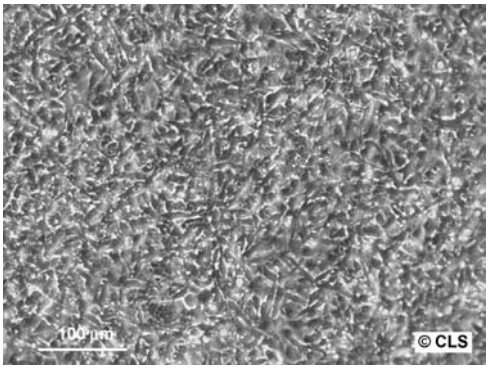
Antigen expression: H-2d
Viruses: Tested and found negative for ectromelia virus (mousepox)
ATCC number: CRL-1581
CLS number: 400481

Further Reading

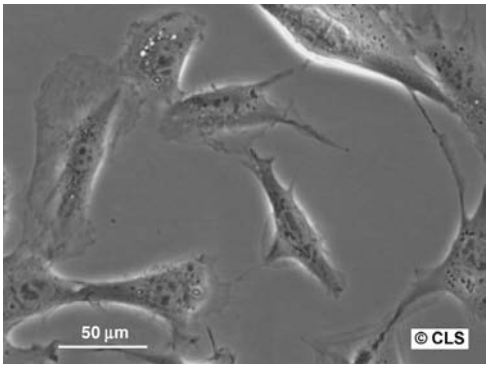
Shulman, M. *et al.* (1978) A better cell line for making hybridomas secreting specific antibodies. *Nature*, **276**, 269–270.



STO, 100× Leica.



STO, 100× Leica.



STO, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

STO

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Embryo
Tissue: Embryo
Morphology: Fibroblast
Growth properties: Adherent
Description: The line was derived from the SIM fibroblast line. Cells have been selected for 6-thioguanine and ouabain resistance. They are HGPRT- (HPRT-), and HAT sensitive. The line is used as feeder layers for teratocarcinoma cells and hybridomas

Culture Conditions and Handling

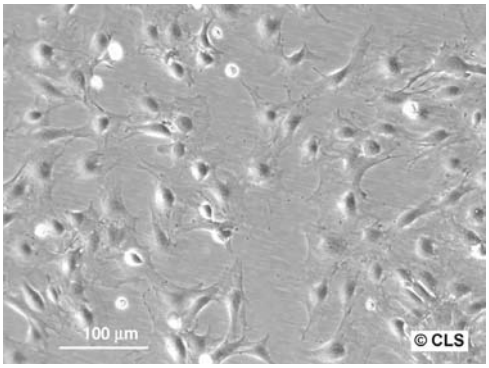
Culture medium: DMEM supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS w/o calcium and magnesium. Add fresh 0.025% trypsin/0.02% EDTA solution and incubate at room temperature until the cells detach. Add fresh medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 6 of sub-confluent cultures is recommended
Fluid renewal: Two to three times per week
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

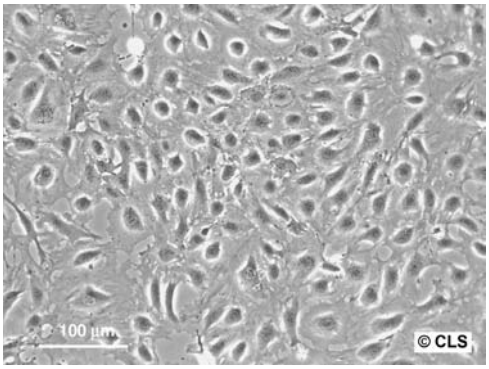
Species: Mouse origin was confirmed by Real-time PCR
Viruses: Tested and found negative for ectromelie virus (mousepox).
ATCC number: CRL-1503
CLS number: 400165

Further Reading

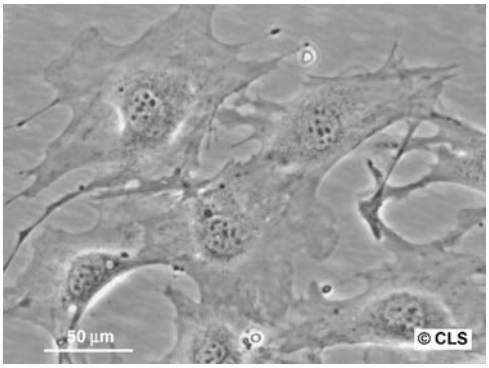
Martin, G.R. *et al.* (1975) Differentiation of clonal lines of teratocarcinoma cells: formation of embryoid bodies *in vitro*. *Proc. Natl. Acad. Sci. USA*, **72**, 1441–1445.



SVI, 100× Leica.



SVI, 100× Leica.



SVI, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

SVI

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Age/stage: Adult
Strain: Immorto-Mouse mice; H-2k^b-tsA58
Tissue: Kidney
Cell type: Podocyte
Growth properties: Monolayer
Description: The SVI cell line has been cloned from the outgrowth of glomeruli which were isolated from H-2k^b-tsA58 transgenic mice. The mice carry a temperature-sensitive variant of the SV40 large T antigen under control of the IFN-gamma-inducible H-2k^b promoter. Cells proliferate at 33 °C, and they differentiate at 38 °C. At present, the cells have been cultured successfully for more than 40 passages without noting phenotypic changes

Culture Conditions and Handling

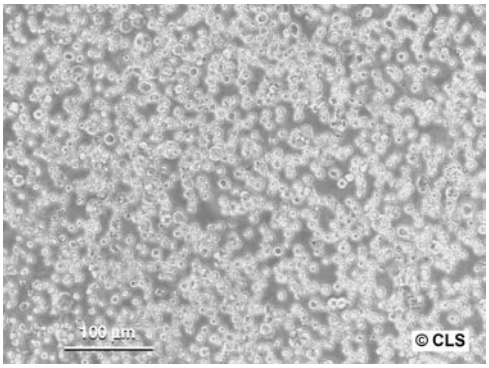
Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Split ratio: A ratio of 1 : 2 to 1 : 3 (38 °C) or 1 : 5 (33 °C) is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

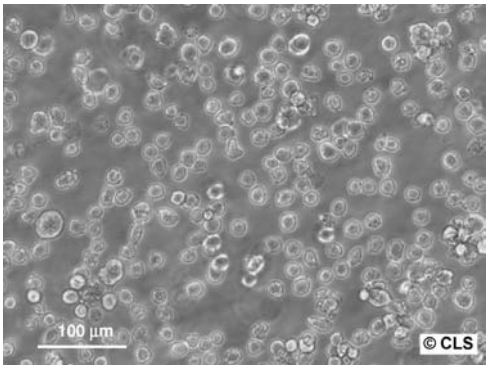
Species: Mouse origin was confirmed by Real-time PCR
Protein expression: WT-1, Lmx1b, nephrin, NEPHI, FAT, P-cadherin, CD2AP, ZO-I, podocalyxin, podoplanin
CLS number: 400495

Further Reading

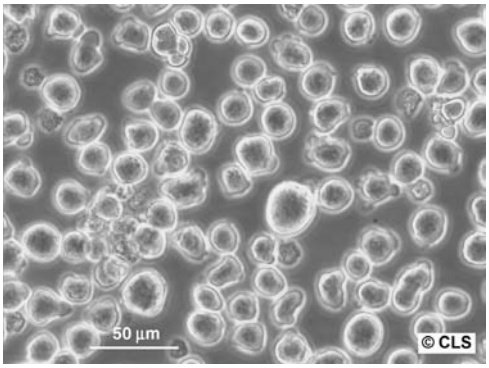
Schiwek, D. *et al.* (2004) Stable expression of nephrin and localization to cell-cell contacts in novel murine podocyte cell lines. *Kidney Int.*, **66**, 91–101.



WEHI-3b, 100× Leica.



WEHI-3b, 200× Leica.



WEHI-3b, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

WEHI-3b

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: BALB/c
Tissue: Blood, peripheral; leukemia
Cell type: Myelomonocyte; macrophage like
Morphology: Epithelial
Growth properties: Suspension (some adherent cells)
Description: The growth of WEHI-3 is inhibited by 4 ng/ml LPS and blocked by higher concentrations. Dextran sulfate at 30–40 ï¿½g/ml also inhibits growth. Latex beads are phagocytized but are not toxic. Zymosan and BCG are phagocytized and block growth. The cells exhibit only weak effector activity in antibody dependent cell mediated cytotoxicity

Culture Conditions and Handling

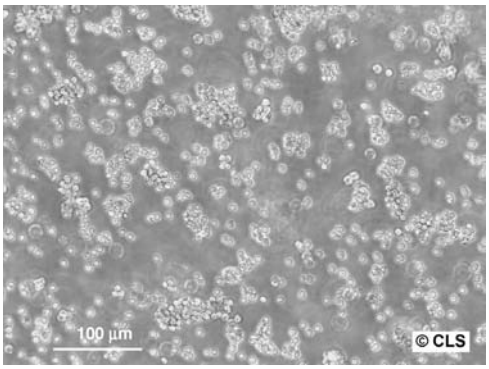
Culture medium: Iscove's modified Dulbecco's medium supplemented 2 mM L-glutamine, 0.05 mM 2-mercaptoethanol and 10% fetal bovine serum
Subculture routine: Start cultures at 2×10^5 cells/ml and maintain between 1×10^5 and 1×10^6 cells/ml. Adherent cells can be recovered by scraping. Replace spent medium by centrifuging the cell suspension, removing the supernatant and resuspending the cells in fresh cell culture medium. Subculture by diluting in fresh medium
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

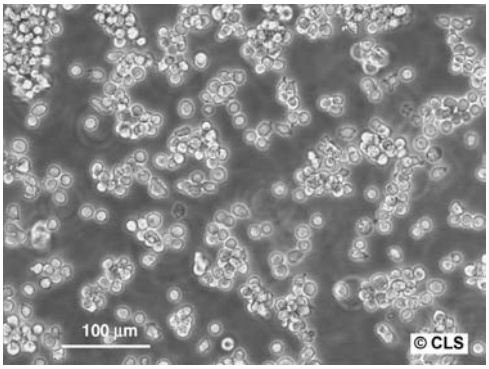
Species: Mouse origin was confirmed by Real-time PCR
Receptors expressed: Immunoglobulin (Fc); complement (C3)
Viruses: Ectromelia virus (mousepox) negative
Products: lysozyme; granulocyte colony stimulating activity (G-CSA); interleukin-3 (interleukin 3, IL-3)
ATCC number: TIB-68/WEHI-3) DSMZ: ACC 26
CLS number: 400376

Further Reading

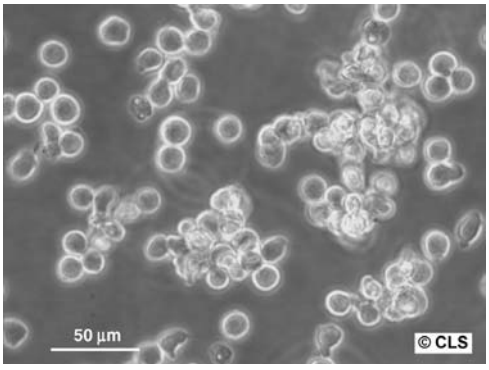
Ralph, P. *et al.* (1976) Lysozyme synthesis by established human and murine histiocytic lymphoma cell lines. *J. Exp. Med.*, **143**, 1528–1533.



YAC-1, 100× Leica.



YAC-1, 200× Leica.



YAC-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

YAC-1

Origin and General Characteristics

Organism: *Mus musculus* (mouse)
Strain: A/Sn
Tissue: Lymphoma
Cell type: Lymphoblast
Growth properties: Suspension
Description: Moloney murine leukemia virus (Mo-MuLV) induced lymphoma. The cells are sensitive to the action of natural killer (NK) cells and are useful in assays of NK cell activity

Culture Conditions and Handling

Culture medium: RPMI 1640 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Start cultures at 3×10^5 cells/ml and maintain between 2×10^5 and 2×10^6 cells/ml. Replace spent medium by centrifuging the cell suspension, removing the supernatant and resuspending the cells in fresh cell culture medium. Subculture by diluting in fresh medium
Fluid renewal: Every two to three days
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

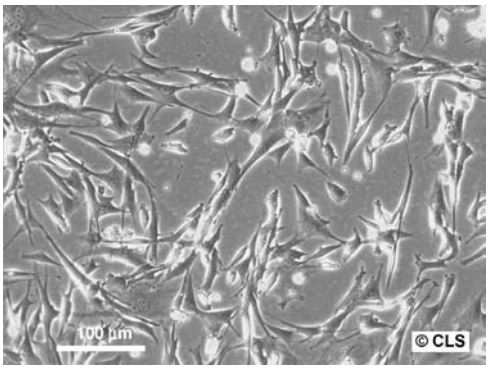
Species: Mouse origin was confirmed by Real-time PCR
ATCC number: TIB-160
CLS number: 400383

Further Reading

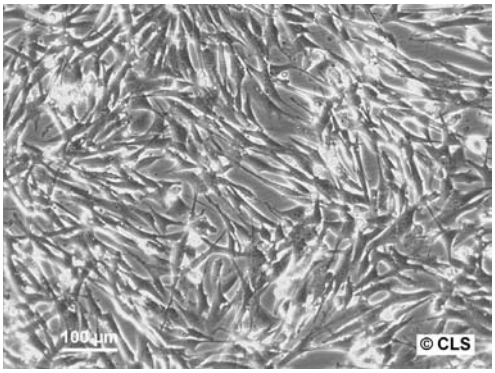
Cikes, M. *et al.* (1973) Progressive loss of H-2 antigens with concomitant increase of cell- surface antigen(s) determined by Moloney leukemia virus in cultured murine lymphomas. *J. Natl. Cancer Inst.*, **50**, 347–362.

4.2.3
Hamster

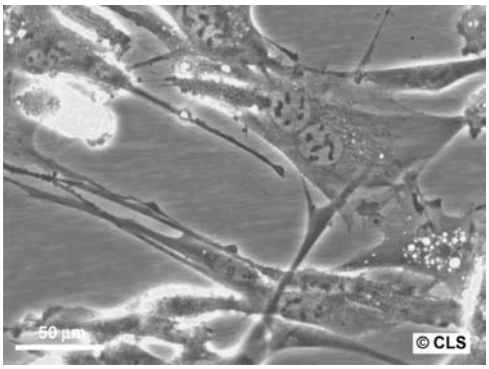
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



BHK-21, 100× Leica.



BHK-21, 100× Leica.



BHK-21, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

BHK-21

Origin and General Characteristics

Organism: *Mesocricetus auratus* (hamster, Syrian golden)
Age/stage: Newborn
Morphology: Fibroblastoid
Tissue: Kidney; normal
Cell type: Adherent

Culture Conditions and Handling

Culture medium: Minimum essential medium Eagle with Earle's BSS, supplemented with 2 mM L-glutamine, 0.1 mM nonessential amino acids, 1.0 mM sodium pyruvate and 10% fetal bovine serum
Subculture routine: Remove medium, add fresh 0.025% trypsin/0.02% EDTA solution for 2–4 min. Remove trypsin; allow culture to sit at room temperature for 10–15 min. Add fresh medium, resuspend the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 10 is recommended
Fluid renewal: One to two times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

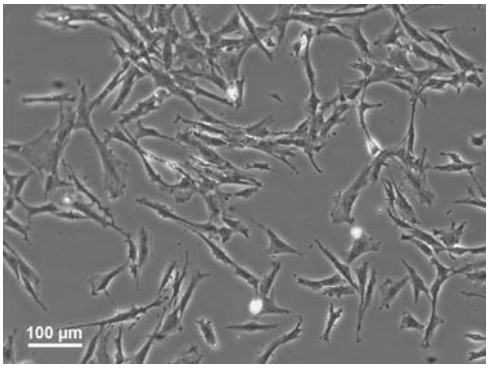
Reverse transcriptase: Negative
Virus resistance: Poliovirus 2
Virus susceptibility: Adenovirus 25; herpes simplex; reovirus 3; vesicular stomatitis (Indiana)
Applications: Transfection host
ATCC number: CCL-10
CLS number: 603126

Further Reading

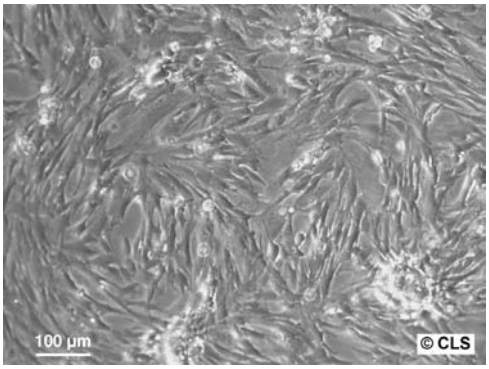
MacPherson, I. and Stoker, M. (1962) Polyoma transformation of hamster cell clones – an investigation of genetic factors affecting cell competence. *Virology*, **16**, 147–151.

4.2.4
Chicken

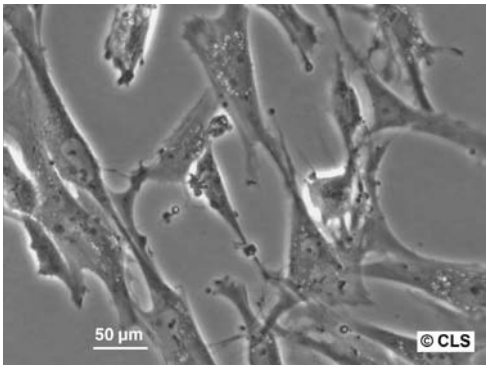
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



ECF-R, 100× Leica.



ECF-R, 100× Leica.



ECF-R, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

ECF-R

Origin and General Characteristics

Organism: *Gallus gallus* (chicken)
Age/stage: Embryo; 11 days gestation
Tissue: Embryo
Morphology: Fibroblastoid
Cell type: Fibroblast, embryo
Growth properties: Adherent
Description: The cells have a life expectancy of 50–60 population doublings. (FAT) 7 porcine and 8 bovine virus negative.

Culture Conditions and Handling

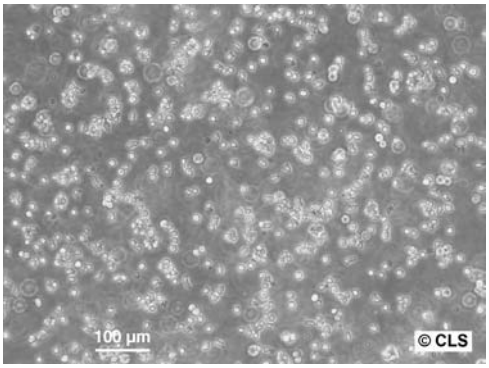
Culture medium: Ham's F12 medium supplemented with 0,1% ECGS and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with PBS free of calcium/magnesium. Add Accutase and incubate for 10 minutes at 37 °C. Control detachment by microscopic observation. Carefully resuspend the cells and dispense into new flasks. A standard trypsinisation protocol may be used
Fluid renewal: Two to three times per week
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

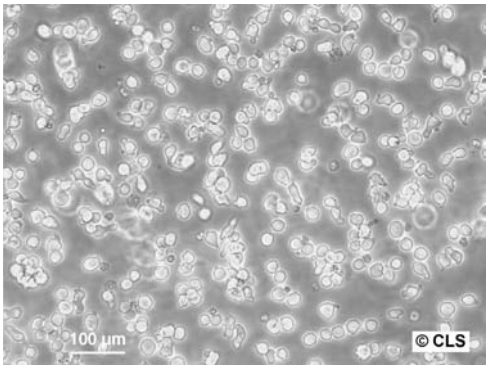
Species: Chicken origin was confirmed by Real-time PCR
Tumorigenic: No
Applications: Transfection host
ATCC number: Not available
CLS number: 601469

Further Reading

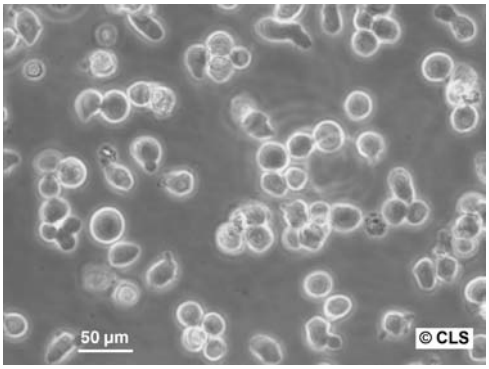
Holeckova, E. and Cristofalo, V.J. (eds) (1970) *Aging in Cell and Tissue Cultures*, Plenum Press, New York, pp. 7–24.



MDCC-MSB1, 100× Leica.



MDCC-MSB1, 200× Leica.



MDCC-MSB1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MDCC-MSB1

Origin and General Characteristics

Organism: *Gallus gallus* (chicken)
Morphology: Round cells
Cell type: Lymphoblast
Growth properties: Suspension

Culture Conditions and Handling

Culture medium: RPMI 1640 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Establish new cultures at 3×10^5 viable cells/ml. Maintain the cell density between 1×10^5 and 1×10^6 cells/ml by transferring an appropriate amount of cell suspension into a new cell culture flask refilled with fresh cell culture medium.
Fluid renewal: Renew medium by centrifuging the cell suspension, remove the medium and re-suspend in fresh medium every two to three days depending on cell density.
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

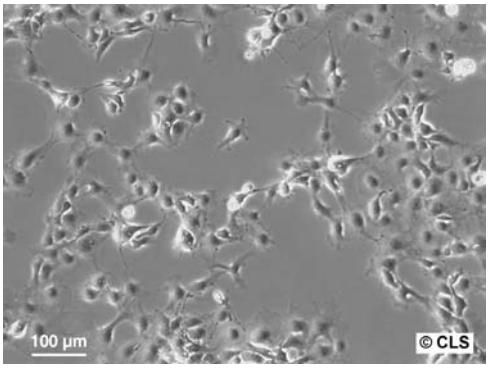
Species: Chicken origin was confirmed by Real-time PCR
ATCC number: Not available
CLS number: 601413

Further Reading

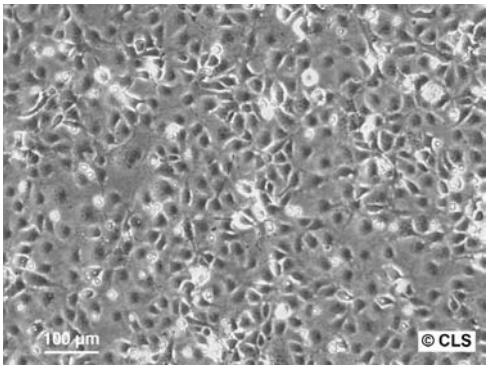
Coleman, R.M. *et al.* (1980) Independence of chicken major histocompatibility antigens and tumor-associated antigen on the surface of herpesvirus-induced lymphoma cells. *Infect. Immun.*, **29**, 1067–1072.

4.2.5
Monkey

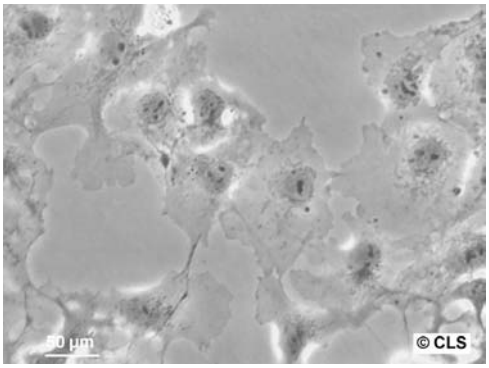
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



COS-7, 100× Leica.



COS-7, 100× Leica.



COS-7, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

COS-7

Origin and General Characteristics

Organism: *Cercopithecus aethiops* (monkey, African green)
Tissue: Kidney; SV40 transformed
Cell type: Fibroblast
Morphology: Fibroblast
Growth properties: Monolayer
Description: The African green monkey kidney fibroblast-like cell line has been established from CV-1 cells which have been transformed by an origin-defective mutant of SV40 coding for wild-type T antigen. This line contains T antigen, retains complete permissiveness for lytic growth of SV40, supports the replication of ts A209 virus at 40 °C, and supports the replication of pure populations of SV40 mutants with deletions in the early region

Culture Conditions and Handling

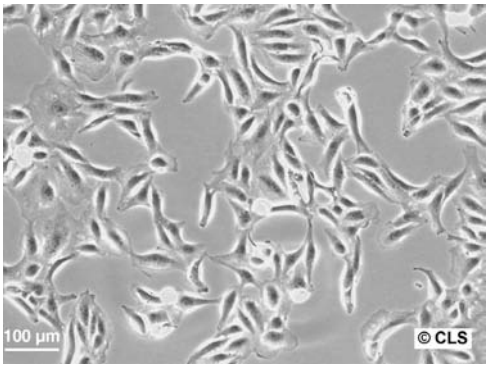
Culture medium: DMEM:Ham's F12 supplemented with 4 mM L-glutamine and 5–10% fetal bovine serum
Subculture routine: Remove medium and rinse with fresh 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA solution and let the culture sit at 37 °C until the cells detach (about 3–5 min). Add fresh medium, resuspend, remove trypsin by centrifugation, and dispense into new flasks
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: According to the GenTSV Section 5 Abs. 2 i.V.m.Anhang Teil B, Teil A II, and the statement of the ZKBS (Central committee for Biological Safety, Germany), the cell line COS-7 is categorized to Biosafety level 1. The COS-7 cell line corresponds to established monkey cells, which contain defective viral genomes but do not release infectious virus particles to the environment. http://194.95.226.234/GENTEC/ZKBS/ALLGSTELL/90_93/COS.HTM

Special Features of the Cell Line and Recommended Use

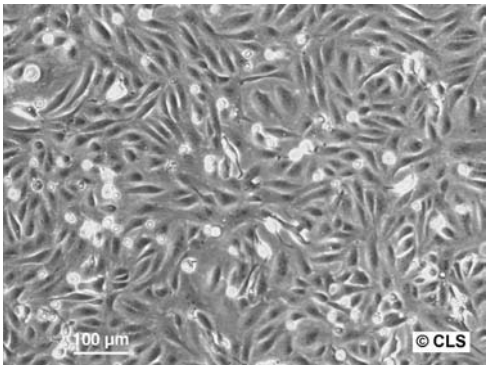
Species: Monkey origin was confirmed by Real-time PCR
Virus susceptibility: SV40 (lytic growth); SV40 tsA209 at 40 °C; SV40 mutants with deletions in the early region
Applications: Transfection host. Suitable for transfection by vectors requiring expression of SV40 T antigen.
Products: T antigen
ATCC number: CRL-1651
CLS number: 605470

Further Reading

Gluzman, Y. (1981) SV40-transformed simian cells support the replication of early SV40 mutants. *Cell*, **23**, 175–182.



CV-1, 100× Leica.



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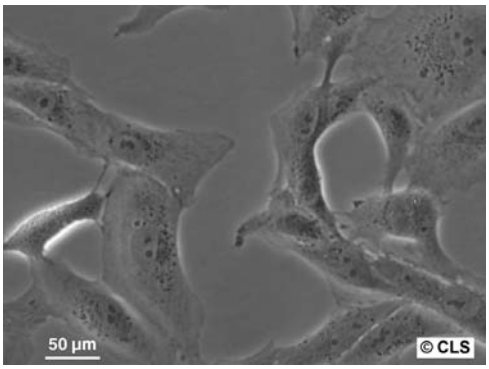


CV-1, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

CV-1

Origin and General Characteristics

Organism:	*Cercopithecus aethiops* (monkey, African green)
Age/stage:	141 days
Gender:	Male
Tissue:	Kidney, normal
Cell type:	Fibroblast
Growth properties:	Monolayer
Description:	Derived from the kidney of male adult African green monkey

Culture Conditions and Handling

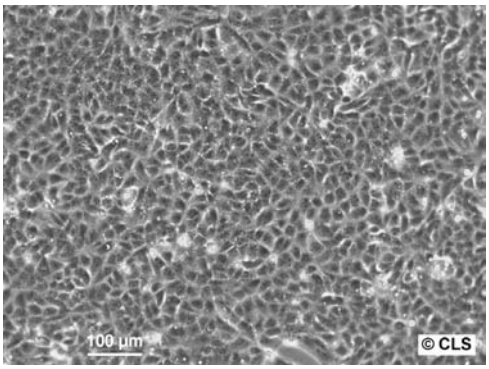
Culture medium:	Minimum essential medium Eagle with 2 mM L-glutamine and Earle's BSS adjusted to contain 1.5 g/l sodium bicarbonate, 0.1 mM nonessential amino acids, and 1.0 mM sodium pyruvate, 90%; fetal bovine serum, 10%
Subculture routine:	Remove medium, add fresh 0.025% trypsin solution for 2–3 min, remove trypsin, and let culture stand for 5–10 min at room temperature. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

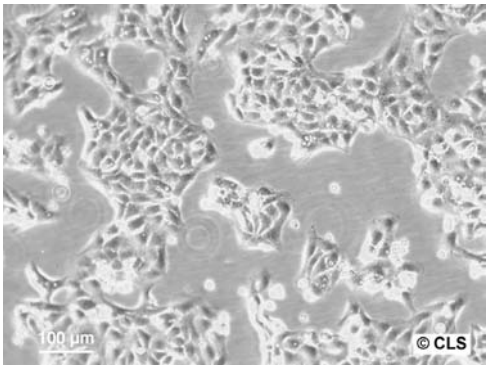
Species:	Monkey origin was confirmed by Real-time PCR
Reverse transcriptase:	Negative
Virus susceptibility:	Poliovirus 1; herpes simplex; Eastern equine encephalitis; Western equine encephalitis; California encephalitis; SV40
Applications:	Suitable host for transfection, especially by SV40 vectors
ATCC number:	CCL-70
CLS number:	605229

Further Reading

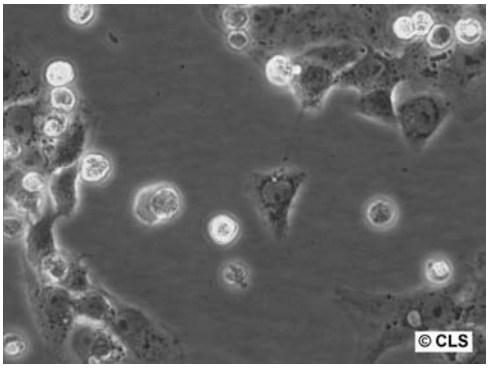
Jensen, F.C. *et al*. (1964) Infection of human and simian tissue cultures with rous sarcoma virus. *Proc. Natl. Acad. Sci. U S A.*, **52**, 53–59.



VERO, 100× Leica.



VERO, 100× Leica.



VERO, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

VERO

Origin and General Characteristics

Organism: *Cercopithecus aethiops* (monkey, African green)
Age/stage: Adult
Tissue: Kidney, normal
Morphology: Epithelial
Growth properties: Monolayer Established from the kidney of a normal adult African Green monkey. Susceptible to a wide range of viruses including polio, rubella, arboviruses and reoviruses. The Vero cell line was initiated from the kidney of a normal adult African green monkey on March 27, 1962, by Y. Yasumura and Y. Kawakita at the Chiba University in Chiba, Japan. ZKBS Germany-http://www.bvl.bund.de

Culture Conditions and Handling

Culture medium: DMEM: Ham's F12 supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 6 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

Species Monkey origin was confirmed by Real-time PCR
Reverse transcriptase: Negative
Viruses: Verotoxin detection of virus in ground beef
Virus resistance: Stratford; Apeu; Caraparu; Madrid; Nepuyo; Ossa
Virus susceptibility: Poliovirus 1, 2, 3; Getah; Ndumu; Pixuna; Ross River; Semliki Forest; Paramaribo; Kokobera; Modoc; Murutucu; Germiston; Guaroa; Pongola; Tacaribe; SV-5; SV40; rubeola; rubellavirus; reovirus 1, 2, 3; simian adenoviruses
Applications: Transfection host
ATCC number: CCL-81
CLS number: 605372

Further Reading

Sasaki, K. *et al.* (1964) Studies on measles virus. II. Propagation in two established simian renal cell lines and development of a plaque assay. *Kitasato Arch. Exp. Med.*, **37**, 27–42.

4.2.6
Pig

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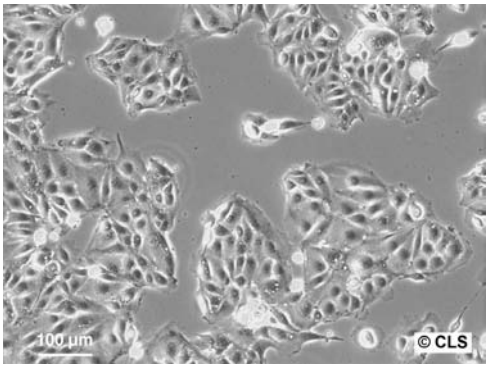
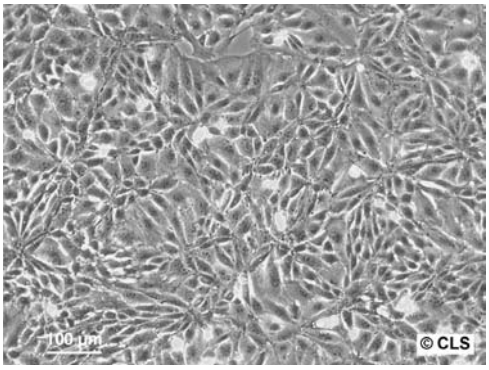
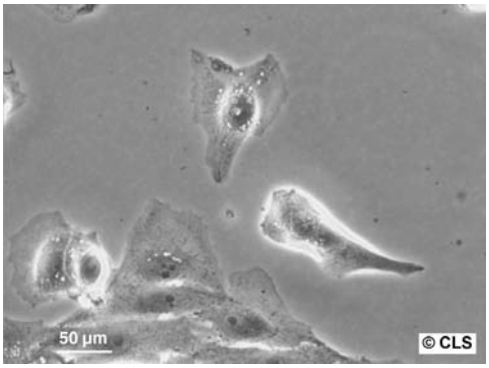


LLC-PK1, 100× Leica.



LLC-PK1, 100× Leica.



LLC-PK1, 400× Leica.

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LLC-PK1

Origin and General Characteristics

Organism:	*Sus scrofa* (pig)
Synonym(s):	Swine
Age/stage:	Three to four weeks
Strain:	Hampshire
Gender:	Male
Tissue:	Kidney
Morphology:	Epithelial
Cell type:	Normal

Culture Conditions and Handling

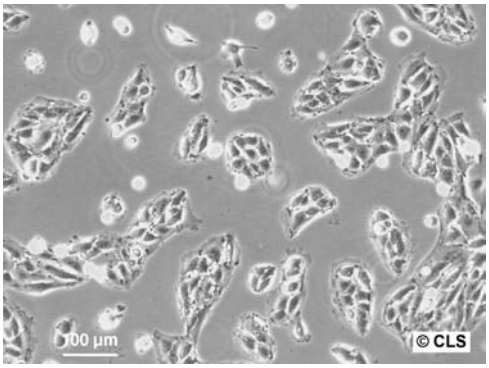
Culture medium:	DMEM:Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.025% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio:	A ratio of 1 : 3 to 1 : 8 is recommended
Fluid renewal:	Twice weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

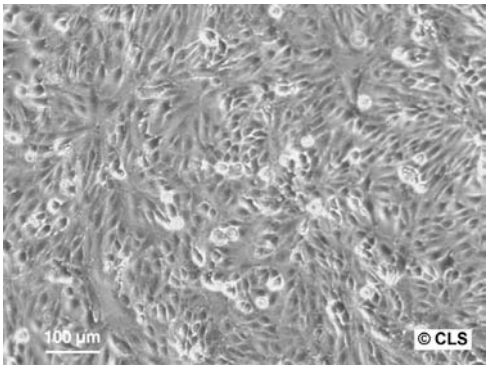
Species:	Pig origin was confirmed by Real-time PCR
Products:	Plasminogen activator
ATCC number:	CL-101
CLS number:	607264

Further Reading

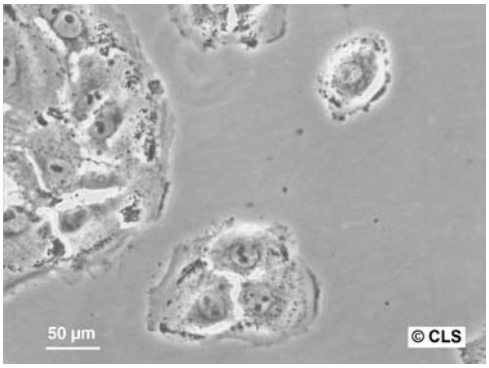
Hull, R.N. *et al.* (1976) The origin and characteristics of a pig kidney cell strain, LLC-PK. *In Vitro*, **12**, 670–677.



PK-15, 100× Leica.



PK-15, 100× Leica.



PK-15, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

PK-15

Origin and General Characteristics

Organism: *Sus scrofa* (pig)
Synonym(s): Swine
Age/stage: Adult
Tissue: Kidney, normal
Morphology: Epithelial
Growth properties: Monolayer
Description: The cells are positive for porcine circovirus (PCV) antigens. The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

Culture medium: Minimum essential medium (Eagle) in Earle's BSS supplemented with 0.1 mM non-essential amino acids, 1.0 mM sodium pyruvate, and 10% fetal bovine serum
Subculture routine: Rinse the cell sheet twice with fresh 0.025% trypsin/0.02% EDTA solution, remove trypsin and incubate at 37°C until the cells detach. Add fresh medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

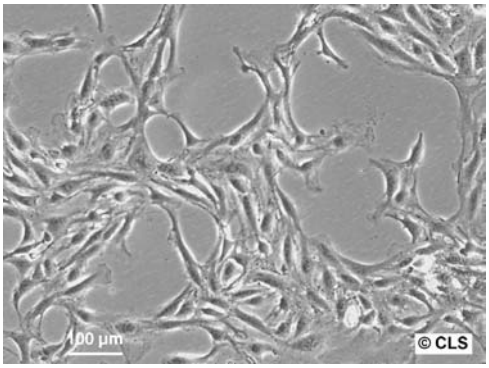
Species: Pig origin was confirmed by Real-time PCR
Reverse transcriptase: Positive
Virus resistance: Poliovirus 2
Virus susceptibility: Hog cholera; African swine fever; vesicular exanthema of swine; foot and mouth disease (FMDV); vesicular stomatitis (Indiana); vaccinia; reovirus 2, 3; adenovirus 4, 5; coxsackievirus B2, B3, B4, B5, B6
Products: Plasminogen activator; keratin
ATCC number: CCL-33
CLS number: 607426

Further Reading

Pirtle, E.C. (1966) Variation in the modal chromosome number of two PK-15 porcine kidney cell lines. *Am. J. Vet. Res.*, **27**, 747–749.

4.2.7
Opossum

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



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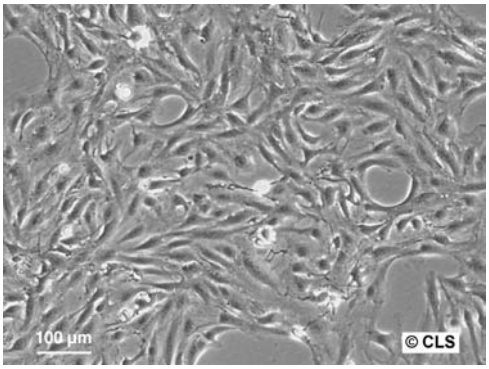

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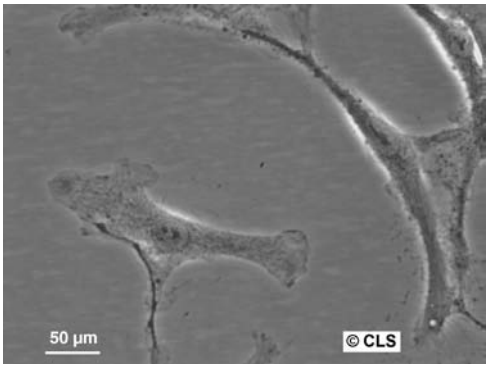


OK, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

OK

Origin and General Characteristics

Organism:	*Didelphis marsupialis virginiana* (opossum)
Age/stage:	Adult
Gender:	Female
Tissue:	Kidney, cortex
Morphology:	Epithelial
Cell type:	Proximal tubule; normal
Growth properties:	Monolayer

Culture Conditions and Handling

Culture medium:	Minimum essential medium (Eagle) with Earle's BSS supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine:	Remove medium, add fresh 0.025% trypsin, 0.03% EDTA solution for 2 min, rinse and remove. Incubate the flask at 37 °C until the cells detach (approximately 5 min). Add fresh medium, aspirate and dispense into new flasks
Split ratio:	A split ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

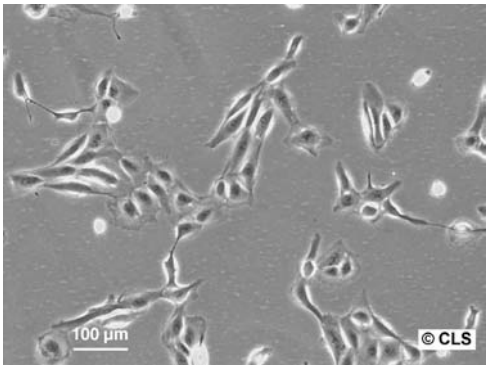
Species:	Opossum origin was confirmed by Real-time PCR
Tumorigenic:	No
Receptors expressed:	Alpha 2-adrenergic; serotonin; parathyroid hormone; atrial natriuretic factor
CLS number:	606465

Further Reading

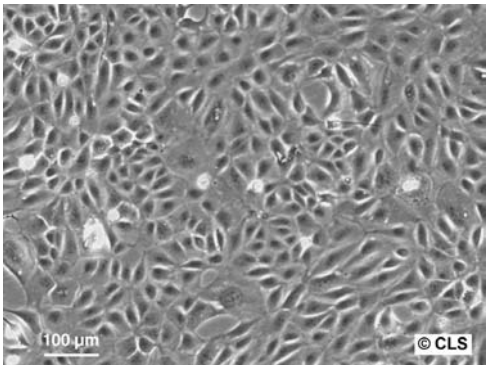
Koyama, H. *et al.* (1978) Establishment and characterization of a cell line from the American opossum (Didelphys virginiana). *In Vitro*, **14**, 239–246.

4.2.8
Potoroo

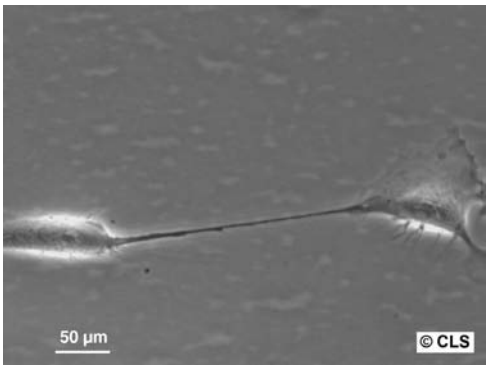
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



PtK-1 (NBL-3), 100× Leica.



PtK-1 (NBL-3), 100× Leica.



PtK-1 (NBL-3), 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

PtK-1 (NBL-3)

Origin and General Characteristics

Organism: *Potorous tridactylis* (potoroo)
Synonym(s): Rat kangaroo
Age/stage: Adult
Gender: Female
Tissue: Kidney, normal
Morphology: Epithelial
Growth properties: Monolayer
Description: The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

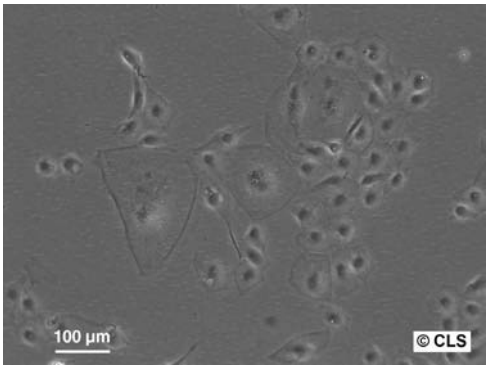
Culture medium: Minimum essential medium (Eagle) in Earle's BSS with non-essential amino acids and 1 mM sodium pyruvate, 90%; newborn bovine calf serum, 10%
Subculture routine: Rinse cell sheet twice with 0.025% trypsin, 0.03% EDTA (or Alsever's Trypsin Versene) solution, remove the trypsin solution, and allow the culture to stand for 5–10 min at room temperature. Add fresh medium, aspirate, and dispense into new flasks.
Split ratio: A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal: Twice per week
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

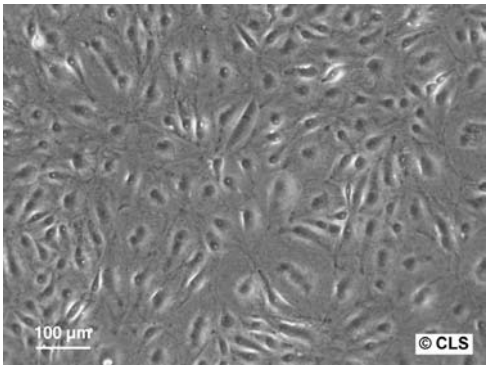
Species: Potoroo origin was confirmed by Real-time PCR
Reverse transcriptase: Negative
Virus resistance: Poliovirus 2
Virus susceptibility: *Vesicular stomatitis* (Indiana)
Products: Keratin
CLS number: 608393

Further Reading

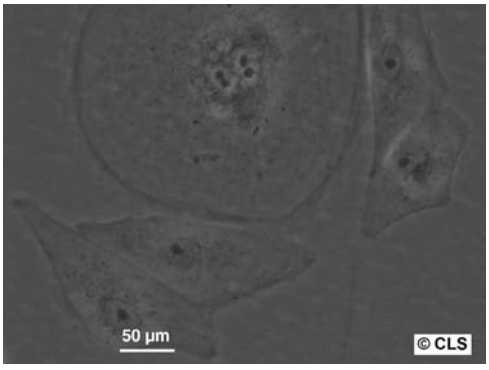
Walen, K.H. *et al.* (1962) Chromosomes in a marsupial (Potorous tridactylis) tissue culture. *Nature*, **194**, 406.



PtK-2, 100× Leica.



PtK-2, 100× Leica.



PtK-2, 400× Leica.

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PtK-2 (NBL-5)

Origin and General Characteristics

Organism:	*Potorous tridactylis* (potoroo)
Synonym(s):	Kangaroo rat
Age/stage:	Adult
Gender:	Male
Tissue:	Kidney, normal
Morphology:	Epithelial
Growth properties:	Monolayer, adherent
Description:	The cells are positive for keratin by immunoperoxidase staining

Culture Conditions and Handling

Culture medium:	Minimum essential medium (Eagle) in reduced bicarbonate (0.85 g/l) Earle's BSS with nonessential amino acids, 90%; fetal bovine serum, 10%
Subculture routine:	Rinse cell sheet two times with ATV solution. Remove old medium, let stand at room temperature for 5–10 min. Add fresh medium, aspirate, and dispense into new flasks
Split ratio:	A ratio of 1 : 2 to 1 : 3 is recommended
Fluid renewal:	Two to three times weekly
Biosafety level:	1

Special Features of the Cell Line and Recommended Use

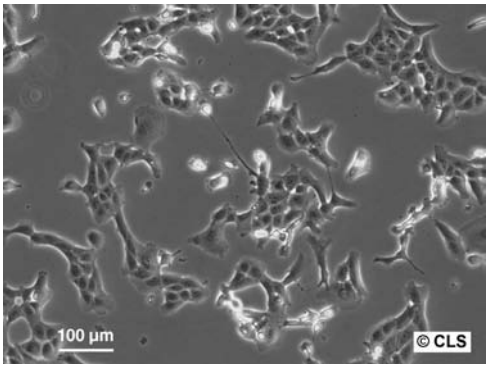
Species:	Potoroo origin was confirmed by Real-time PCR
Reverse transcriptase:	Negative
Virus resistance:	Adenovirus 5; coxsackievirus B5; poliovirus 2
Virus susceptibility:	Coxsackievirus A9; herpes simplex; vaccinia; vesicular stomatitis (Ogden)
Products:	Keratin
CLS number:	608316

Further Reading

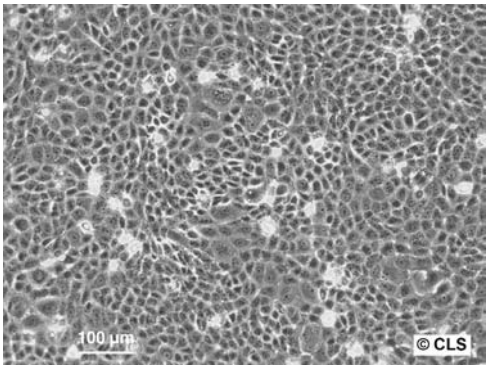
Walen, K.H. (1965) Spatial relationships in the replication of chromosomal DNA. *Genetics*, **51**, 915–929.

4.2.9
Bovine

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



BFA, 100× Leica.



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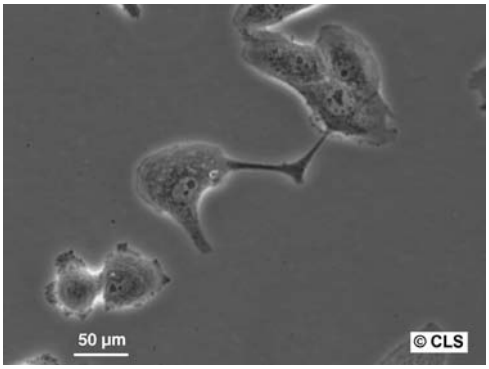

BFA, 400× Leica.

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BFA

Origin and General Characteristics

Organism: Bovine
Tissue: Bovine aorta endothelium, fetal
Morphology: Endothelial
Growth properties: Monolayer
Description: Derived from a bovine fetus. The cells have not been tested for BVDV

Culture Conditions and Handling

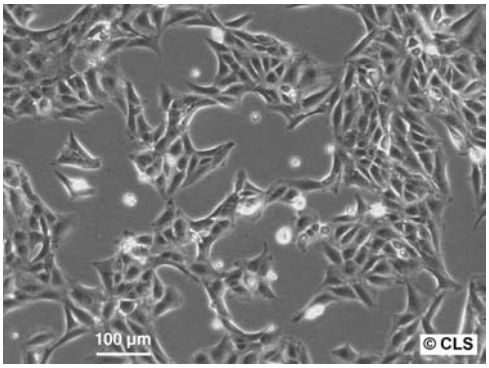
Culture medium: Ham's F12 medium supplemented with 2 mM L-glutamine and 10% fetal bovine serum
Subculture routine: Remove medium, rinse with calcium and magnesium free PBS, add fresh 0.025% trypsin solution for 3–5 min at room temperature until the cells detach. Add fresh medium, aspirate and dispense into new flasks. Subculture every three to five days
Split ratio: A ratio of 1 : 4 to 1 : 8 is recommended
Fluid renewal: Two to three times weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

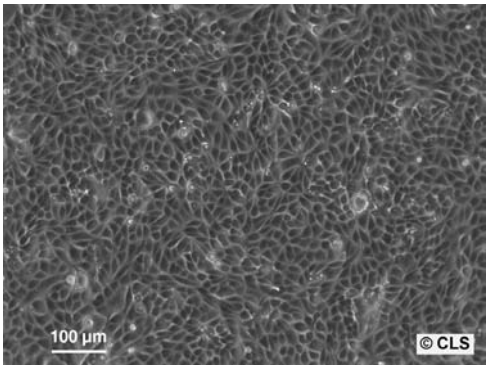
Tumorigenic: No
Products: Collagen type 3
ATCC number: Not available
CLS number: 600124

4.2.10
Dog

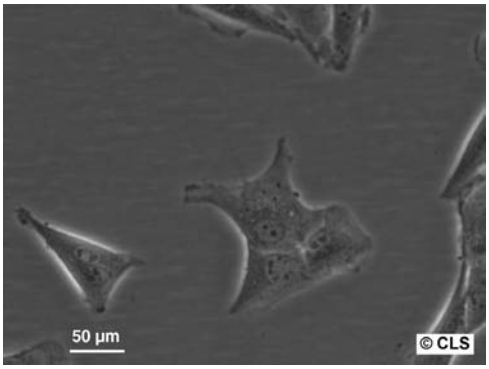
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



MDCK, 100× Leica_P23.



MDCK, 100× Leica_P25.



MDCK, 400× Leica_P23.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

MDCK

Origin and General Characteristics

Organism: *Canis familiaris* (dog)
Strain: Cocker spaniel
Synonym(s): Canine
Gender: Female
Age/stage: Adult
Tissue: Kidney, normal
Cell type: Carcinoma
Morphology: Epithelial
Growth properties: Monolayer
Description: The cells are positive for keratin by immunoperoxidase staining. MDCK cells have been used to study processing of beta amyloid precursor protein and sorting of its proteolytic products

Culture Conditions and Handling

Culture medium: DMEM:F12 supplemented with 2 mM L-glutamine and 5% fetal bovine serum
Subculture routine: Remove medium and rinse with 0.02% EDTA solution. Add fresh 0.25% trypsin/0.02% EDTA and incubate at 37 °C until cells detach. Add culture medium, collect the cells and dispense into new flasks
Split ratio: A ratio of 1 : 2 to 1 : 4 is recommended
Fluid renewal: Twice weekly
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

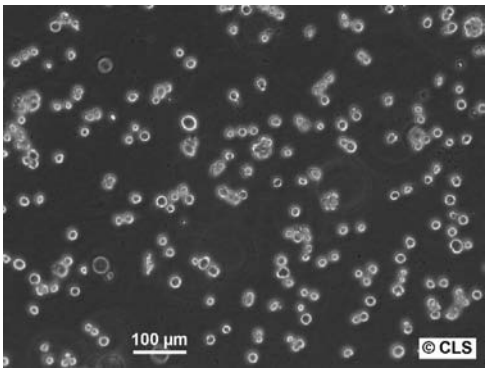
Reverse transcriptase: Negative
Virus resistance: Poliovirus 2; coxsackievirus B3, B4
Virus susceptibility: Vesicular stomatitis (Indiana); vaccine; coxsackie virus B5; reovirus 2, 3; adenovirus 4, 5; vesicular exanthema of swine; infectious canine hepatitis
Products: Keratin
ATCC number: CCL-34
CLS number: 602280

Further Reading

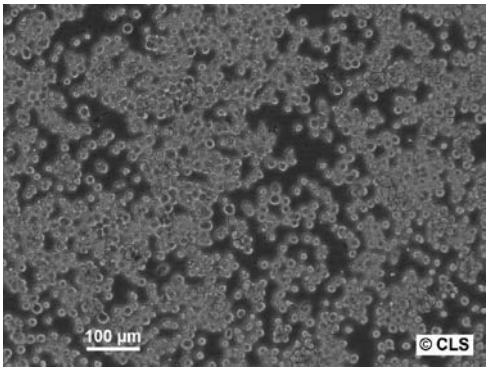
Gaush, C.R. *et al.* (1966) Characterization of an established line of canine kidney cells (MDCK). *Proc. Soc. Exp. Biol. Med.*, **122**, 931–935.

4.2.11
Insect

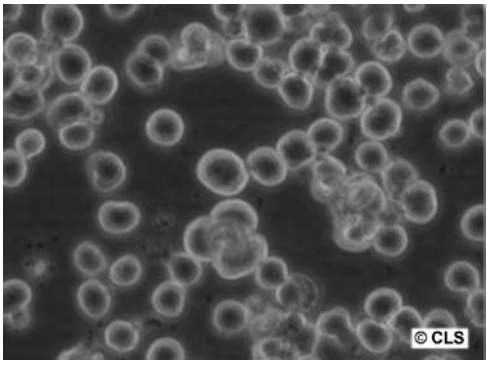
Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.



SF-9, 100× Leica.



SF-9, 100× Leica.



SF-9, 400× Leica.

Atlas of Living Cell Cultures, First Edition. Toni Lindl and Rosemarie Steubing.

SF-9

Origin and General Characteristics

Organism: *Spodoptera frugiperda* (fall armyworm)
Age: Pupa
Gender: Female
Tissue: Ovary
Morphology: Epithelial
Growth properties: Adherent
Description: This line can be used to replicate baculovirus expression vectors. For long-term culture, it is important to use the medium described below. Omission of the TC Yeastolate or lactalbumin hydrolysate will lead to poor performance

Culture Conditions and Handling

Culture medium: TC 100 (500 ml) supplemented with 2 mM L-glutamine, 3.3 g of TC Yeastolate, 3.3 g of lactalbumin hydrolysate, and 10% heat-inactivated fetal bovine serum
Subculture routine: Gently resuspend cells in the spent culture medium by pipetting across the monolayer or by hitting the flask against the palm of your hand (the latter is only preferable when working with larger flasks). If many floating cells are present before subculturing, the old medium and the floating cells may be discarded and the medium replaced before subculture. Incubate the cells at 27 °C without CO_2
Split ratio: A ratio of 1 : 5 or greater is recommended
Fluid renewal: Three times per week
Freeze medium: CM-1
Biosafety level: 1

Special Features of the Cell Line and Recommended Use

Viruses: Baculoviruses; *Autographa californica* (MNPV); St. Louis encephalitis (SLE)
Applications: Transfection host
ATCC number: Not available
CLS number: 604328

Further Reading

Vaughn, J.L. *et al*. (1977) The establishment of two cell lines from the insect Spodoptera frugiperda (Lepidoptera; Noctuidae). *In Vitro*, **13**, 213–217.

4.3
Human Primary Cells

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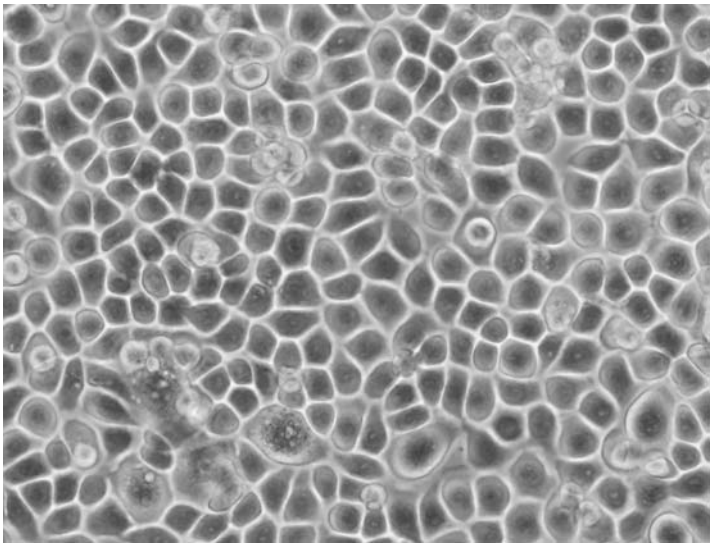
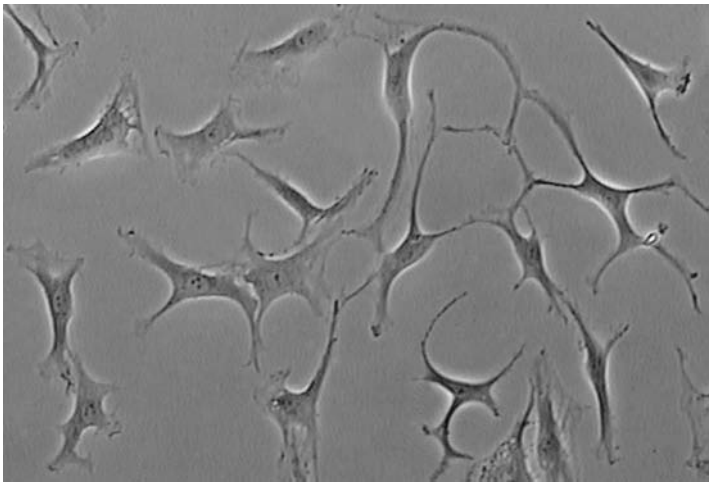
Airway Small Epithelial



Chondrocytes



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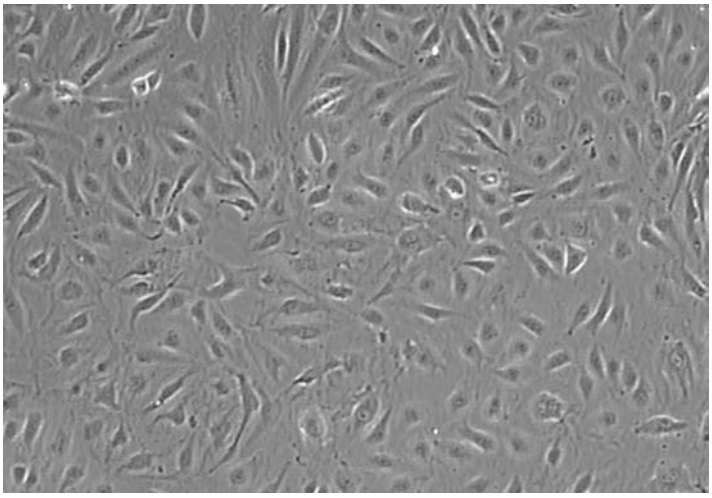
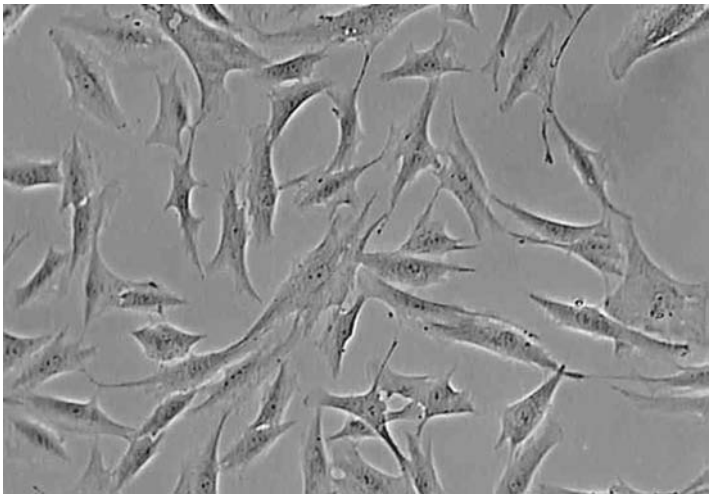
Endothelial Cells (Dermal Microvascular)



Fibroblasts Dermal Normal



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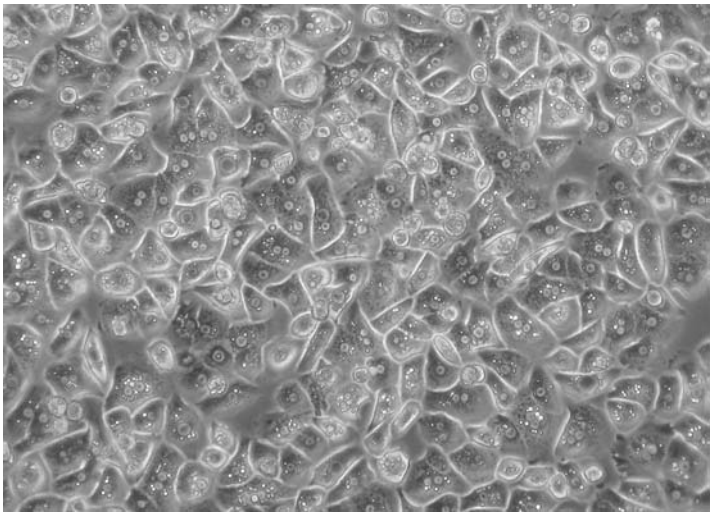
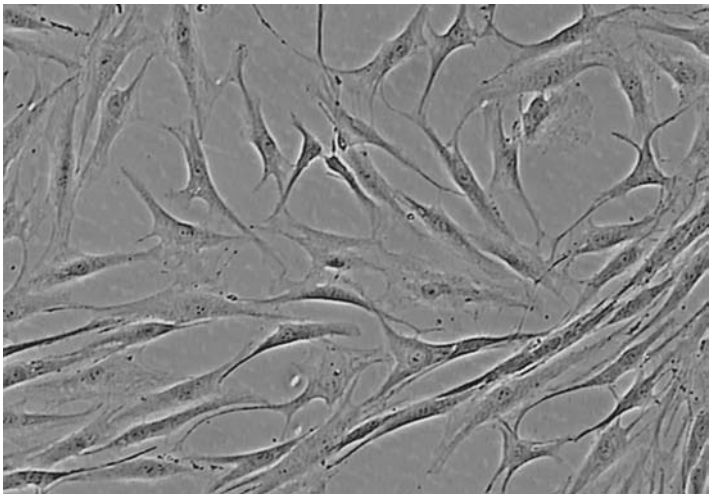
Hepatocytes



Human Follicle Dermal Papilla Cells (HFDPC) Culture in Phase Contrast



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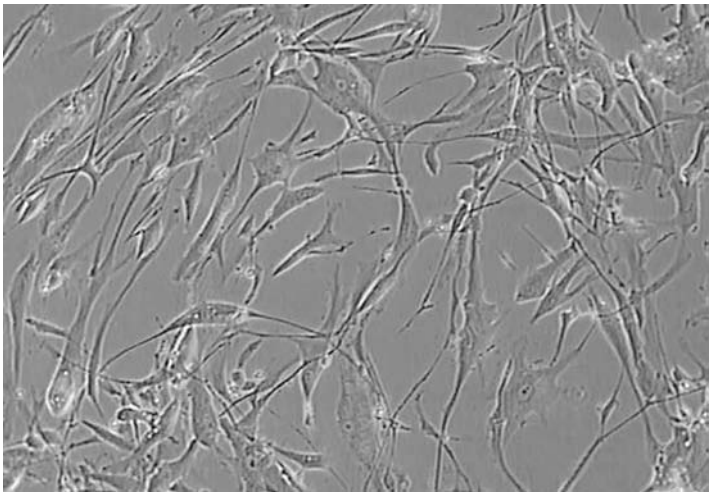
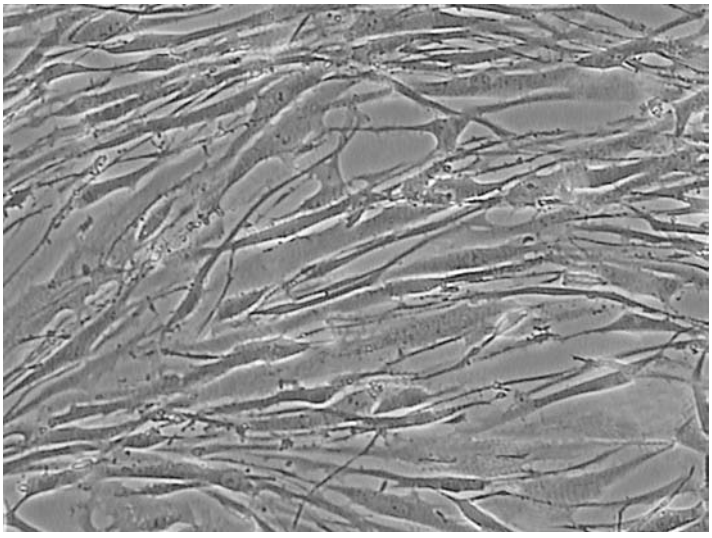
Human Skeletal Muscle Cells (SkMC)



Human Tracheal Smooth Muscle Cell (HTSMC) Culture in Phase Contrast



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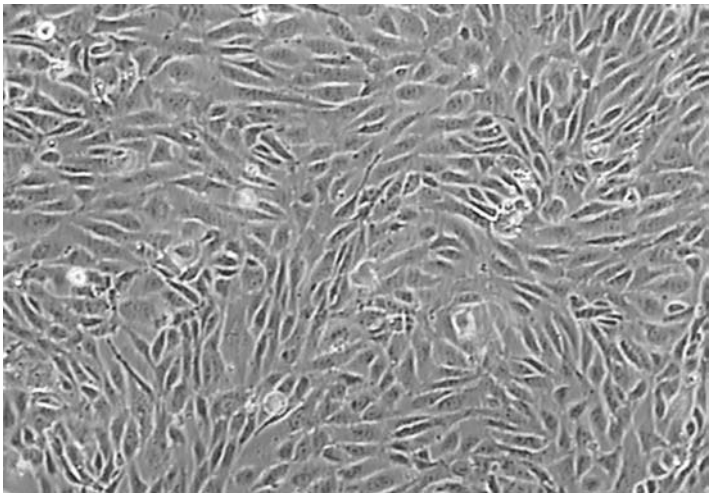
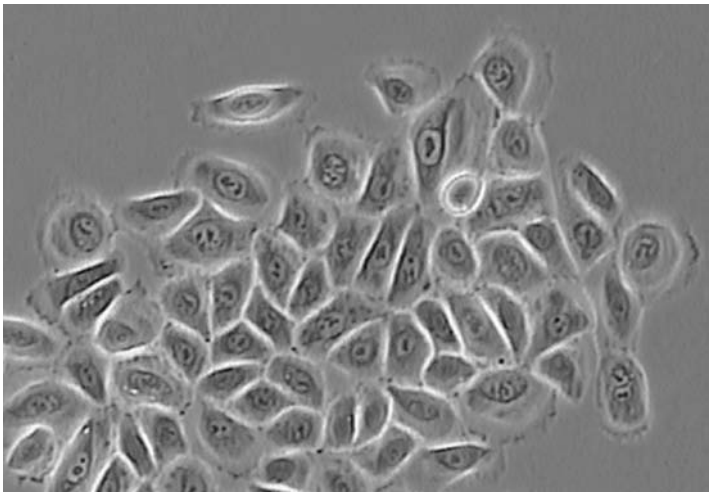
Human Umbilical Vein Endothelial Cells (HUVEC)



Keratinocytes Normal Epidermal



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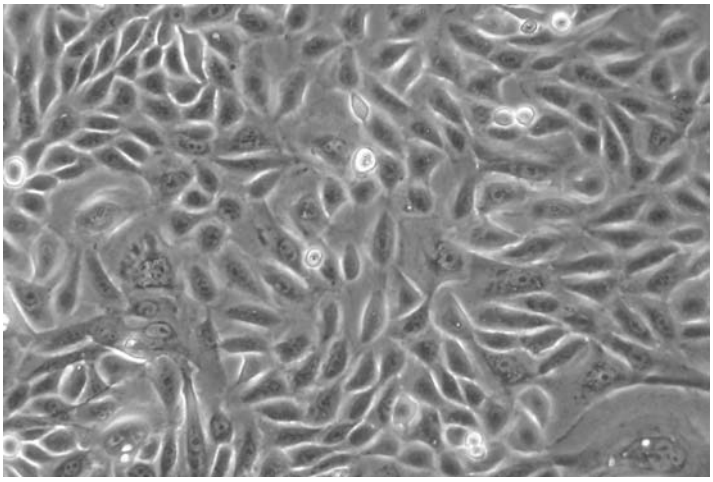
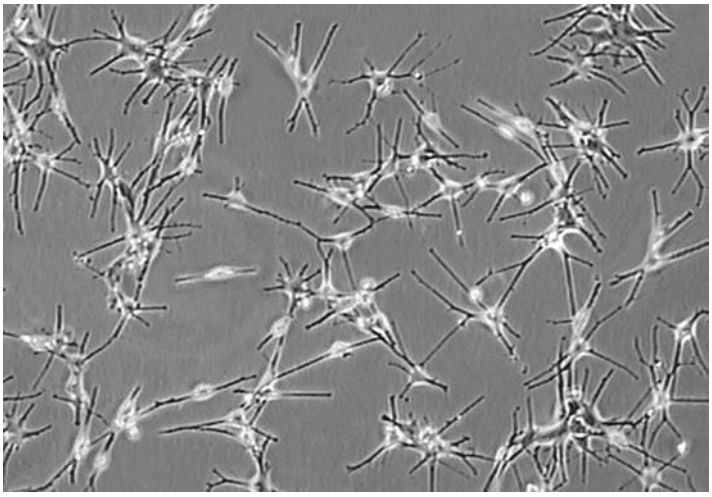
Mammary Epithelial Cells



Melanocytes Normal Epidermal



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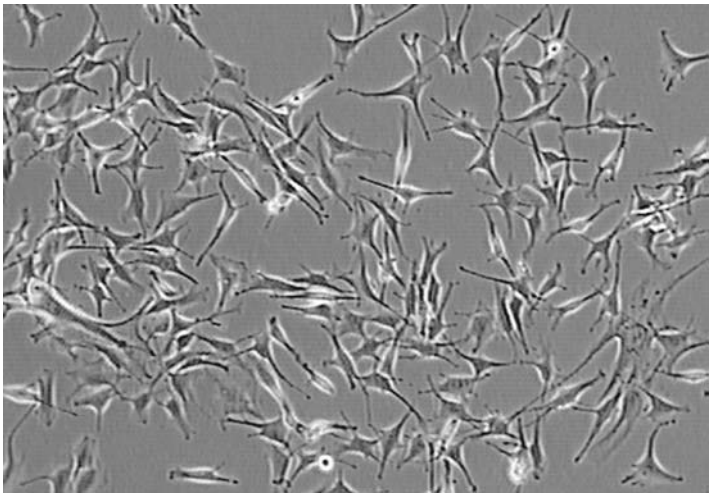
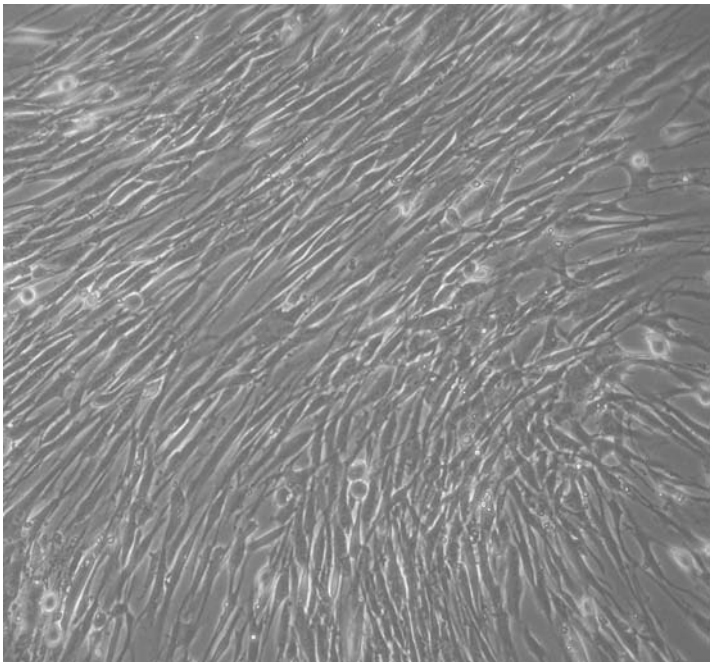
Melanocytes Epidermal Normal



Mesenchymal Stem Cells from Bone Marrow Undifferentiated



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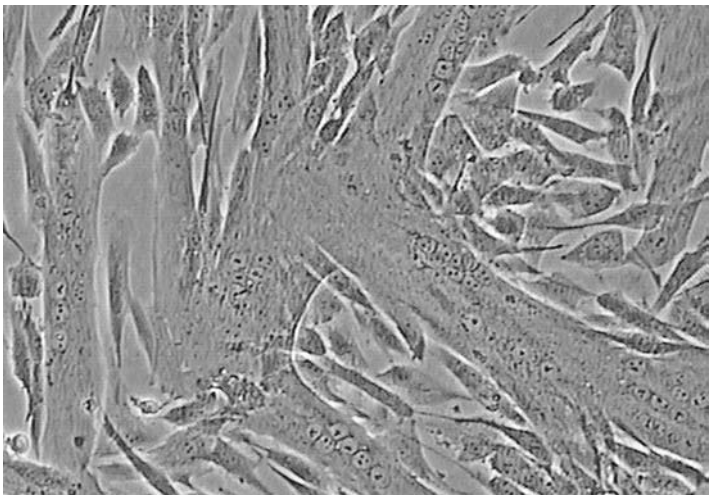
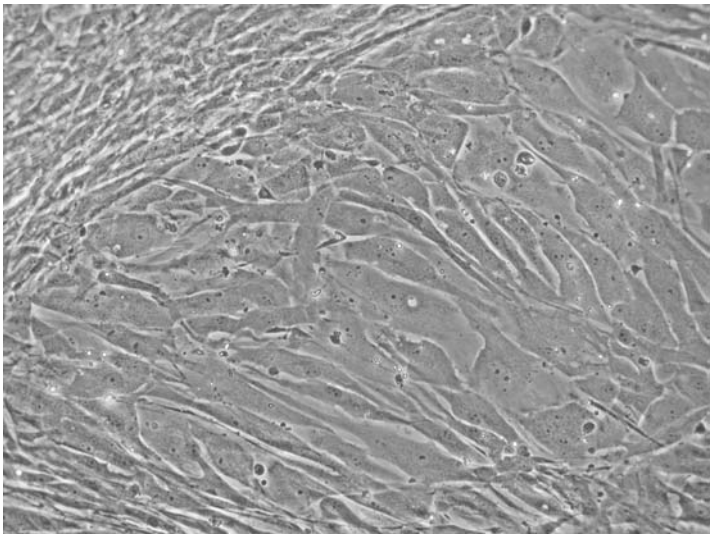
Muscle Cells Skeletal Differentiated



Myocytes



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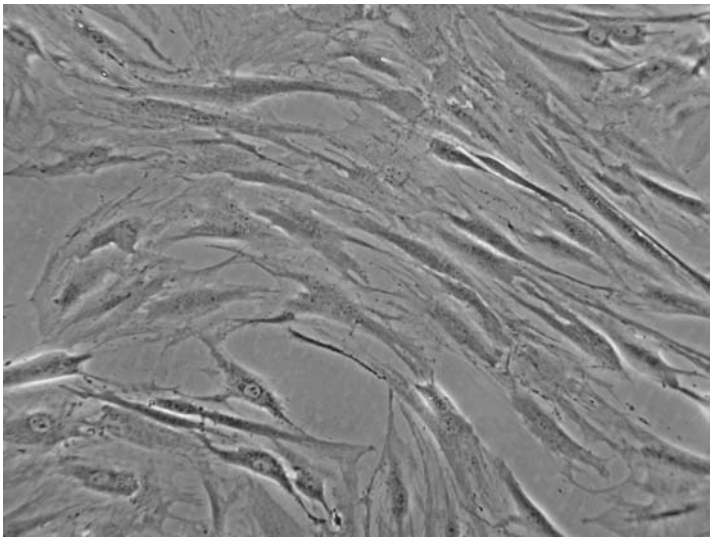
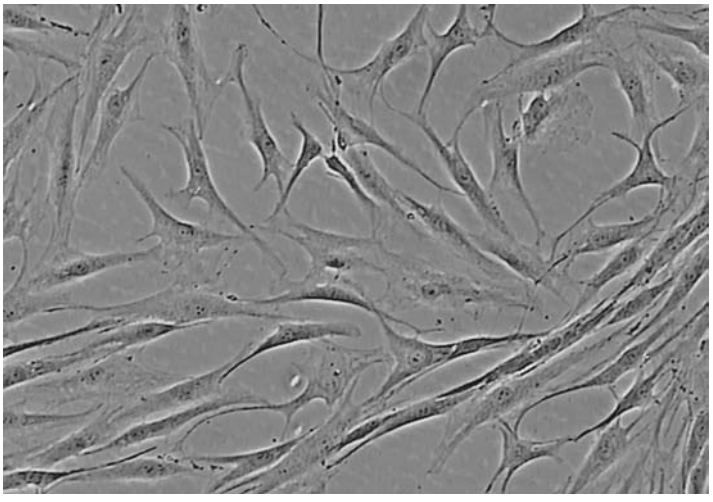
Osteoblasts



Papillar Follicle Dermal Cells



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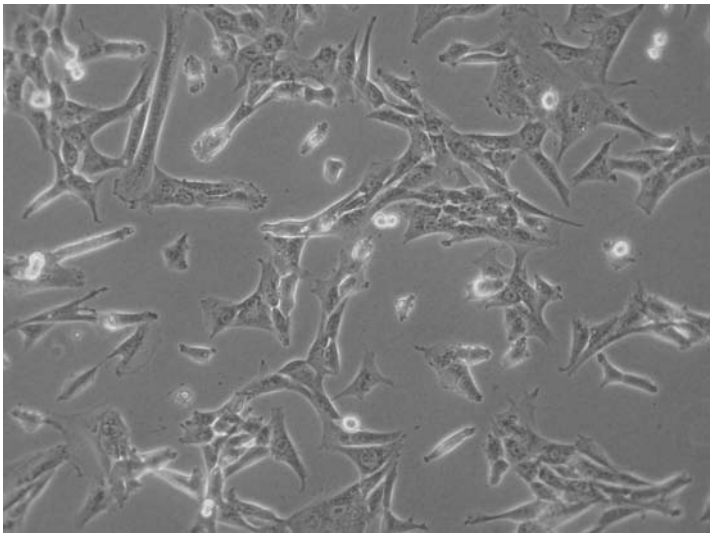
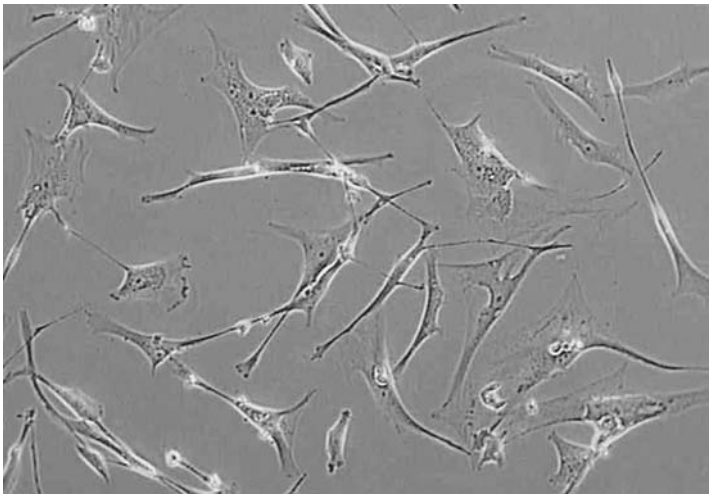
Pericytes from the Placenta Proliferating



Preadipocytes Undifferentiated



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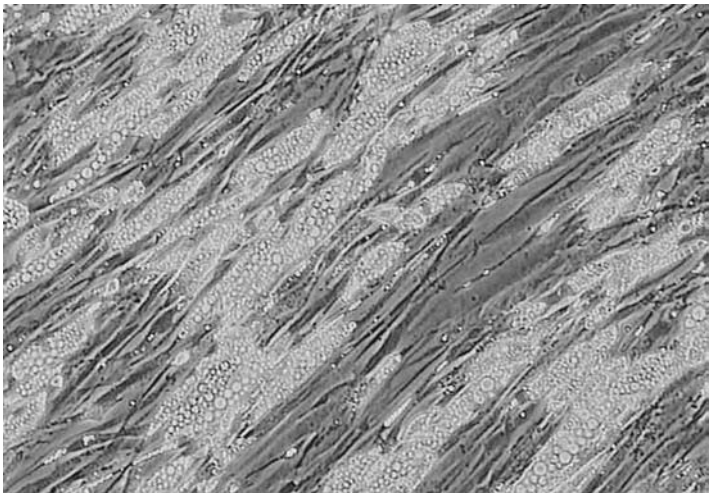
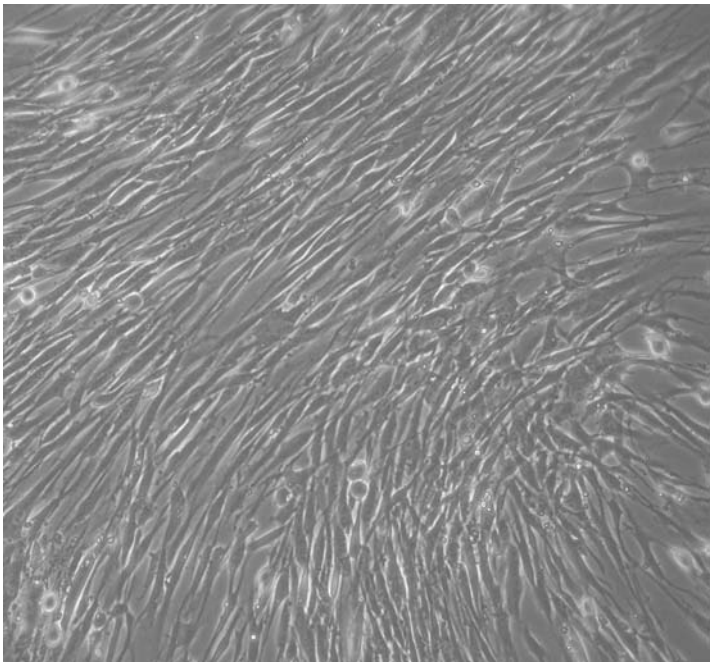
Preadipocytes After *In Vitro* Differentiation into Adipocytes



Skeletal Muscle Cells Undifferentiated



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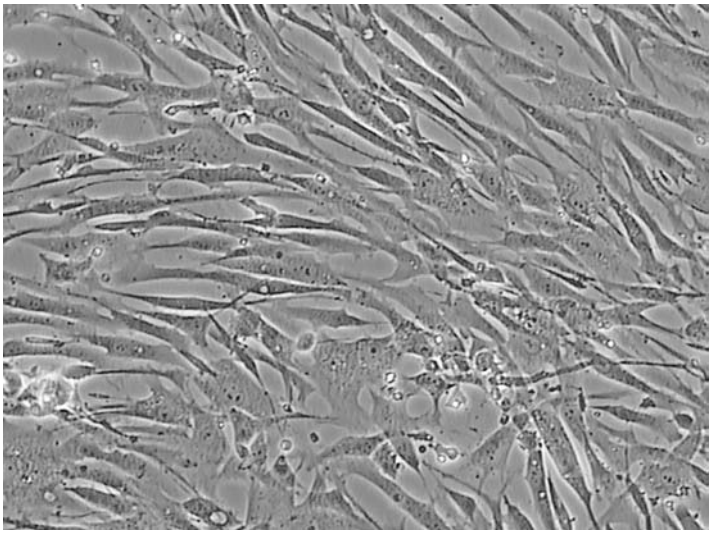
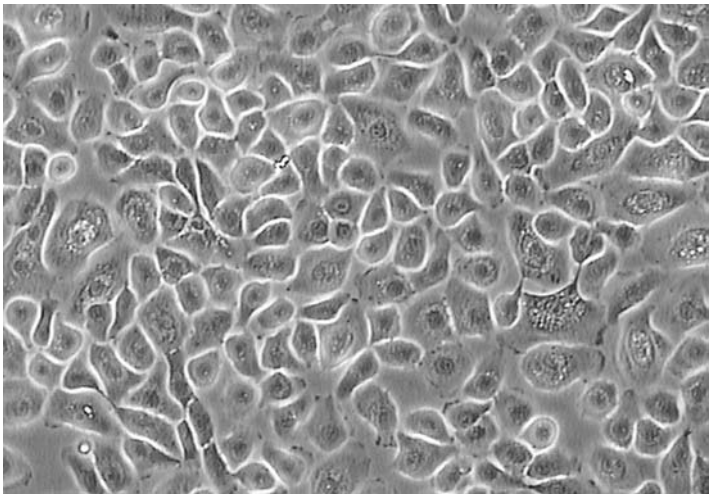
Smooth Muscle Cells (Artery Pulmonary)



Tracheal Epithelial Cells



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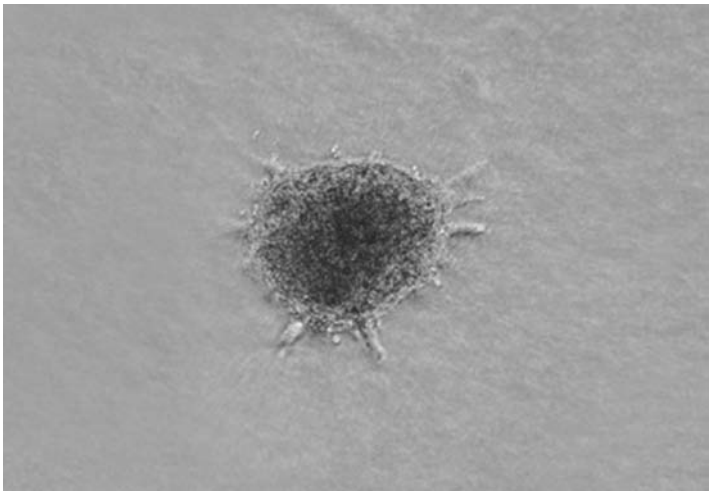
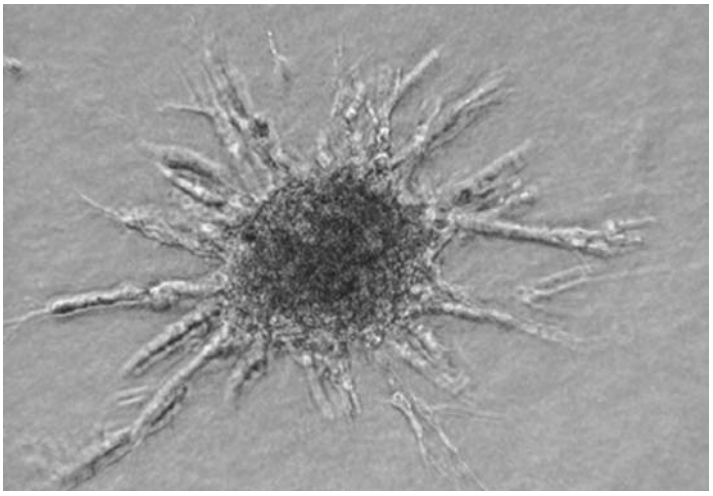
Umbilical Vein Endothelial Cells, Spheroid



Vascular Endothelial Growth Factor (VEGF)



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Appendix A
Materials and Suppliers

Materials	Suppliers
Accutase	PAA
Acetic acid	neoLab, Roth
Agarose	Axon, Serva
Amphotericin B	Biochrom AG
Antibiotics	provitro
Basal medium Eagle	Lonza
100 BP DNA ladder	Invitrogen
Cameras	Leica, Applied Spectral Imaging
Cell culture flasks	Corning, neoLab, Greiner
Cell culture plates	Biochrom AG, Greiner, neoLab, TPP
Cell lines	CLS
Centrifuge tubes	Corning
Cell scraper	Corning
C-CHIP Disposable Hemocytometer	Neubauer Improved, PAA
CO_2-incubators	SANYO, Slimcell
Collagen, rat tail	Invitrogen, Biochrom AG
Coon's mod. Ham's F-12 medium	PELOBiotech
Cryomedia	CLS
Cryotubes	Greiner bioone, neoLab, Nunc, VWR
DAPI (4′,6-diamidino-2-phenylindole)	Invitrogen
D+ glucose solution	Sigma
Digital camera	Olympus
Disposable serological pipettes	Corning
Dulbecco's modified Eagle's medium (DMEM)	Lonza
Dulbecco's modified Eagle's medium Ham's F12 (DMEM Ham's F12)	Lonza
Dulbecco's phophate buffer saline	Lonza, Sigma
EC Supplement-Mix, FCS	provitro
EDTA (ethylenediamintetraacetate)	Serva, Roth
EGF-Biotin	Invitrogen
Eagle's minimal essential medium (EMEM)	Lonza
Endothelial cell growth supplement	C.c. pro

(*Continued*)

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Materials	Suppliers
Entellan	Merck
Erlenmeyer flasks, sterile	Corning
Ethanol	Roth
Ethidiumbromid Lösung	Serva
EUB DNA polymerase	Minerva Biolabs
Fetal bovine serum South American origin	Lonza
Fetal bovine serum Gold USA origin	PAA
Fetal bovine serum low in Endotoxin	Sigma
FlexiGene DNA kit	Quiagen
Fluorescence microscope	Leica
G418	Biochrom AG
G5 Supplement	PAA
Gelatin	Biochrom AG
Gentamycin	Lonza
Giemsa Stain	neoLab, Roth
Glycin	Serva, neoLab
Ham's F12	Lonza, Sigma
HEPES buffer	Sigma, Lonza
Human IL-2	Biochrom AG
Human IL-3 recombinant	Biomol
Hydrocortisone	Sigma
Iscove's modified Dulbecco's medium (IMDM)	Lonza
Insulin	Biochrom AG,Invitrogen
Inverted microscope	Leica
ITS-Premix	BD Biosciences
KMG-2 Conditioned growth medium	CLS
KMG-5 Conditioned growth medium	CLS
L-Alanyl-L-Glutamine	Biochrom AG
Laminar Air Flow	Kojair, Holten Lamin Air A/S
L-Glutamine	Lonza
Lectin	Sigma
L-Leucin	Serva
McCoy's 5A	Biochrom AG
Medium 199	Lonza
Medium 199 w/EBSS	Lonza
MEM non-essential amino acid solution	Sigma
Minimum essential medium (Eagle)	Lonza, Sigma
MycoKill AB antibiotic mixture	PAA
MycoZap 1 treatment kit	Lonza
Mynox Gold, elimination reagent	Biochrom AG
Mynox Gold, main treatment	Biochrom AG
Nano-drop 1000 calibration check	Peqlab
Nano-drop-spectrometer	Kisker
Natriumchlorid	Roth

(*Continued*)

Materials	Suppliers
Needles	neoLab
May-Grünwald stain solution	Merck
PCR Quick-Load 100 bp DNA-ladder	Biolabs
Penicillin/Streptomycin	Lonza
Phage Lambda DNA	Bioron
Phalloidin, Alexa Fluor 488 Conjugate	Lonza
Phosphoethanolamin	Thermo Scientific
Pipettes	Eppendorf, Gilson
Pipette tips	Eppendorf, Axon, Corning, neoLab
Pipette washer	Kartell, Roth
Protease	Quiagen
Proteinase K	Invitek
QIAamp DNA Mini Kit	Quiagen
RIPA Buffer (Radio-Immunoprecipitation Assay)	Invitrogen
RPMI-1640	Lonza
Standard Taq reaction buffer	Biolabs
Sterile pipettes	Corning
Sterilizing tape (indicator)	neoLab
Stripettor	Corning
Stripettor air filter	Corning
Suction system	Schuett biotec GmbH
Supplement mix fibroblast growth medium 2	PromoCell
Syringes	B.Braun Melsungen AG, Terumo, Becton Dickenson, VWR
Syringe filters	Corning, Roth
Taq DNA polymerase	Biolabs
TBE Buffer (Tris-Borat-EDTA-Buffer)	Serva
TBST (Tris-buffered saline and Tween 20)	Sigma
Thermocycler	Labnet International
Thermomixer	Eppendorf
Type F immersion liquid	Leica
Transluminator	Biostep
Tris (Tris-(hydroxymethyl)-aminomethane)	Serva, neoLab
Tryple express	Invitrogen
Trypsin	Lonza, Biochrom AG
Tubes	Axon, Corning, Eppendorf, Greiner, neoLab, Roth, Sorenson Bioscience
Ultra pure sterile water	Biochrom AG
Vacuum pump	Schuett biotec GmbH
Vortexer mixer	Scientific Industries
Water bath	B.Braun Melsungen AG
Waymouth medium	Lonza

Appendix B
Suppliers of Cell Culture Materials

Here are the names of companies which provided the scientific community with cell culture media and related biochemicals and with consumer goods around the whole laboratory.

We have just given the URLs here, because other information, like addresses, telephone number and so on, can vary between different countries and they can change within short time due to mergers and takeovers.

B.1
Biochemicals and Chemicals

- Abbott; abbott.de
- Alfa Aesar GmbH & Co KG, Postfach 110765, D-76057 Karlsruhe; www.alfa-chemcat.com
- Amersham Pharmacia Biotech; gehealthcare.com
- Applichem; www.applichem.com
- Axon Labortechnik; www.axon-lab.de
- Becton Dickinson; bd.com
- Bio-Rad Laboratories bio-rad.com
- Calbiochem-Novabiochem GmbH, Lisztweg 1, D-65812 Bad Soden; www.calbiochem-novabiochem.de
- Campro Scientifc GmbH, Köpenicker Str. 10a, D-10997 Berlin; www.campro.eu
- Carl Roth GmbH & Co. KG; www.carlroth.com
- Difco; www.bd.com
- Dojindo Molecular Technologies, Inc.; www.dojindo.com
- Dunn Labortechnik; dunnlab.de
- Fluka fine chemicals; sigmaaldrich.com
- ICN Biomedicals; ICNBiomed.com
- Invitrogen (GIBCO); www.invitrogen.com
- Lonza Group Ltd; www.lonza.com
- Merck KGaA, www.merck.de
- Minerva Biolabs; www.minerva-biolabs.com
- MP Biomedicals, www.mpbio.com
- neoLab Migge Laborbedarf-Vertriebs GmbH; www.neolab.de
- PAA Laboratories; www.paa.com

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- Promega; www.promega.com
- Provitro; www.provitro.de
- Qiagen GmbH; www.qiagen.com
- Roche Diagnostics; www.roche-applied-science.de
- Serva Electrophoresis; www.serva.de
- SIGMA-ALDRICH; www.sigmaaldrich.com

B.2 Filters

- Carl Roth GmbH & Co. KG; www.carlroth.com
- Corning; www.corning.com
- ICN Biomedicals; www.ICNBIOMED.com
- Millipore; www.millipore.com
- Pall; www.Pall.com
- Sartorius; www.sartorius.de
- VWR International; www.vwr.com

B.3 Glassware

- Bellco Glass: Dunn Labortechnik GmbH, Thelenberg 6, D-53567 Asbach; dunnlab.de
- BRAND GmbH & Co. KG, Postfach 1155, D-97861 Wertheim; Brand.de
- DURAN Group GmbH, Otto-Schott-Str. 21, D-97877 Wertheim; duran-group.com
- INTEGRA Biosciences GmbH (IBS), Ruhberg 4, D-35463 Fernwald; integra-biosciences.de
- Karl Hecht GmbH, Stettener Str. 22–24, D-97647 Sondheim v.d. Rhön; hecht-assistent.de
- Schott Instruments GmbH, Hattenbergstr. 10, D-55122 Mainz; Schott.com, schott-geraete.de
- VWR International GmbH; www.vwr.com
- Wheaton; www.wheaton.com

B.4 Plastics

- Axon Labortechnik; www.axon-lab.de
- Becton Dickinson; www.bd.com
- BRAND; Brand.de
- Carl Roth GmbH & Co.KG; www.carlroth.com
- Corning Costar; www.scienceproducts.corning.com
- Eppendorf; www.eppendorf.de
- Greiner Bio-One; www.gbo.com
- ICN Biomedicals; ISNBIOMED.com
- INTEGRA (IBS); integra-biosciences.de
- neoLab Migge Laborbedarf-Vertriebs GmbH; www.neolab.de

B.5
Incubators

- BINDER; www.binder-world.com
- Fisher Scientific; www.de.fishersci.com
- INTEGRA Biosciences; www.integra-biosciences.de
- Kendro; www.thermo.com
- Labotect; www.labotect.com
- Memmert; www.Memmert.com
- New Brunswick Scientific; www.eppendorf.com
- Thermo Scientific; www.thermo.com
- VWR International; www.vwr.com
- Nalgene, Fisher Scientific; www.de.fishersci.com
- neoLab Migge Laborbedarf-Vertriebs GmbH; www.neolab.de
- Nunc; www.nuncbrand.com
- Sarstedt; www.Sarstedt.com
- TPP; www.tpp.ch
- VWR International; www.vwr.com

B.6
Equipment

- Axon Labortechnik; www.axon-lab.de
- B.Braun Melsungen AG; www.bbraun.de
- Biostep; www.biostep.de
- Bosch; www.bosch.de
- Gebr. Liebisch GmbH; www.liebisch.com
- Kisker; www.kisker-biotech.com
- Kojair; www.kojair.com
- Labnet International; www.labnetinternational.com
- Liebherr; www.liebherr.com
- Mettler Toledo; www.mt.com
- National Lab; www.nationallab.com
- Schuett Biotec GmbH; www.schuettbiotec.de
- Scientific Industries; www.scientificindustries.com
- Systec; www.systec-lab.de
- Taylor-Wharton; www.taylor-wharton.com

B.7
Media, Sera and Supplements

- Biochrom; www.biochrom.de
- CLS Cell Lines Service GmbH; www.cell-lines-service.de
- ICN Biomedicals; ICNBIOMED.com

- Invitrogen; www.invitrogen.com
- Lonza Group Ltd; www.lonza.com
- PELOBiotech; www.pelobiotech.com
- PromoCell; promocell.com, promokine.de
- Roche Diagnostics; roche-applied-science.com
- SIGMA-ALDRICH; www.sigma-aldrich.com

B.8
Micropipettes

- Abimed; www.abimed.de
- BRAND; www.Brand.de
- INTEGRA Biosciences; www.Integra-biosciences.de
- Eppendorf AG; www.eppendorf.de
- VWR International; www.vwr.com

B.9
Microscope

- Carl Zeiss AG; www.zeiss.de
- Keyence; www.keyence.de
- Leica Microsystems; www.Leica-microsystems.com
- Nikon Instruments; www.nikoninstruments.eu
- Olympus; www.olympus.de

B.10
Cell banks

- American Tissue Culture Collection (ATCC); www.ATCC.org
- CLS Cell Lines Service GmbH; www.cell-lines-service.de
- Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ); www.dsmz.de
- European Collection of Cell Cultures (ECACC); www.hpacultures.org.uk/collections/ecacc.jsp
- I.A.Z. Institute of Applied Cell Culture; www.I-A-Z-Zellkultur.de
- Interlab Cell Line Database; www.biotech.ist.unige.it/cldb/indexes.html
- JCRB (**J**apanese **C**ollection of **R**esearch **B**ioresources); http://cellbank.nibio.go.jp/
- RIKEN Bioresource Center Cell Bank, Japan; http://www.brc.riken.jp/lab/cell/english/

B.11
Cells (Primary Cells, Transfected Cells, and Other Cell Types)

- Lonza Group Ltd; www.lonza.com
- Millipore; www.millipore.com
- PromoCell; promocell.com, promokine.de
- provitro GmbH; www.provitro.de
- SIGMA-ALDRICH Chemie GmbH, distributo of ECACC-cell lines; www.sigma-aldrich.com

Further Reading

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Freshney, R.I. (2010) *Culture of Animal Cells: A Manual of Basic Techniques and Specialized Applications*, 6th edn, Wiley-Blackwell, Hoboken.

Hay, R.J. (1992) *ATCC Quality Control Methods for Cell Lines*, 2nd edn, ATCC.

Langdon, S.P. (2004) *Cancer Cell Culture: Methods and Protocols (Methods in Molecular Medicine)*, Humana Press, Totowa.

Lindl, T. and Gstraunthaler, G. (2008) *Zell- und Gewebekultur – Von den Grundlagen zur Laborbank*, 6 Auflage, Spektrum Akademischer Verlag, Heidelberg.

Pfragner, R. and Freshney, R.I. (2004) *Culture of Specialized Cells – Culture of Human Tumor Cells*, Wiley-Liss, New York.

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Index

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