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ATCC [®] Number	Authenticult [™] Set Description
20-1001	VITEK [®] GNI QC Set
20-1002	VITEK [®] EPS QC Set
20-1003	VITEK [®] GNI+ QC Set
20-1004	VITEK [®] GNS MIC QC Set
20-1005	VITEK [®] GPI QC Set
20-1006	VITEK [®] GPS MIC Panels QC Set
20-1007	VITEK [®] GPS MIC II Panels QC Set
20-1008	VITEK [®] NHI QC Set
20-1009	VITEK [®] UID-1 & UID-3 QC Set
20-1049	VITEK [®] GNS II QC Set
40-1001	VITEK [®] YBC QC Set

In the future, additional sets for QC of microbial identification systems will be available.



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ATCC recommends cell line verification tests and guidelines for publishing

Abstract

Authentication of a cell line is the sum of the processes by which a line's identity is verified and shown to be free of contamination from other cell lines and microbes. Using standard techniques, authentication enables communication among all users about the culture and ensures valid, reproducible experimental results. Without periodic testing, over-subcultured, misidentified or cross-contaminated cell lines are released into the research arena resulting in spurious data.¹ Clearly, the research community is better served by the use of tested material. However, guidelines for general testing of cell lines currently do not exist — especially for lines not obtained from a cell bank or which are derived locally. In this article, ATCC seeks to recommend basic benchmark verification tests that can be employed by any lab and the results easily included in publication. ATCC seeks to engage the research community in an ongoing dialogue about this topic, including suggestions and ideas about the tests set forth herein.

As a biological resource center, ATCC comprehensively performs authentication and quality-control tests on all distribution lots of cell

To ensure consistent cell line performance in your lab, ATCC recommends basic tests be performed at the following times:

- when deriving a new line
- before a series of experiments
- any time your cells appear to produce inconsistent and/or unexpected results
- when acquiring a line from a collaborator

lines. Therefore, obtaining and using low-passage cell lines from ATCC is a sure way to work and publish with confidence. At the time of publishing with an ATCC obtained cell line, the designation, the ATCC catalog number and the passage numbers under which experiments were conducted should be included in the materials and methods (e.g., NIH/3T3, ATCC® CRL-1658™, passage number XX – YY).

ATCC recognizes that many cell lines used in basic and biomedical research are not available at ATCC or another cell bank. In some cases, these lines have undergone little or no authentication testing. In other cases, only outdated testing has been conducted. When performing research with these cell lines, it is good cell culture practice to conduct fundamental tests to ensure that the lines are uncontaminated and correctly identified. When research with this material is published, details of the tests can and should be submitted to the journal editor and included in the materials and methods section of a manuscript.

Recommended tests

Morphology check by microscope — Cellular morphology refers to the observation of a magnified cell culture. This can be the simplest and most direct method used to identify the state of cells. Obtaining morphological information from comparative observations both at high and low densities of cultures depends on knowledge of several factors. Morphology varies between lines, depending on the health of the cells and, in some cases, the differentiation state. Morphology can change with plating density as well as with different media and sera combinations. Cell morphology is best monitored through frequent, brief observations. In general, if a culture has an unusual appearance, there is

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www.atcc.org/cellSurvey.cfm

Thank you in advance for your help.

likely a problem. It is recommended that researchers be alert during periodic morphology checks and maintain cell morphology images for comparisons.

Growth curve analysis — Evaluation of cell proliferation can yield valuable information about a culture's response to a stimulus. Variable or sudden decreases or increases in growth rate are a sign that something may be amiss with your cell lines. Establishing baselines and quantifying cell culture growth is a crucial element for monitoring the consistency of the culture and determining a number of other factors, such as the best time to subculture, the optimum dilution and the estimated plating efficiency at various cell densities. Growth curve analysis can also help determine population doubling times and should be performed routinely when enzymatic or functional analysis is imminent. Using cell lines with consistent growth properties should be pursued as a rule.

Species verification by isoenzymology — Isoenzyme analysis is used to verify the species of origin. Isoenzyme specimens are differentiated based on electrophoretic properties. Distribution patterns of a group of enzymes are characteristic of a particular species which simultaneously confirms the species identity and reveals contamination by another line of different species. Isoenzyme testing is available in a kit format from the company Innovative Chemistry www.authentikit.com (AuthentiKit System) and a detailed protocol may also be found in *Culture of Animal Cells: A Manual of Basic Technique* by R. Ian Freshney, 5th edition, pp. 275 – 278 (ATCC® Cat. No. 30-3001).

Identity verification with STR analysis (DNA fingerprinting) for human cell lines — DNA fingerprinting is a powerful tool in determining the identity and uniqueness of a human line. Short tandem

repeat (STR) profiling establishes a DNA fingerprint for every human cell line and may be used as a record of that line. ATCC STR profiling uses multiplex PCR to simultaneously amplify the amelogenin gene and eight of the most informative polymorphic markers in the human genome. The pattern of repeats results in a unique STR identity profile for each cell line analyzed. The profile can be used as a baseline for comparison with future tests. ATCC uses the Promega PowerPlex® 1.2 system and the Applied Biosystems Genotyper® 2.0 software for analysis of the amplicons (see page 5 for more information).

Mycoplasma detection — A major problem in cell culture, mycoplasma infection can have adverse effects on cell lines and can alter cell behavior and metabolism in many ways.²⁻⁷ Periodic assays to detect mycoplasma are critical for all continuous cell lines. A relatively easy and reliable biochemical method for detecting mycoplasma in a cell culture is to use Hoechst 33258, a fluorescent dye that binds specifically to DNA. Fluorescent Hoechst staining reveals mycoplasma infections through their characteristic patterns of extracellular particulate or filamentous fluorescence at 500× magnification.

Conclusion

While tests are always a good idea, your intuitions should not be ignored — when in doubt about the state of your cell lines, start with a new vial from your cell bank. By treating your cell lines as standard research components and providing verification benchmarks in publication, the research community is better served and information exchange between colleagues is enhanced. The result will be more reliable and reproducible experimental data.

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continued from page 3

ATCC respectfully seeks feedback on this article and requests that readers complete the survey which may be found online. We will report on your opinions in the next issue of *ATCC Connection*. To complete the survey, type this URL into your Web browser: www.atcc.org/cellSurvey.cfm. Thank you in advance for your help.

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ATCC congratulates winners of \$1000 in reagents

As leading suppliers of reagents used in life science discoveries, **ATCC and Roche Applied Science** are working together to help researchers increase their success with cell culture and transfection. In keeping with that goal, **ATCC and Roche Applied Science** partnered to give attendees at the 2006 American Society for Cell Biology Annual Meeting the unique opportunity to win \$500 worth of reagents from both companies. All researchers who visited each company's booth were auto-

matically entered into the drawing, and there was quite a turn-out. Allow us to extend a big "thanks" to all who participated.

It is our pleasure to congratulate the following winners of the ASCB \$1000 reagents prizes.

- H. Holman, Van Andel Institute
- D. Garbellini, Ohio State University
- J. Jennings, Emory University

A word on cell line passage number

Passage number is generally the number of times cells have been subcultured into a new vessel, usually within one lab. Avoiding the use of cell lines that have been in culture too long is an important step to ensure reliable and reproducible results.

Unlike counting rings in a tree cross-section to determine age, passage number is not a property that can be tested or counted with a straightforward method. However, the experimental consequences of using over-subcultured or high-passage cell lines remain.

It is well documented that cell characteristics can change when cell lines are cultivated for extended periods.⁸⁻¹³ Cell lines that have been over-subcultured can experience phenotypic as well as genotypic changes (genetic drift). It is also true that stocks of commonly used cell lines maintained in many laboratories have been passaged hundreds of times and should not be considered true models of the original source material.^{9,13,14}

It is good cell culture practice to start experiments with fresh, low-passage cells and to use the cells in a predetermined range of passage numbers for best results. If you start to experi-

ence sudden and inexplicable variations in your experimental results, it may be that the cell line has been subcultured too often and needs to be replaced. By recording passage number, monitoring your cells with morphology checks, establishing and observing changes unique to the line you work with, you can help to promote the integrity of your research institution's cell banks.

Citations in this article correspond to the reference list on page 4.

ATCC and Roche are working together to help researchers optimize their success transfecting cell lines.



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Are you confident that the cellular effects you observe are the result of your transfected plasmid? Or are your results due to differential gene expression caused by the transfection reagent you use?

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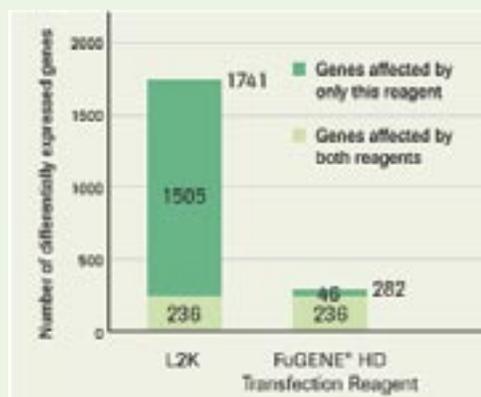


Figure 1. Minimize off-target effects by using FuGENE® HD Transfection Reagent.

FuGENE® HD Transfection Reagent or a reagent from another supplier (L2K) was used to transfect MCF7 cells (ATCC® HTB-22™). Subsequent microarray expression profiling experiments demonstrated that L2K significantly altered the expression levels of six times more genes than FuGENE® HD Transfection Reagent.

(View the complete article online in *Biochemica* (2006) 4 at www.roche-applied-science.com/publications/biochemica.htm)

Efficient Transfection of Neuroblastoma Cell Lines

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Medical Faculty of the University of Jena, Germany



Michael Grün

Efficient transfection of cells is a prerequisite for genetic manipulation. However, many cell lines remain hard to transfect with established protocols, hampering consecutive analysis. Here, we compare three different methods (FuGENE[®] HD Transfection Reagent, transfection reagent L, and calcium phosphate) for the transfection of neuroblastoma cell lines. We show that FuGENE[®] HD Transfection Reagent is able to transfect all of these cell lines with high efficiency for further analysis.

Introduction

Cellular research regularly requires transfection of cells under investigation for genetic manipulation (e.g., over-expression or knockdown of the gene of interest). Although numerous different transfection methods are available today that work well with standard cell lines such as **HEK293 (ATCC[®] CRL-1573[™])** or **HeLa (ATCC[®] CCL-2[™])**, many cell types remain hard to transfect with standard

protocols. In our hands, the neuroblastoma cell lines **SK-N-AS (ATCC[®] CRL-2137[™])**, **SK-N-LO**, and **SK-N-MC (ATCC[®] HTB-10[™])** belong to this group, resisting transfection with reagents such as calcium phosphate, transfection reagent L, and DEAE dextrane (Figure 1 and data not shown). During the attempt to achieve efficient transfection, we compared FuGENE[®] HD Transfection Reagent, transfection reagent L, and a calcium phosphate-based transfection kit for their capacity to transfect these cell lines. Using an EGFP reporter construct and FACS analysis for quantification of transiently transfected cells, we found a superior transfection ability with all three cell lines (up to 24% EGFP positive cells) using FuGENE[®] HD Transfection Reagent compared with the other methods.

Materials and Methods

Transfection

One day prior to transfection, 350,000 cells (SK-N-MC; SK-N-LO) or 500,000 cells (SK-N-AS) were seeded into 6-well plates, resulting in about 60% confluency within 24 hours. Cells were transfected with

pHygEGFP (Clontech, USA), using transfection reagent L, a calcium phosphate-based mammalian transfection kit, and FuGENE[®] HD Transfection Reagent, according to the manufacturers' instructions.

In the case of FuGENE[®] HD Transfection Reagent (Roche Applied Science), growth medium was renewed directly before transfection. DNA solution containing 2 µg of the vector was diluted with OptiMEM to a volume of 100 µL. FuGENE[®] HD Transfection Reagent (4 µL, 6 µL, or 8 µL) was added, resulting in reagent: DNA ratios of 4:2, 6:2, or 8:2 (as recommended in the protocol). The mixture was incubated for

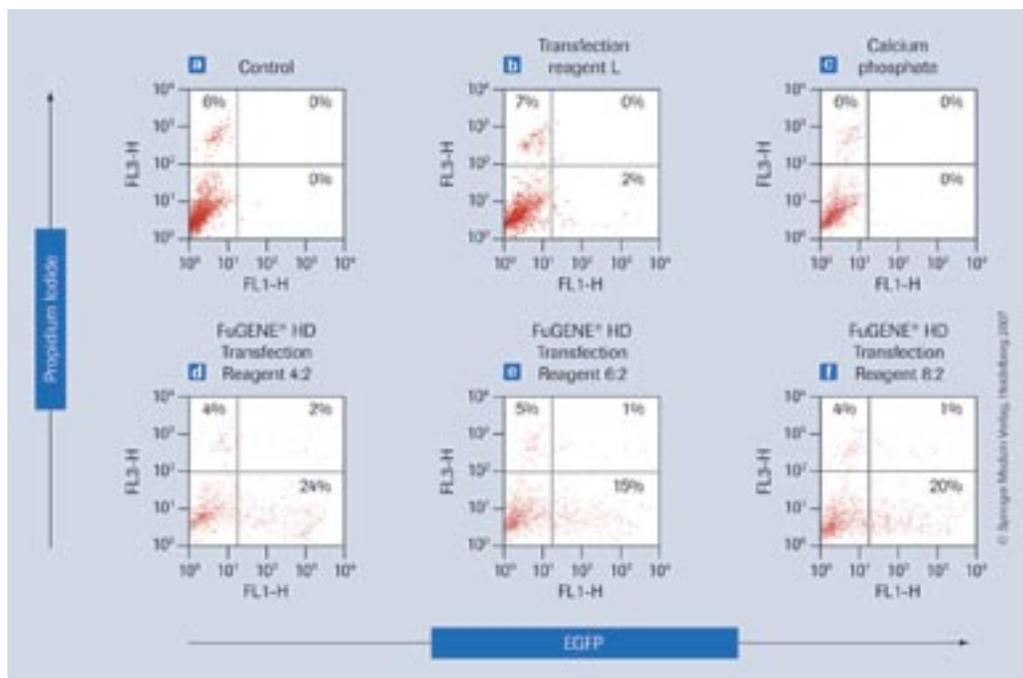


Figure 1: Transfection of SK-N-AS cells. SK-N-AS cells were transfected with pHygEGFP using transfection reagent L, calcium phosphate, or 3 concentrations of FuGENE[®] HD Transfection Reagent. Two days post transfection, cells were harvested, stained with PI, and analyzed by FACS.

Using FuGENE® HD Transfection Reagent*

15 minutes at room temperature, then added to the cells. After incubation for 5 hours under optimal growth conditions, the growth medium was removed and replaced with a new one.

Analysis of transgene expression

Two days post transfection, cells were harvested and stained with propidium iodide (PI) for differentiation between dead and vital cells, and EGFP expression was determined with a FACSCalibur (Becton-Dickinson, USA). Data acquisition and analysis were done using Cell Quest Pro (Becton-Dickinson) and WinMDI software (J. Trotter, The Scripps Research Institute).

Results and Discussion

Using the pHygEGFP vector and FuGENE® HD Transfection Reagent resulted in efficient transfection of each of the neuroblastoma cell lines SK-N-AS, SK-N-LO, and SK-N-MC. FACS analysis 2 days post transfection revealed up to 24% EGFP-positive cells per sample (Figure 1 and Table 1). In contrast, transfection reagent L provided no mentionable EGFP-positive cells (max. 2%) with either of the three cell lines. Calcium phosphate was able to transfect SK-N-LO (24% positive cells, Table 1) to a degree sufficient for further analysis, but was not efficient with SK-N-AS. FuGENE® HD Transfection Reagent revealed no toxicity for the cells in either concentration used, as determined microscopically (data not shown) and via PI staining of harvested cells (Figure 1). A tendency towards higher amounts of transfected cells was observed with decreasing FuGENE® HD Transfection Reagent:DNA ratio for all three cell lines tested (Table 1). However, whether this effect is significant, and if a further decrease of the FuGENE® HD Transfection Reagent:DNA ratio may lead to even higher transfection rates, remains to be elucidated. However, the EGFP expression level per cell (as measured by FACS) was not affected by different reagent:DNA ratios (Figure 1 and data not shown).

Table 1: Transfection of neuroblastoma cell lines with different methods.

Transfection method	EGFP-positive cells (%)		
	SK-N-AS	SK-N-LO	SK-N-MC
Transfection reagent L	2	<1	2
Calcium phosphate	<1	24	Not determined
FuGENE® HD Transfection Reagent 4.2	24	19	7
FuGENE® HD Transfection Reagent 6.2	15	12	4
FuGENE® HD Transfection Reagent 8.2	20	12	3

Conclusions

With EGFP as a reporter gene, FuGENE® HD Transfection Reagent showed satisfying transfection abilities with all three neuroblastoma cell lines tested. It was superior to two other established transfection methods. Thus, FuGENE® HD Transfection Reagent might be well-suited for genetic manipulation of neuronal cells resistant to other transfection methods. In our ongoing experiments, we obtained stably transfected clones from cultures transfected with FuGENE® HD Transfection Reagent upon selection with hygromycin and G418. These clones are currently under further investigation for stability of integration and expression levels.

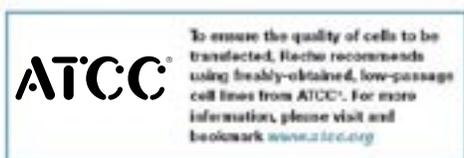
In the near future, the aim is to test whether the promising results from our experiments can also be obtained for other hard-to-transfect cells (e.g., primary neuronal cells).

For more information about the FuGENE® HD Transfection Reagent please visit the Roche Applied Science Internet site: www.powerful-transfection.com.

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Thank you for taking our survey!

Now here's the data.

ATCC would like to thank all those who visited ATCC exhibits in 2006, and especially the more than 600 of you who took the time to fill out our survey. Your interest and participation are much appreciated. We thought you might be interested in some of the survey results.

Over 70% of you said you know media formulations vary from supplier to supplier, and over 75% expressed the opinion that differences in media formulations exert significant influence on cell growth. Indeed, ATCC has found exactly that — variations in media formulations among suppliers are common, even when media are called by the same name.

Media formulation variations can impact the viability and performance of your cell line. For example, varying concentrations of culture medium ingredients such as glycine, glutamine and sodium pyruvate will directly influence the cell line's growth rate. Concentrations of buffers like HEPES and sodium bicarbonate will impact the pH of your media, which can affect the viability of the

cell line. Slight changes in pH or reduced availability of CO₂ in the culture medium may also inhibit recovery of cells from cryopreservation or cause delayed attachment and slower proliferation.

ATCC addresses these potential problems by growing cell lines in uniquely formulated ATCC media (RPMI, DMEM, etc.), designed to optimize growth and performance. A case in point: all ATCC liquid media is specifically formulated for use in a 5% CO₂ environment. This maintains the sodium bicarbonate / CO₂ balance to ensure optimal pH and the healthiest possible cells. ATCC has found the best cell culture results come from growing cells in the same media in which they were preserved.

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ATCC and amaxa are working together to help researchers optimize their success transfecting cell lines.



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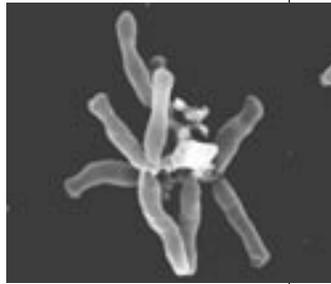
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Scanning electron micrograph courtesy of Caroline Harwood, Univ. of Washington, Seattle, WA

Look for additions to this list online at: www.atcc.org.

Laboratories around the world have sequenced the genomes of a wide range of microbes. New genomic DNA from fully sequenced, well-characterized microbial strains are listed below. All are available in the new 5-µg package size. ATCC testing has expanded to include the determination of the total amount of DNA by PicoGreen® measurement. This high-quality DNA has been isolated under aseptic conditions to prevent cross-contamination. Batches are evaluated for integrity, purity and quality by sev-

eral methods, including agarose gel electrophoresis, spectrophotometry, suitability for amplification by PCR, sequencing of the 16S ribosomal RNA gene (first ~500 base pairs) consistent with the sequence of the source organism for bacteria and ITS sequencing for fungi and yeast. Genomic DNA from ATCC's fully sequenced microbial strains can save you the time and expense of isolating DNA yourself. **Watch for a new poster that lists ATCC strains that have been fully sequenced.** Contact us by email at help@atcc.org for a free copy.

ATCC® Number	Source Organism	Source Strain	Significance
BAA-125D-5	<i>Bacillus halodurans</i>	JCM 9153	Sequenced genome; GenBank BA000004.3
BAA-588D-5	<i>Bordetella bronchiseptica</i>	RB 50	Sequenced genome; GenBank BX470250.1
700819D-5	<i>Campylobacter jejuni</i>	NCTC 11168	Sequenced genome; GenBank AL111168.1
2001D-5	<i>Candida glabrata</i>	CBS 138	Type strain; Sequenced genome
700971D-5	<i>Corynebacterium diphtheriae</i>	NCTC 13129	Sequenced genome; GenBank BX248353.1
MYA-565D-5	<i>Cryptococcus neoformans</i>	JEC 21	Sequenced genome
43123D-5	<i>Cupriavidus metallidurans</i>	CH34	Type strain; Sequenced genome; GenBank CP000352.1
33406D-5	<i>Cytophaga hutchinsonii</i>	NCBI 9469	Type strain; Sequenced Genome; GenBank CP000383.1
36239D-5	<i>Debaryomyces hansenii</i>	CBS 767	Type strain; Sequenced genome
700926D-5	<i>Escherichia coli</i>	MG1655	Sequenced genome; GenBank U00096.2
51573D-5	<i>Geobacter sulfurreducens</i>	PCA	Type strain; Sequenced genome; GenBank AE017180.1
43049D-5	<i>Haloarcula marismortui</i>	DSM 3752	Type strain; Sequenced genome; GenBank AY596297.1
700721D-5	<i>Klebsiella pneumoniae</i> subsp. <i>pneumoniae</i>	MGH78578	Sequencing in progress at Washington University (WashU)
8585D-5	<i>Kluyveromyces lactis</i>	MRRL-Y-1140	Sequenced genome
33152D-5	<i>Legionella pneumophila</i>	Philadelphia-1	Type strain; Sequenced genome; GenBank AE017354.1
BAA-335D-5	<i>Neisseria meningitidis</i>	MC58	Serogroup B; Sequenced genome; GenBank AE002098.2
43587D-5	<i>Pyrococcus furiosus</i>	DSM 3638	Type strain; Sequenced genome; GenBank AE009950.1
700860D-5	<i>Pyrococcus horikoshii</i>	JCM 9974	Type strain; Sequenced genome; GenBank BA000001.2
BAA-98D-5	<i>Rhodospseudomonas palustris</i>	CGA009	Sequenced genome; GenBank BX571963.1
204508D-5	<i>Saccharomyces cerevisiae</i>	S288C	Sequenced genome
9150D-5	<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar <i>Paratyphi A</i>		Sequenced genome; GenBank CP000026.1
700720D-5	<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar <i>Typhimurium</i>	LT2	Sequenced genome; GenBank AE006468.1
700931D-5*	<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar <i>Typhi</i>	Ty2	Sequenced genome; GenBank AE014613.1
35984D-5	<i>Staphylococcus epidermidis</i>	RP62A	Sequenced genome; GenBank CP000029.1
BAA-611D-5	<i>Streptococcus agalactiae</i>	2603 V/R	Serotype V; Type strain; Sequenced genome; GenBank AE009948.1
700294D-5	<i>Streptococcus pyogenes</i>	SF370, M1 GAS	Sequenced genome; GenBank AE004092.1
35092D-5	<i>Sulfolobus solfataricus</i>	DSM 1617	Sequenced genome; GenBank AE006641.1
51530D-5	<i>Thermoplasma volcanium</i>	DSM 4299	Type strain; Sequenced genome; GenBank BA000011.4
43589D-5	<i>Thermotoga maritima</i>	DSM 3109	Type strain; Sequenced genome; GenBank AE000512.1
39315D-5*	<i>Vibrio cholerae</i>	N16961	biovar eltor, serotype Inaba, serovar O:1 Sequenced genome; GenBank AE003852.1
29543D-5	<i>Wolinella succinogenes</i>	FDC 602W DSM 1740	Type strain; Sequenced genome; GenBank BX571656.1

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ATCC® CRL-4013™ — CuFi-1, human airway epithelial cells derived from lung tissue of a cystic fibrosis patient, do not undergo growth arrest in culture due to expression of the telomerase and E6/E7 genes. This cell line should be a useful model for studying ion physiology, therapeutic intervention for cystic fibrosis, and innate immunity.

ATCC® CRL-4011™ — NuLi-1, human airway epithelial cells derived from normal lung tissue, do not undergo growth arrest in culture due to expression of the telomerase and E6/E7 genes. This cell line should be a useful model for studying ion physiology, therapeutic intervention for cystic fibrosis, and innate immunity.

For more information, please visit
www.atcc.org/common/products/CellImmortProducts.cfm

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You’re invited to join us for a series of Web-based technical seminars on cell culture. Cosponsored by Corning and ATCC, the webinars are designed to provide novel tips, best practices and proven techniques to help you with your research needs. Upcoming online seminars will be presented on the Corning website and will cover the following topics:

Grow More Cells! A Practical Approach for Scaling Up Cell Production
May 15 @ noon EDT and May 16 @10:00 a.m. EDT

Life and Death In Vitro — The Evolution of Techniques for Measuring Cell Growth and Toxicity in Cell Cultures
June 5 @ noon EDT and June 6 @10 a.m. EDT

To register, visit:
http://www.corning.com/lifesciences/news_center/web_seminars/

ATCC®

Cell Culture Tip #5



Media matters!

Media by the same name from different manufacturers may have subtle, but important differences in their compositions. Such differences may alter or disturb cell growth as well as morphology — potentially resulting in downtime with no cells for your experiments.

There are several media suppliers, but only ATCC thoroughly investigates and identifies specific requirements for thousands of individual cell lines to ensure optimal and reproducible cell culturing (ATCC distributes over 3,600 cell lines).

REMEDY Use ATCC High-Performance Media containing specific component concentrations which are based on extensive evaluation of growth and viability of individual cell lines.

RESULTS Robust cell growth with minimal cell loss especially when reviving cells from cryopreservation. Cell cultures grow in a continuous and consistent manner, providing a supply of cells when needed.

To learn more, contact ATCC today to order and/or download the document *High-Performance Media and Sera*.

www.atcc.org/media.cfm
800-638-6597

P.O. Box 1549
Manassas, VA 20108

For Genuine ATCC Cell Cultures™ contact ATCC or an authorized distributor.

Note to ATCC Connection Readers

Accompanying this issue of *ATCC Connection*, ATCC is sharing with you an article recently published in *Science* (Vol. 315, no. 5814, pp. 928-931) that considers the topics of cell line contamination and misidentification historically as well as in a current context. ATCC has long recognized the problems of culture contamination and misidentification in research and has been working to address this problem. The article on pp. 2-4 of this issue ("ATCC recommends cell line verification tests and guidelines for publishing") is intended as a step toward generating consensus about a minimal level of testing required to confirm cell culture identity and purity. ATCC welcomes your thoughts and opinions on the matter. Please give us feedback on the "ATCC suggestions" article by filling out a brief survey. To access it, type the following URL into your Web browser: www.atcc.org/cellSurvey.cfm. Thank you for your interest.

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An authenticated, ATCC Genuine Culture™ from ATCC (or an authorized international distributor) is a direct, minimal-passage descendant of the original material deposited with ATCC and has been handled only by ATCC. Our system of maintaining seed stock and distribution stock — with quality control checks throughout the process — ensures this. These products are backed by the ATCC warranty and are covered by our expert technical support.

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Meetings and Conferences

ATCC will be attending the following meetings. Stop by and talk to an ATCC representative about how we can help your research.

American Association for Cancer Research
April 14-18, Los Angeles, CA

Biogen Idec/Novartis/MIT/Whitehead Institute
April 25, Boston, MA

Dana Farber Cancer Institute/Longwood Medical Center
April 26, Boston, MA

Merck Technology Symposia
May 9, Long Branch, NJ

University of Pennsylvania
May 10, Philadelphia, PA

Biomedical Research Equipment & Supplies Exhibit at Fort Detrick
May 16-17, Frederick, MD

American Society for Microbiology Meeting
May 21-25, Toronto, Canada

Harvard University Medical School
June 13, Boston, MA

Abbott Pharmaceuticals/UMASS Medical School
June 14, Boston, MA

International Association for Food Protection
July 8-11, Lake Buena Vista, FL

American Society of Virology Meeting
July 14-18, Corvallis, OR

Proper credit for the image on p.2 of the Winter 2006 *ATCC Connection* was omitted inadvertently. The image was courtesy of Christine M. Szymanski, PhD, Institute for Biological Sciences, Molecular Pathogenesis National Research Council of Canada, Ottawa, Ontario.