



CELL LINES UNVEILED: A CONCISE REVIEW

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ABSTRACT

Cell lines have revolutionized research project that are used in vaccine production, testing drug metabolism and cytotoxicity, antibody production, study of gene function, generation of artificial tissues and synthesis of biological compounds e.g., therapeutic proteins.

INTRODUCTION AND DEFINITION

Cell line is a general term that applies to a defined population of cells that can be maintained in culture for an extended period of time, retaining stability of certain phenotypes and functions.

Culture of animal cells that can be propagated repeatedly and sometimes indefinitely and arise from primary cell cultures.

The primary cultures are initiated directly from the cells, tissues, or organs of animals and are typically used in experiments within a few days.

Some Commonly Used Cell Lines	
Cell line*	Cell type and origin
3T3	Fibroblast (mouse)
BHK21	Fibroblast (Syrian hamster)
MDCK	Epithelial cell (dog)
HeLa	Epithelial cell (human)
PtK1	Epithelial cell (rat kangaroo)
L6	Myoblast (rat)
PC12	Chromaffin cell (rat)
SP2	Plasma cell (mouse)
COS	Kidney (monkey)
293	Kidney (human); transformed with adenovirus
CHO	Ovary (Chinese hamster)
DT40	Lymphoma cell for efficient targeted recombination (chick)
R1	Embryonic stem cell (mouse)
E14.1	Embryonic stem cell (mouse)
H1, H9	Embryonic stem cell (human)
S2	Macrophage-like cell (<i>Drosophila</i>)
BY2	Undifferentiated meristematic cell (tobacco)

*Many of these cell lines were derived from tumors. All of them are capable of indefinite replication in culture and express at least some of the special characteristics of their cells of origin.

Immortalized cell lines

Immortalized cell lines are derived from cells that have undergone certain genetic changes that permit them indefinite proliferation as long as their metabolic requirements are satisfied. They have chromosomal abnormalities or mutations that let them to repeatedly divide, like tumors and eventually refill the dish or flask during which they're growing.

Such cell lines can be used to overcome some of the source limitations of current cell culture technology. Safety is a concern when using these cell lines, because immortalized cells exhibit some of the properties of neoplastically transformed cells, and partially transformed cells has predisposition to become fully neoplastic cells that are capable of forming tumors in the recipient. HeLa cells are an example of an immortal cell line. These are human epithelial cells obtained from fatal cervical carcinoma transformed by human papilloma virus 18 (HPV18).

Indefinite cell line

Cell lines obtained from *in vitro* transformed cell lines or cancerous cells are indefinite cell lines and can be grown in monolayer or suspension form. These cells divide rapidly with a generation time of 12 to 14 hours and have a potential to be sub-cultured indefinitely. They may exhibit aneuploidy or heteroploidy due to an altered chromosome number and has altered growth properties. Indefinite cell lines are easy to manipulate and maintain. However, these cell lines have a tendency to change over a period of time.

Cell Culture and Establishment of cell lines

- Cell culture and cell lines have assumed an important role in studying physiological, pathophysiological, and differentiation processes of specific cells. It allows the examination of stepwise alterations in the structure, biology, and genetic makeup of the cell under controlled environments.
- This is especially valuable for complex tissues, such as the pancreas, which is composed of various cell types, where *in vivo* examination of individual cells is difficult. Tendency of human cells to undergo senescence after a certain cell division.
- Transfection of these cells with the *E6E7* gene of human papilloma virus 16, or with the small and large T antigen of the simian virus 40, has partially overcome the senescence and has increased cell longevity *in vitro* but has not led to immortality of the cells. The introduction of these foreign genes alters the function of the host's regulatory genes including the inactivation of the tumor suppressor protein p53 and retinoblastoma protein pRb.
- Further studies in mice have shown that additional transfection with certain oncogenes such as *k-ras* has resulted in the malignant transformation of the cells.

- Another, recently discovered method to prolong the life span of human cell is the infection of cells with telomerase, an enzyme that prevents telomere loss by *de novo* addition and it restores the length of telomeres. So far, successful reports include immortalized fibroblasts and retinal and endothelial cells.

Advantages of cell culture

- Cell culture offers many research possibilities difficult or impossible to achieve *in vivo*.
- The effects and metabolism of certain drugs and toxins can be tested under various conditions in individual cells of a complex tissue.
- Growth rate can be controlled.
- Furthermore, cells can be manipulated by transfection to investigate the role of various genes in the physiology or malignancy of the cells.
- Cell lines are useful for defining therapeutic measures *in vitro* as well as after implantation of the cells into animals before the procedures can be applied to humans.

Types of cell lines

Finite cell lines

The cells in culture divide only a limited number of times, before their growth rate declines and die. The cell lines with limited culture life spans are referred to as **finite cell lines**.

Continuous cell lines

- A few cells in culture may achieve a different morphology and get altered. Such cells are capable of growing faster resulting in an independent culture has unlimited life. They are designated as continuous cell lines.
- The continuous cell lines are transformed, immortal and tumorigenic, may be obtained from normal primary cell cultures by treating them with chemical carcinogens or by infecting with cancer causing viruses.

Multipotency of PDLSC-like cell lines

- Cell lines had unique characteristics in multipotency *in vitro*: cell line 1–11 exhibited the potential to differentiate into osteoblastic and adipocytic cells, and cell line 1–17 performed osteoblastic, adipocytic, chondrocytic, and even neurocytic differentiations.
- These cell lines intrinsically originated from the same donor; however, the differentiation range of cell line 1–17 was wider than that of cell line 1–11. This suggests that PDLSCs at the various differentiation stages are localized in PDL tissue.

Diagnosis and Methods

Cultivation of virus

- A variety of animal and human cell lines are available and used for virus cultivation.

- Cell lines are the most convenient methods for virus cultivation in a laboratory.
- However, in a case where cell lines susceptible to the virus infection are unavailable, primary cells explanted directly from a living animal or human are the only choice for virus cultivation.

Tissue culture

- Animal viruses are typically grown by using tissue culture in laboratories.
- In most cases, cell lines, instead of tissue, are used.
- Cell lines referring to the immortalized cells have acquired the ability to proliferate indefinitely.

Primary cells

- Cells that are isolated directly from a subject are known as primary cells. With the exception of some derived from tumors, most primary cell cultures have a limited lifespan.
- Hence, primary cells can be maintained only for a month or so. Therefore, need to be prepared each time from a subject. Thus, it is impractical to use primary cells routinely for virus infection in most laboratories.
- One outstanding feature is that primary cells maintain almost all properties of tissues. For instance, none of hepatoma (liver cancer) cell lines available are susceptible to HBV infection, while primary hepatocytes isolated from an individual are susceptible to HBV infection.
- It is believed that the viral receptor essential for HBV infection is not expressed in hepatoma cell lines, but expressed in primary cells.

CONCLUSION

Cell lines and Cell culture have provided some information on physiological and pathophysiological processes of various cell types. So far, most of the findings are based on the cultured cells of rodents. The advancement of tissue culture techniques and molecular biology offers steady progress in this important line of research.

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