Lec4 \ Cell Culture Techniques

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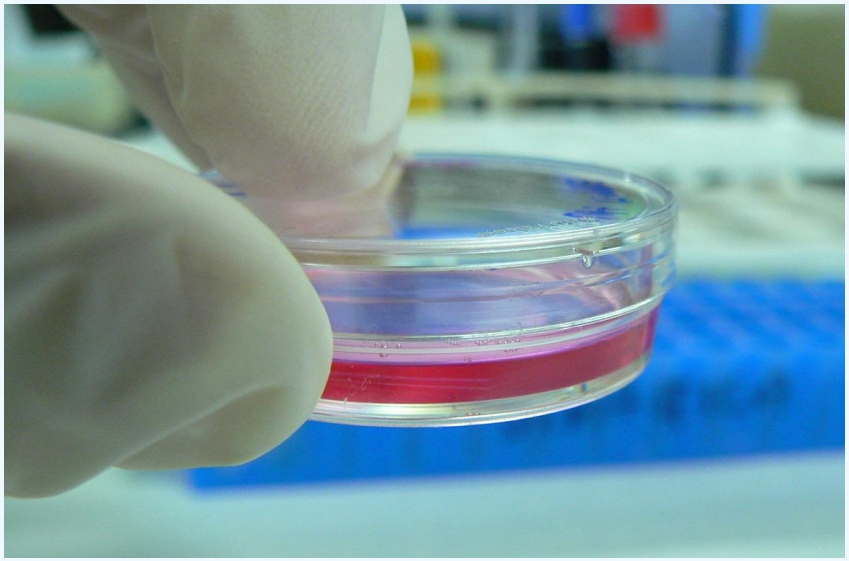
cell line

Cell culture is the process by which cells are grown under controlled conditions, generally outside their natural environment



Cell line

Most cells require a surface or an artificial substrate (adherent or monolayer culture), whereas others can be grown free floating in culture medium (suspension culture). The lifespan of most cells is genetically determined, but some cell culturing cells have been "transformed" into immortal cells which will reproduce indefinitely if the optimal conditions are provided.

Cell strains: سلالات الخلايا

Cell strains are cells that have been adapted to culture but, unlike cell lines, have a finite division potential. Non-immortalized cells stop dividing after 40 to 60 population doublings and, after this, they lose their ability to proliferate, which is a genetically determined event known as senescence.

A cell strain is derived either from a primary culture or subpopulation of a cell line by the selection or cloning of cells having specific properties or characteristics which must be defined. A cell strain often acquires additional genetic changes subsequent to the initiation of the parent line.

Finite and continuous cell line :

Normal cells usually divide only a limited number of times before losing their ability to proliferate and reach senescence (aging); these cell lines are known as finite. However, some cell lines become **immortal** through a process called transformation, which can occur spontaneously or can be **chemically or virally induced**. When a finite cell line undergoes transformation and acquires the ability to divide indefinitely, it becomes a **continuous cell line.**

Finite and continuous cell line :

Attempts have been made to culture almost every tissue, including neuronal cells, bone, cartilage and hair cells. However, **human fibroblasts are easier** to culture than epithelial cells. Different epithelial cells show different responses to culture conditions.

Reasons for failure or difficulty in epithelial tissue culture
سبب فشل او صعوبة زراعة الانسجة الظهارية

Despite advances in culturing techniques, human epithelial cells could not be maintained in culture for long time periods. The problem is the tendency of human cells to undergo senescence after a certain cell division.

There are two types of Cell Line or Cell Strain:

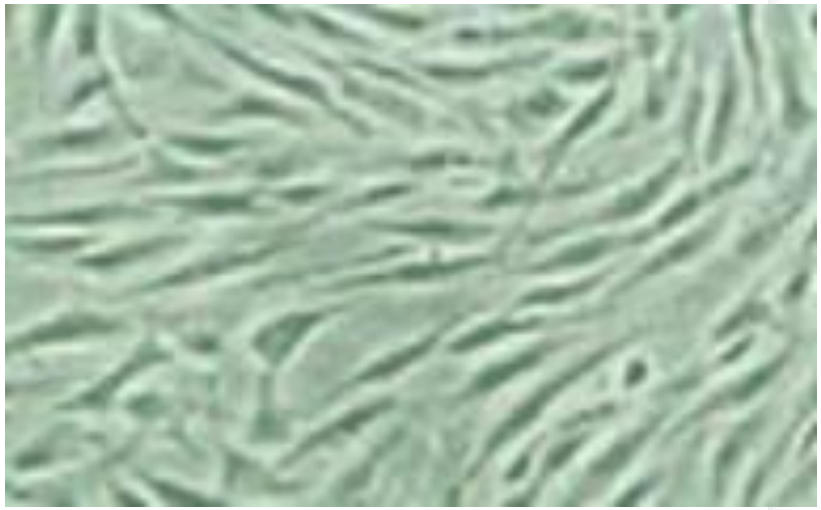
Finite cell Lines	Continuous Cell Lines
• Have a limited life span	• Have unlimited life span, Exhibit heterogeneity
• They grow in monolayer form	• They grow in monolayer or suspension form
• Exhibit the property of contact inhibition	• Absence of contact inhibition
• The growth rate is slow	• The growth rate is rapid
• The doubling time is around 24-96 hours	• The doubling time is 12-24 hours

Morphology of Cells in culture:

Cells in culture can be divided into three basic categories based on their shape and appearance (morphology).

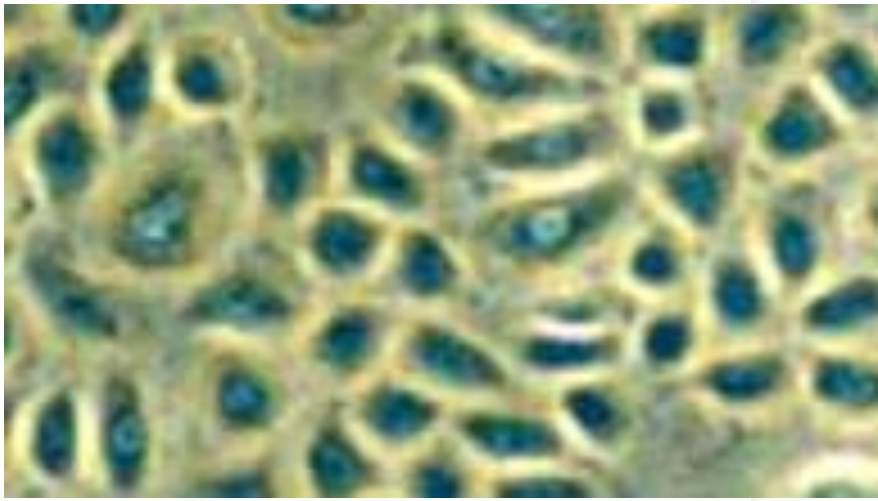
Morphology of Cells in culture:

1. **Fibroblastic (or fibroblast-like) cells: they are bipolar or multipolar, have elongated shapes, and grow attached to a substrate.**



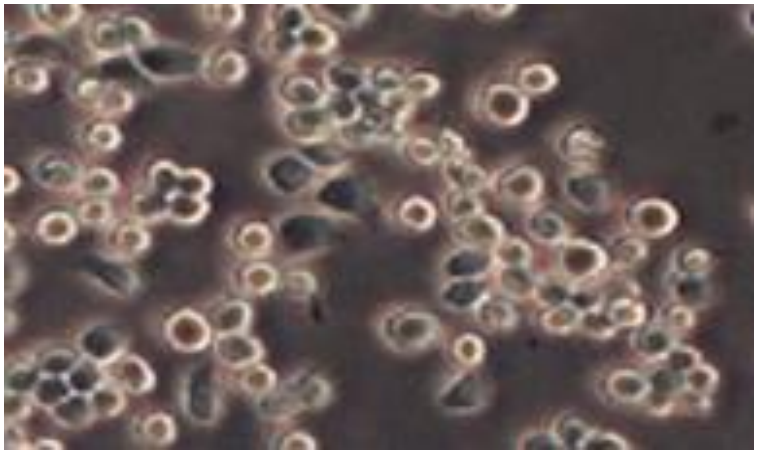
Morphology of Cells in culture:

2. Epithelial-like cells: they are polygonal in shape with more regular dimensions, and grow attached to a substrate in discrete patches.



Morphology of Cells in culture:

3. Lymphoblast-like cells: they are spherical in shape and usually grown in suspension without attaching to a surface.



cell culture in two and three dimensional :

Research in tissue engineering, stem cells and molecular biology primarily involves cultures of cells on flat plastic dishes. This technique is known as two-dimensional (2D) cell culture.

From the advance of polymer technology, today's standard plastic dish (commonly known as the Petri dish) had arose for the 2D cell culture. However, various researchers today also utilize laboratory culture flasks and conicals.

cell culture in two and three dimensional :

In addition, cell culture in three dimensions (3D) has been described as "Biology's New Dimension". Currently, there is an increase in the use of 3D cell cultures in research areas, including drug discovery, cancer biology, regenerative medicine, nanomaterials assessment and basic life science research.

Petri Dishes

Different sizes of cell culture flasks

cell culture in two and three dimensional :

The 3D cell culture is unlike 2D cell culture environments; it is an artificially created environment in which cells are permitted to grow or interact with their surroundings in vitro in all three dimensions, similar to how they would in vivo.

The 3D cultures are usually grown in bioreactors, small capsules in which the cells can grow into spheroids, or 3D cell colonies. Approximately 300 spheroids are usually cultured per bioreactor.

Samples of Bioreactors

Sample of Bioreactor