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# Cell Biology Biochemicals for Cell Growth

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## Abstract

Cell cycle is a highly ordered process that results in the duplication and transmission of genetic information from one generation to the next.

The cell cycle is divided into various phases

1. G1
2. S phase
3. G2
4. M phase.

Interrupting every two mitotic phases, an interphase exists comprising of G1, S and G2 phases. Both extracellular and intracellular signals are responsible for governing the cells to progress through different stages of cell cycle. The G1 phase is associated with the cell growth. It is the preparatory phase for DNA synthesis. The S phase is devoted to DNA synthesis while G2 is another growth phase. The M phase comprises of the following stages sequentially:

1. Prophase: The replicated chromosomes condense and the mitotic spindle begins to assemble outside the nucleus. 2. Prometaphase: The membrane surrounding the nucleus (nuclear envelope) breaks down and allows the mitotic spindle to contact the chromosomes. 3. Metaphase: All the chromosomes are gathered at the center of the cell i.e. equatorial plate 4. Anaphase: The chromosomes are split apart and pulled towards opposite sides of the cell. 5. Telophase: The nuclear envelope reassembles around the two new sets of separated chromosomes to form two nuclei. 6. Cytokinesis: The last phase in which the other components of the cell, membranes, cytoskeleton, organelles, and soluble proteins, are distributed to the two daughter cells through a process called cytokinesis

**Keywords:** Cell; Phases; DNA; Synthesis

## Introduction

**Regulation and control of cell cycle:** The regulation of the cell cycle must ensure that the events in each phase are complete before moving to the next. Thus checkpoints for monitoring the integrity of DNA are strategically placed in late G1 and at G2/M interface to prevent progression and propagation of mutated or damaged cells. G0 refers to cells that are quiescent (temporarily or permanently out of cycle). The normal cell is dependent on external stimuli (mitogens or growth factors) to move it out of 2 G0 and through the early part of G1.Cells have evolved many mechanisms that monitor various discrepancies occurring during their cell cycle, e.g. a fatal DNA damage. Because errors encoded in the genome may result in defective clones, close monitoring of the cell cycle for abnormal programming is mandatory.

## Defective Cell Cancer

The cells tend to remain in the cell cycle machinery are such alterations is mutation in the genes involved in cell cycle regulation. The hallmark of the transformed state (cancerous state) is incompetent checkpoint control, resulting in aberrant responses to cellular damage. For example, damage to DNA or the spindle apparatus normally triggers cell cycle arrest or apoptosis, depending on the degree of damage and the cellular context. Cell cycle arrest most frequently occurs at the G1/S or G2/M boundaries. When checkpoint arrest control is compromised, initiation of S phase or mitosis occurs despite cellular damage, and the ensuing genetic instability may lead to the eventual emergence of a cancerous clone.

## Cell and tissue culture techniques

Study of any particular type of cell in its natural environment is generally not possible because of various constraints like growth of other organisms, temperature, pH etc. So, the necessity of cell culture came into picture that involves growing of cells in artificial condition, in vitro.

1. Tissue culture – It is a very generic term involving the removal of cells, tissue or organs from animal/plant and subsequent incorporation into an artificial condition suitable for their growth. The liquid or semi liquid medium is supplied as the nutrients for their survival and growth.

2. Organ Culture involves the culture of whole organs or intact organ fragments with the aim of studying their function and development. When the cells are removed from the organ/tissue (thus disrupting their normal relationship with neighboring cells) and cultured in artificial condition, it is called Cell Culture.

## Cell Culture Systems

There are two basic systems used for growing cells:

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Suspension culture: cells divide and grow while floating in the culture medium 2. Monolayer culture: cells need the substratum for their growth and division.

Experimental Model System

Cell culture serves as a good model system for studying:

- The mechanism of basic cytological and biochemical processes taking place in any particular organism
- The host-pathogen interaction and its consequence
- Process of senescence
- Monoclonal antibodies
- Vaccines
- Hormones
- Other useful proteins

## Maintenance

Media and growth requirements

- Physiological parameters
- pH= 7.2-7.5
- osmolality of the medium must be maintained
- Temperature= 37°C
- Cells should be protected from direct light as it can produce toxic substances in the medium ii. Medium requirements:
- Na+, K+, Ca++, Mg++, Cl-, PO43-, HCO3- and $CO_2$
- Fe, Zn, Se (Trace elements)
- Glucose
- 13 essential amino acids
- Vitamins
- Choline, Inositol Serum – It contains various growth factors and hormones. Also, it neutralizes the adverse effect of trypsin and other proteases on the cells. Antibiotics - although not required for cell growth, antibiotics are often used to control the growth of unwanted bacterial and fungal contaminants.

Feeding – 2-3 times/week

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