

## **Applications of cell culture**

Cell culture is one of the major tools used in cellular and molecular biology, providing excellent model systems for studying the normal physiology and biochemistry of cells (e.g., metabolic studies, aging), the effects of drugs and toxic compounds on the cells and mutagenesis and carcinogenesis. It is also used in drug screening and development and large scale manufacturing of biological compounds (e.g., vaccines, therapeutic proteins). The major advantage of using cell culture for any of these applications is the consistency and reproducibility of results that can be obtained from using a batch of clonal cells.

### **I. Model System:**

Cell culture are used as model system to study basic cell biology and biochemistry, to study the interaction between cell and disease causing agents like bacteria, virus, to study the effect of drugs, to study the process of aging and also it is used to study triggers for ageing.

### **II. Cancer Research**

The basic difference between normal cell and cancer cell can be studied using animal cell culture technique, as both cells can be cultured in laboratory. Normal cells can be converted into cancer cells by using radiation, chemicals and viruses. Thus, the mechanism and cause of cancer can be studied. Cell culture can be used to determine the effective drugs for selectively destroy only cancer cells.

### **III. Virology**

Animal cell cultures are used to replicate the viruses instead of animals for the production of vaccine. Cell culture can also be used to detect and isolate viruses, and also to study growth and development cycle of viruses. It is also used to study the mode of infection.

### **IV. Toxicity Testing:**

Animal cell culture is used to study the effects of new drugs, cosmetics and chemicals on survival and growth of a number of types of cells. Especially liver and kidney cells. Cultured animal cells are also used to determine the maximum permissible dosage of new drugs.

### **V. Vaccine Production:**

Cultured animal cells are used in the production of viruses and these viruses are used to produce vaccines. For example vaccines for deadly diseases like polio, rabies, chicken pox, measles and hepatitis B are produced using animal cell culture.

#### **VI. Genetically Engineered Protein:**

Animal cell cultures are used to produce commercially important genetically engineered proteins such as monoclonal antibodies, insulin, hormones, and much more.

#### **VII. Replacement Tissue or Organ:**

Animal cell culture can be used as replacement tissue or organs. For example artificial skin can be produced using this technique to treat patients with burns and ulcers. However research is going on artificial organ culture such as liver, kidney and pancreas. Organ culture techniques and research are being conducted on both embryonic and adult stem cell culture. These cells have the capacity to differentiate into many different types of cells and organs. It is believed that by learning to control the development and differentiation of these cells may be used to treat variety of medical conditions.

#### **VIII. Genetic Counseling:**

Fetal cell culture extracted from pregnant women can be used to study or examine the abnormalities of chromosomes, genes using karyotyping, and these findings can be used in early detection of fetal disorders.

#### **IX. Genetic Engineering:**

Cultured animal cells can be used to introduce new genetic material like DNA or RNA into the cell. These can be used to study the expression of new genes and its effect on the health of the cell. Insect cells are used to produce commercially important proteins by infecting them with genetically altered baculoviruses.

#### **X. Gene Therapy:**

Cultured animal cells can be genetically altered and can be used in gene therapy technique. First cells are removed from the patient lacking a functional gene or missing a functional gene. These

genes are replaced by functional genes and altered cells are cultured and grown in laboratory condition. Then these altered cells are introduced into the patient. Another method is by using viral vector, functional gene is inserted into the genome of viral vector and then they are allowed to infect the patient, in the hope that the missing gene will be expressed with the help of the viral vector.

#### **XI. Drug Screening and Development:**

Animal cell cultures are used to study the cytotoxicity of new drugs. This is also used to find out the effective and safe dosage of new drugs. Now these tests are being conducted in 384 and 1536 well plates. Cell-based assay plays an important role in pharmaceutical industry.