1. Model Systems

Cell cultures provide a good model system for studying:

-basic cell biology and biochemistry

-the interactions between disease-causing agents and cells

-the effects of drugs on cells

-the process and triggers for aging

-nutritional studies

2. Toxicity Testing

-Cultured cells are widely used alone or in conjunction with animal tests to study the effects of new drugs, cosmetics and chemicals on survival and growth in a wide variety of cell types.

3. Cancer Research

-both normal cells and cancer cells can be grown in culture, the basic differences between them can be closely studied

-it is possible, by the use of chemicals, viruses and radiation, to convert normal cultured cells to cancer causing cells

-mechanisms that cause the change can be studied

-cultured cancer cells also serve as a test system to determine suitable drugs and methods for selectively destroying types of cancer

4. Virology

-replication of viruses in cell cultures (in place of animals) for use in vaccine production

-used in the clinical detection and isolation of viruses, as well as basic research into how they grow and infect organisms

5. Cell-Based Manufacturing

-large-scale production of cells that have been genetically engineered to produce proteins that have medicinal or commercial value (e.g. monoclonal antibodies, insulin, hormones)

-use of cells as replacement tissues and organs

->Artificial skin for use in treating burns and ulcers is the first commercially available product.

6. Genetic Counseling

-Amniocentesis, a diagnostic technique that enables doctors to remove and culture fetal cells from pregnant women, has given doctors an important tool for the early diagnosis of fetal disorders.

-These cells can then be examined for abnormalities in their chromosomes and genes using karyotyping, chromosome painting and other molecular techniques.

7. Genetic Engineering

-The ability to transfect or reprogram cultured cells with new genetic material (DNA and genes) has provided a major tool to molecular biologists wishing to study the cellular effects of the expression of these genes (new proteins).

-These techniques can also be used to produce these new proteins in large quantity in cultured cells for further study.

8. Gene Therapy

-Cells can be removed from a patient lacking a functional gene and the missing or damaged gene can then be replaced.

-The cells can be grown for a while in culture and then replaced into the patient.

-An alternative approach is to place the missing gene into a viral vector and then 'infect' the patient with the virus in the hope that the missing gene will then be expressed in the patient's cells.

Purpose:

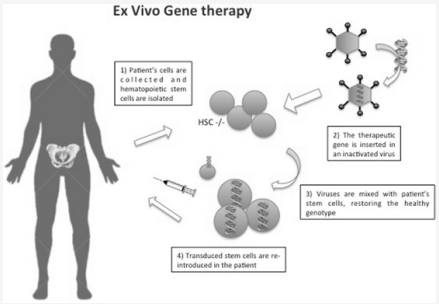
1. Swapping harmful mutant alleles with functional ones by selective reverse mutation.

2. Deactivating improperly functioning mutated gene.

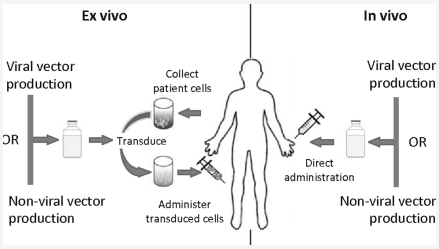
3. Inserting a new gene into the body to help battle a disease.

4. Interchanging non-functional gene with normal gene through homologous recombination.

Ex Vivo Gene Theraphy



In vivo and ex vivo Gene Therapy



9. Vaccine Production

-ability to grow large amounts of virus in cell culture eventually led to the creation of vaccines

-In early times, researchers had to use live animals to grow poliovirus, but due to the development of cell culture technique they were able to achieve much greater control over virus production and on a much larger scale which eventually develop vaccines and various treatments.

Vaccine Production

10. Immunological Studies

-Cell culture techniques are used to know the working of various immune cells, cytokines, lymphoid cells, and interaction between disease causing agent and host cell.

11. Medicine Production

Proteins	Animal Cell Line used	Therapeutic use
Erythropoietin (EPO)	CHO cells	Anemia
Factor VIII	CHO cells	Hemophilia A
Factor IX	CHO cells	Hemophilia B
Follicle Stimulating Hormone (FSH)	CHO cells	Infertility
Human Growth Hormone (hGH)	CHO cells	GH deficiency
Interleukin 2 (IL2)	CHO cells	Cancer therapy
Tissue Plasminogen Activator (t-PA)	CHO cells	Stroke
Monoclonal antibodies (mAbs)	Hybridoma cells	Cancer therapy & Autoimmune diseases

Several medically important protein pharmaceuticals have been produced using animal cell culture and recombinant DNA technology.

Proteins

Check Lecture Notes Chapter 14 for the protein details.