

Therapeutic Peptides

Study on Controlled and Site Specified Delivery of Therapeutic Peptides and Proteins

Introduction

- Therapeutic peptides and proteins are medicines made of amino acids, such as insulin, growth hormones, and antibodies.
- They are used to treat many diseases.
- However, these molecules are very sensitive and can be easily broken down inside the body, so special delivery methods are needed.

Need for Controlled Drug Delivery

- **Controlled delivery** means releasing the drug slowly over time at a desired rate.
- **Importance**
 - Maintains a constant drug level in the body
 - Reduces the number of doses required
 - Improves patient comfort
 - Minimizes side effects
 - Increase treatment effectiveness

Need for Site-Specific Drug Delivery

- **Site-specific delivery** means delivering the drug directly to the target tissue or organ.
- **Importance**
 - Increases drug effectiveness
 - Reduces damage to healthy tissues
 - Minimizes side effects

Challenges in Delivery

- Peptides and proteins can be destroyed by enzymes (especially in digestion)
- Poor absorption across cell membranes
- Short half-life (removed quickly from the body)

Routes of Administration

1. Oral Route

- Drug is taken by mouth
- Not suitable for most peptides because they are digested in the stomach

2. Injectable Route

- Includes intravenous, intramuscular, and subcutaneous injections
- Most common method for protein drugs
- Allows direct entry into the bloodstream

3. Nasal Route

- Drug is delivered through the nose
- Avoids digestion
- Allows fast absorption

4. Transdermal Route

- Drug is delivered through the skin using patches
- Provides slow and controlled release

5. Pulmonary Route

- Drug is inhaled into the lungs
- Rapid absorption due to large surface area

Methods for Controlled and Targeted Delivery

A. Sustained Release Systems

- Drug is released slowly over a long period
- Uses special materials like polymers

B. Encapsulation

- Drug is enclosed in carriers like liposomes or nanoparticles
- Protects the drug from degradation

C. Implantable Devices

- Small devices placed inside the body
- Release drug gradually over time

Advanced Drug Delivery Systems

1. Liposomes

- Small lipid vesicles
- Carry drugs and release them slowly

2. Nanoparticles

- Very small carriers

- Improve stability and enable targeted delivery

3. Hydrogels

- Water-containing materials
- Provide controlled drug release

4. Biodegradable Polymers

- Break down slowly in the body
- Release drug over time

Techniques for Site-Specific Delivery

A. Targeted Carriers

- Drugs attached to carriers like antibodies or nanoparticles
- Deliver drugs to specific cells

B. Receptor-Mediated Targeting

- Drug binds to specific receptors on target cells
- Ensures selective delivery

C. pH-Sensitive Systems

- Drug release occurs only in specific pH conditions
- Useful for tumors or stomach environments

Solutions to Delivery Challenges

- Use of protective carriers (liposomes, nanoparticles)
- Chemical modification of peptides
- Use of advanced delivery systems

Applications

- Treatment of diabetes, cancer, and hormonal disorders
- Targeted drug delivery systems
- Improves effectiveness of protein-based medicines

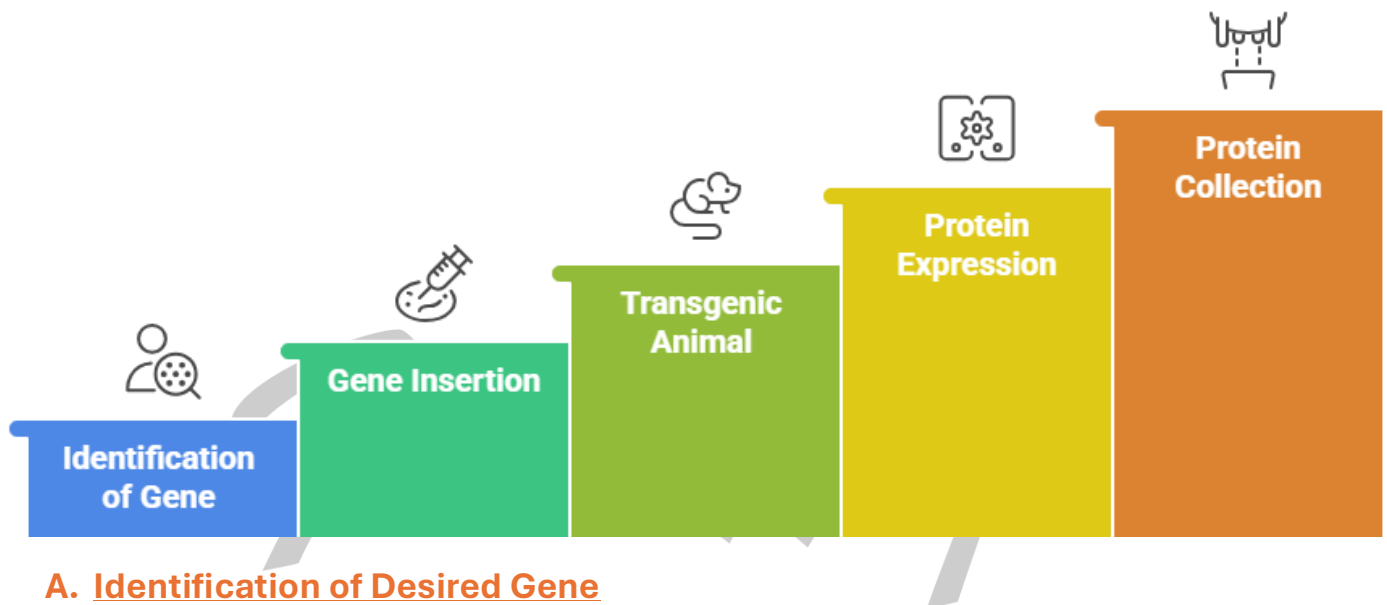
Transgenic Animals

Production of Useful Proteins in Transgenic Animals

Introduction

- Transgenic animals are genetically modified animals used to produce useful proteins for medical and industrial purposes.
- This process is also known as **biopharming**. Common animals used include cows, goats, and sheep.

Steps in Production



A. Identification of Desired Gene

- The gene responsible for a useful protein is selected.

B. Gene Insertion

- The gene is inserted into the animal's embryo using genetic engineering techniques.

C. Development of Transgenic Animal

- The embryo is placed into a female animal.

D. Expression of Protein

- The inserted gene produces the desired protein in the animal.

E. Collection of Protein

- Proteins are often collected from milk, blood, or eggs.

Examples

- Production of **human proteins in milk** of cows, goats, and sheep
- Production of **antithrombin** (prevents blood clotting) in goat milk
- Production of other therapeutic proteins for medical use

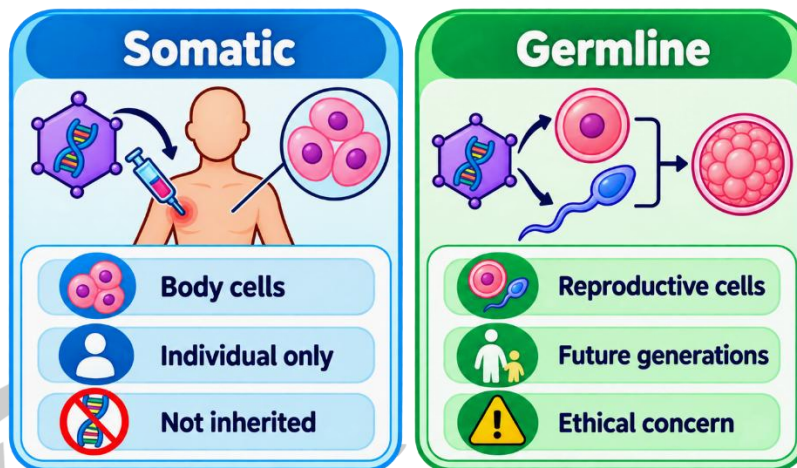
Advantages

- Large-scale production of proteins.
- Cost-effective compared to cell culture methods.
- Proper protein folding and modification.

Gene Therapy

- **Gene therapy** is a technique used to treat diseases by modifying or replacing defective genes.

Types of Gene Therapy



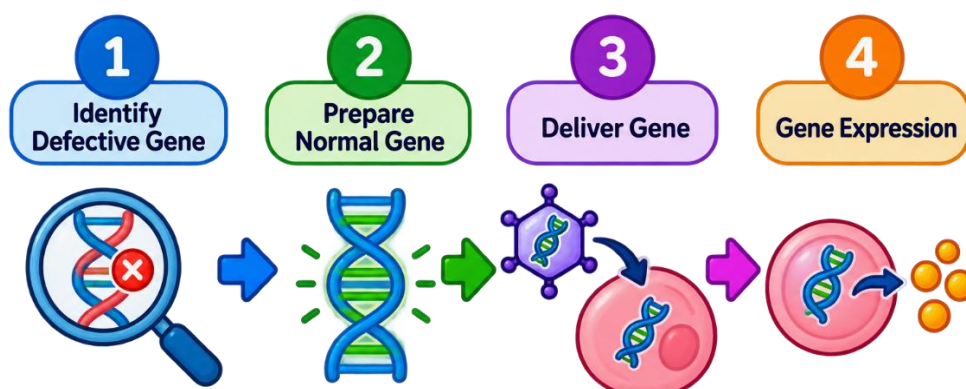
1. Somatic Gene Therapy

- Genes are introduced into body (non-reproductive) cells
- Effects are limited to the treated individual
- Not inherited

2. Germline Gene Therapy

- Genes are introduced into reproductive cells
- Changes can be passed to future generations
- Raises ethical concerns

Steps in Gene Therapy





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