

GENETICS

LESSON 12: GENETIC TECHNOLOGIES

Learning Outcomes

- I can describe different technologies used to manipulate genes.

Scientific Gene Manipulation

- in addition to using breeding practices to influence the genetic makeup of an individual or species, scientists can now directly modify or change the genetic code of an individual or species

1. Cloning

- producing an identical copy of an _____
- involves _____ the entire DNA within an egg with the DNA of the individual to be copied, and then _____ the new egg into a host mother

Dolly the sheep.

2. Gene Cloning

- producing many identical copies of a specific gene in a _____ host cell
- these copies can then be used for _____ or for making _____ organisms.

3. Transgenic Organisms

- the introduction of a _____ into an organism to introduce a new _____
- often done using _____ DNA technologies (i.e., the method used for creating transgenic organisms) – using a _____ (often a manipulated virus) to inject the new gene.

- called _____ (GMO's)
 - Green fluorescent protein as a _____
 - golden rice – higher _____ and _____ content
 - tomatoes that can grow in _____ climates
 - increased crop resistance to _____ or infections
 - _____ producing bacteria
 - modifying milk production in goats to produce human _____ products (growth hormones, anti-clotting factors, etc.)
 - more _____ pig organs for human transplant operations

4. Reproductive Technologies

- procedure used to _____ the chance of becoming pregnant
- artificial _____
 - collection and concentration of _____ cells that are then placed into the female's _____
 - also used in _____ animals
- in vitro fertilization (i.e., test tube babies)
 - combining _____ and _____ cells in glassware for fertilization, allowing the embryos to start to grow, then _____ the embryo(s) into the mother's uterus
- intracytoplasmic sperm injection (form of in vitro fertilization)
 - directly _____ the sperm DNA into an egg for direct fertilization
 - embryo is _____ in mother's uterus

5. Gene Therapy

- replacing a missing or _____ gene with a healthy gene to cure a genetic disorder – this is _____ introducing genes from a different species
- used to _____ recognition of diseased cells to the _____ system
- new gene is _____ using a viral vector
- first _____ use in US
 - used to _____ a 4-year-old girl for ADA-SCID (a severe autoimmune deficiency disorder; called “_____ children”)
 - received injections every 2 months – achieved _____ success
- since then, there have been many _____ and some FDA and European Medicines Agency (EMA) approvals for gene therapy treatment
 - _____ treatment of ADA-SCID in multiple children
 - treatment of _____
 - treatment of _____ cell disease
 - treatment of _____ – loss of motor neurons leading to muscle wasting
 - treatment of simian _____ in monkeys
- Potential Gene Therapy for Spinal Cord Injury without Side Effects
 - _____ is the damage of nerves resulting in pain, numbness, tingling, and muscle dysfunction.
 - _____ (morphine, oxycodone (OxyContin), hydrocodone (Vicodin), methadone) commonly prescribed for pain management.
 - adverse effects, including severe withdrawal and dependence

- Gamma-aminobutyric acid (_____) is a neurotransmitter that suppresses nerve impulses between neurons (pain receptors in this case).
- _____ of GABA gene therapies (*gad65* and *vgat*) into _____ injury in mouse spine successfully blocked pain signaling in mouse injured area lasting for at least _____ post-treatment.