



Biotechnology

Your name | Teacher's name | School

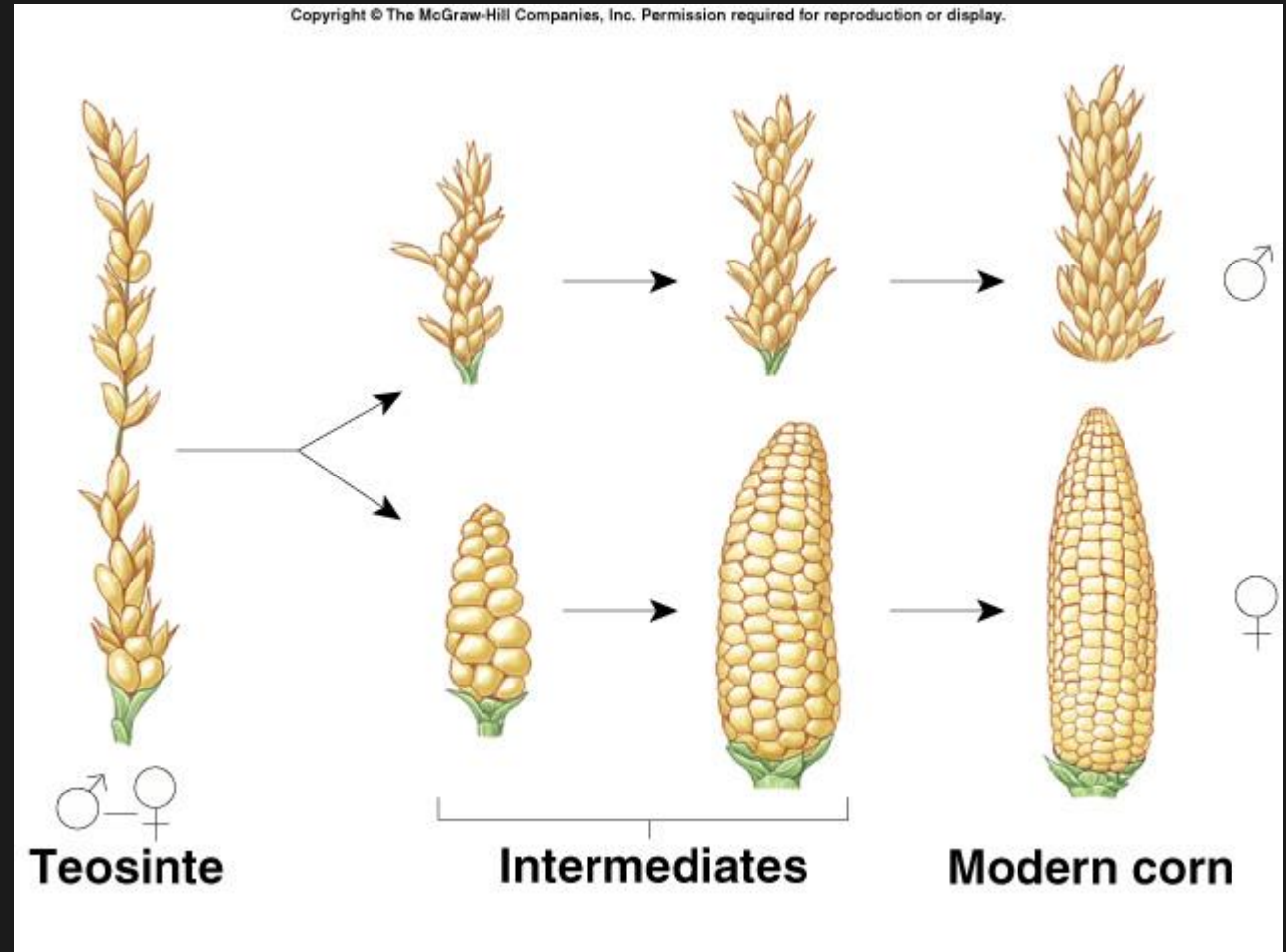
What is it?

A scientific method that relies on the study of living organisms (biology) and tools (technology).

Biotechnologies use living organisms (like bacteria) or substances that come from living organisms (genes) to meet a need or want.

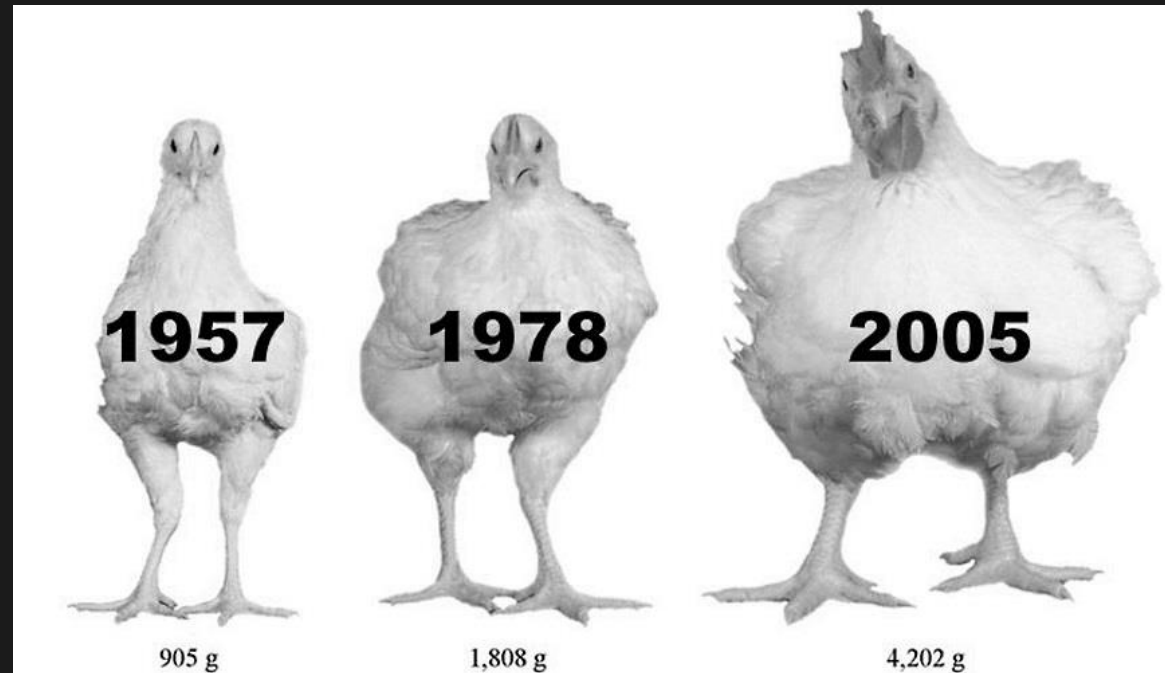
Farming

- 10 000 years ago, farmers realized certain plants had traits or characteristics that were advantageous. They tasted better, produced more fruit or were more resistant to disease.
- Farmers selected and bred these plants.
- This is called selective breeding.



Animals

- When humans first domesticated animals, they used the same methods of selective breeding. They were able to obtain cows that produced more milk, sheep that produced more wool, etc.



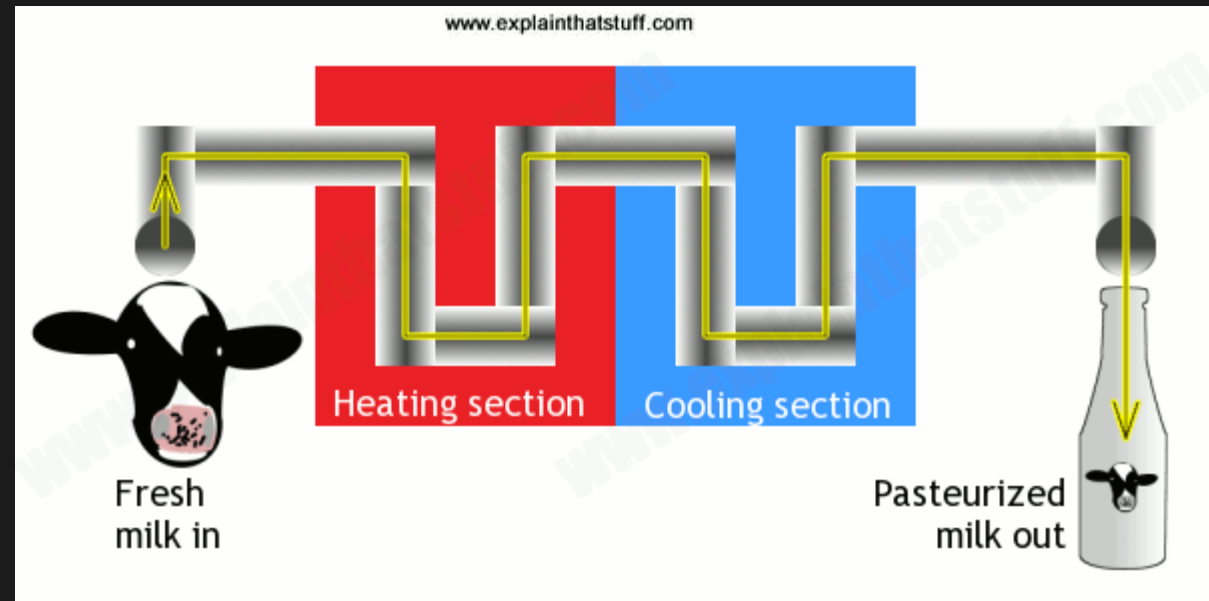
Food

- **Sometimes important discoveries happen by accident. An example of this was when people used to store milk in bags made from camel stomachs. It would turn into cheese.**



Modern Biotechnologies

- **Pasteurization: a process where food is heated for a period of time to destroy harmful microorganisms**
- **Food is pasteurized for the following reasons;**
- **It provides healthier food**
- **It prolongs the shelf-life of food**
- **Preserves the nutritional properties of food**
- **An example is the pasteurization of milk. Raw milk is heated at 78.8°C for six seconds and becomes pasteurization of milk.**



GMOs

Foods and animals can be genetically modified. This can improve many things (resistance to viruses or improvement of quality) but it can also have consequences.



Pros and Cons

Benefits

- Can produce desired results after only one generation
- Can transfer a useful gene from one species to another
- Can produce more nutritional foods
- Can produce less allergenic foods

Consequences

- Risk of creating new allergies
- Risk that GMOs hazardous to humans and other species could be accidentally created
- Risk that biodiversity will be compromised.

Vaccinations

- Vaccinations introduce weakened agents of a disease into the body. This way, the white blood cells can learn how to fight the disease (by creating antibodies) without people getting hurt or ill from the disease.



Vaccinations

Live Vaccine

Samples of infectious agents are chemically treated to remove the ability to cause illness.

Traditional Method

Culture (or sample) of infectious agent
↓
Chemical treatment of infectious agent to render it harmless
↓
Addition of agent to pharmaceutical products

Method Using Genetic Transformation

Genetic transformation of infectious agent
↓
Culture of modified infectious agent
↓
Addition of agent to pharmaceutical products.

Inactive Vaccine

Developed using only parts of an infectious agent, the antigens.

Traditional Method

Culture (or sample) of infectious agent
↓
Isolation of antigen
↓
Addition of antigen to pharmaceutical products

Method Using Genetic Transformation

Introduction of a gene causing production of desired antigens in a microorganism
↓
Culture of modified microorganism
↓
Isolation of antigen
↓
Addition of antigen to pharmaceutical products

Assisted Reproduction

- What is it?
- All medical procedures used to help women become pregnant.
- What's the purpose?
- People who are infertile (cannot naturally conceive a child) can become pregnant
- Animal Reproduction
- Preservation of the gene pool

Types of Assisted Reproduction

- **Ovarian Stimulation**

- Used for woman who rarely or never ovulate
- Medication stimulates ovaries into developing one or more mature follicles

- **Artificial Insemination**

- Used when sperm cannot pass through the cervix, or when the sperm count is low.
- Semen is injected directly into the uterus on the day of ovulation
- Semen can be treated prior to insemination to increase sperm count

Types of Assisted Reproduction

- **In Vitro Fertilization**

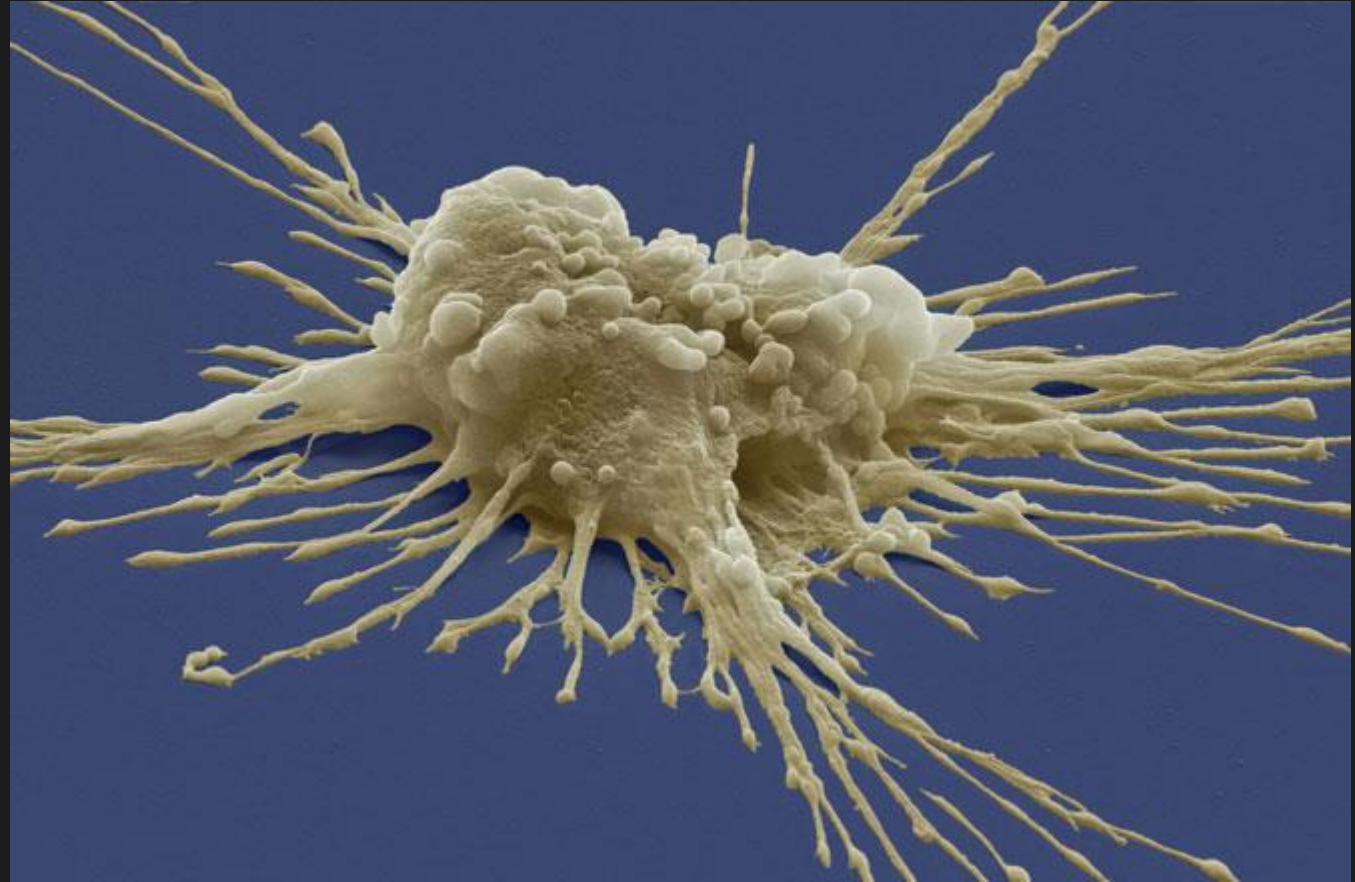
- The ovum is fertilized by a sperm cell in a lab (using a test tube or petri dish).
- The best embryos are implanted in the uterus to continue their development

- **Microinjection**

- Follows the same steps as in vitro fertilization except that a physician injects the sperm cells directly into the ova with a micro syringe.
- Used when fertilization poses a problem

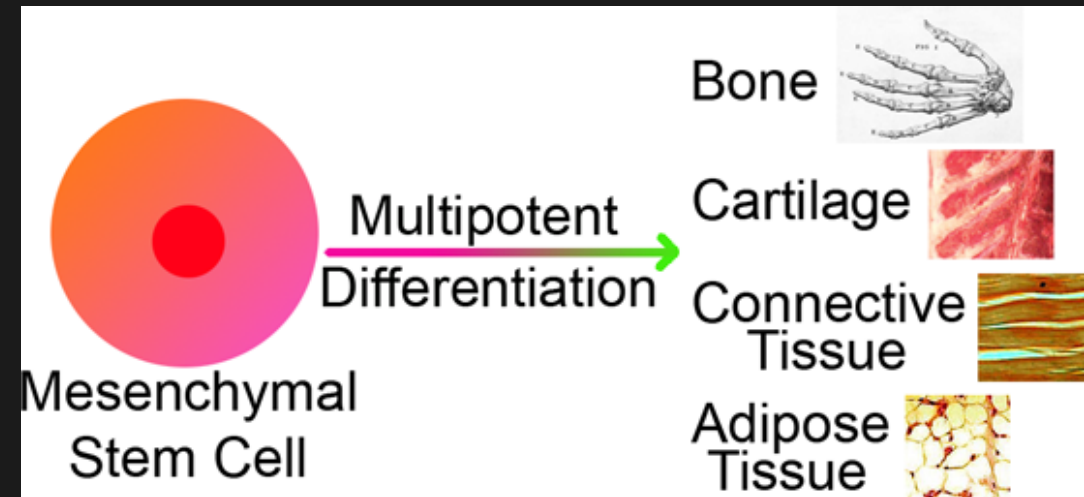
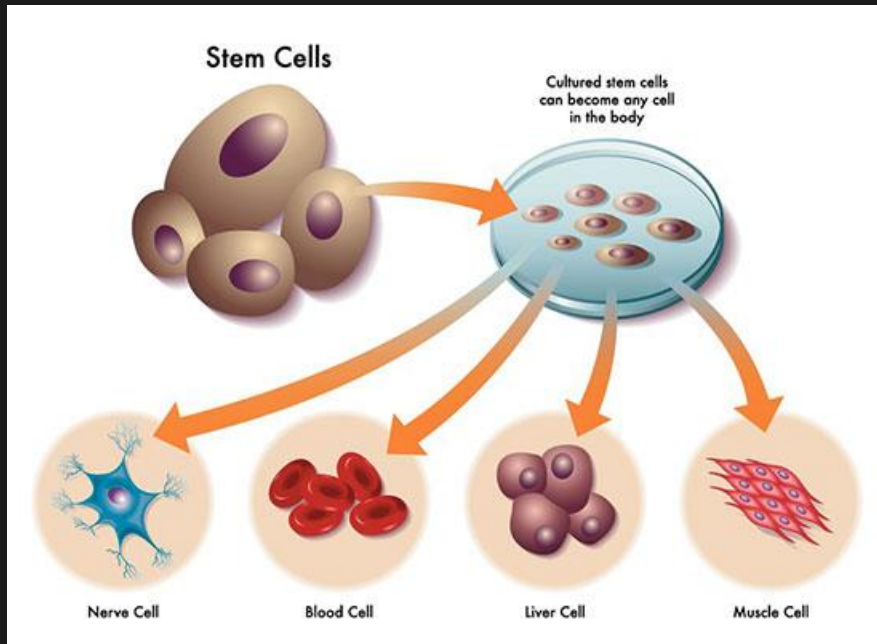
Stem Cells

- Stem cells are the body's master cells. Stem cells can renew themselves (a process called *self-renewal*), and they can also make a variety of other kinds of cells (liver cells, heart cells, skin cells, etc...)
- Stem cells can be obtained from the embryo, umbilical cord or placenta.



Why use stem cells?

- It can lead to the cure for certain diseases, can be used to form new tissues and cells.



Ethical Standards

- Mothers who donate embryos must do so of their own free will, and they need to know it will be used for stem cell research
- The umbilical cord and placenta can only be used if both parents consent.
- Embryos cannot be obtained through commercial transactions (no money can be involved).