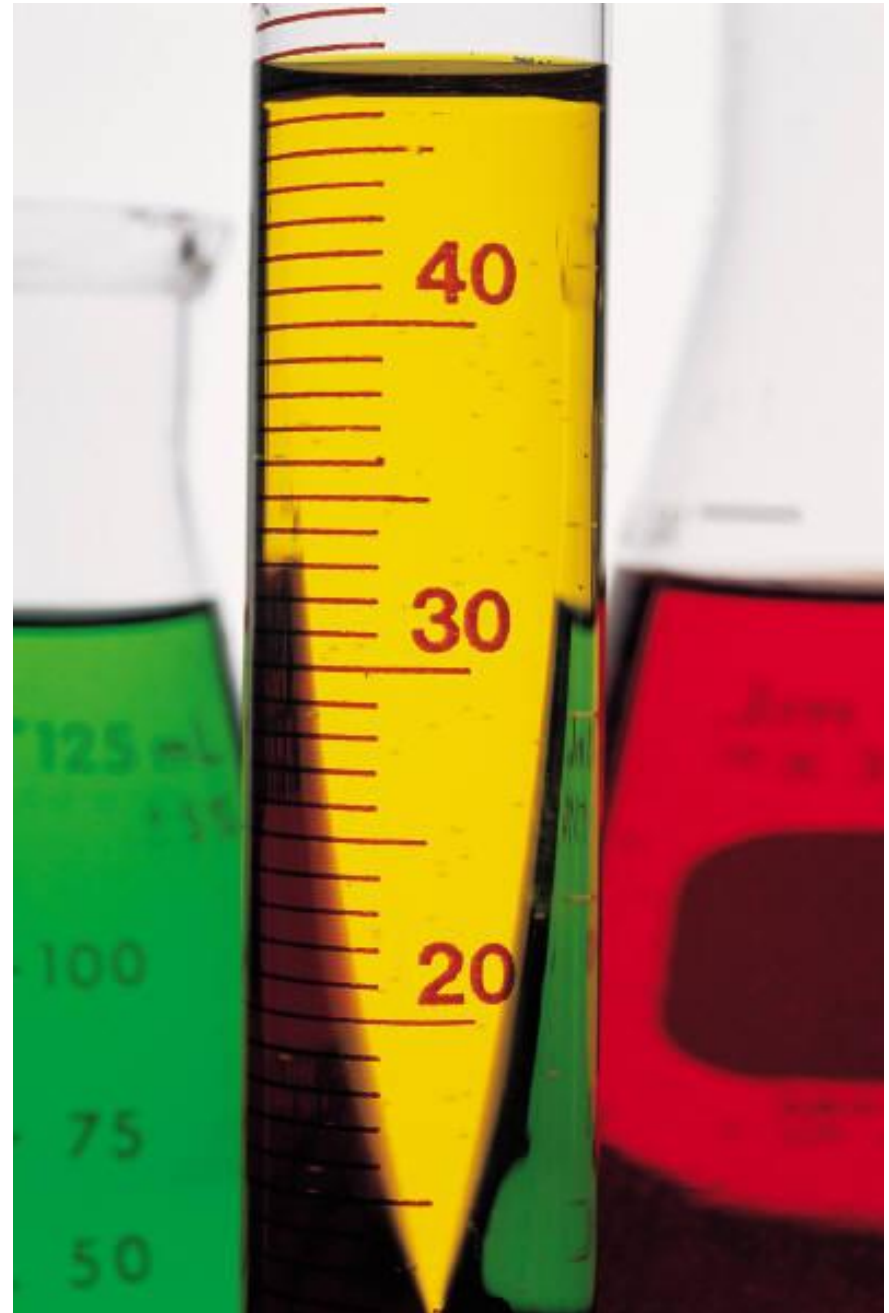
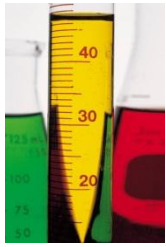


Introduction to Biotechnology

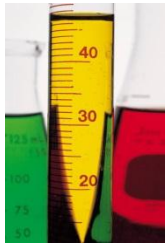
Competencies
7.00-8.00





What is Biotechnology?

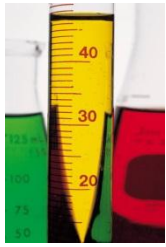
- **Biotechnology is the manipulation of living organisms and organic material to serve human needs.**
- **Examples:**
 - **Yeast in bread making and alcohol production**
 - **Use of beneficial bacteria (penicillin) to kill harmful organisms**
 - **Cloning of plants and animals**
 - **Artificial insemination**



Biotechnology Industry

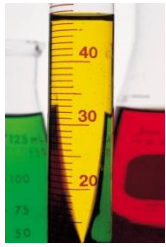
- **Research is conducted by small companies, large corporations, and public universities.**





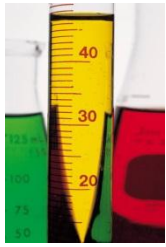
Biotechnology Industry

- **Funding comes from a variety of sources:**
 - **Public (government)**
 - **Private (companies and foundations)**
- **California passed a \$300 billion referendum for research in stem cells in 2004.**



Biotechnology Industry

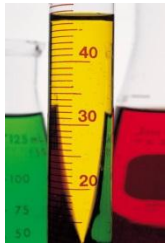
- **Focuses on a variety of research areas including:**
 - **Health/medicine**
 - **Food science**
 - **Environmental science**
 - **Agriscience**



Impact of Biotechnology

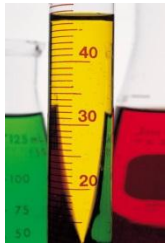
- **Genetically modified organisms (GMOs) are consumed by millions of people (especially Americans) EVERY DAY.**
 - **Almost 56% of all soybean plantings worldwide are genetically engineered (much higher in the US)**





Impact of Biotechnology

- **Genetically modified crops were produced on more than 167 million acres in 18 countries in 2003, a 15% increase from 2002**
 - **The US was the largest single producer with more than 60% of the total acreage in production.**

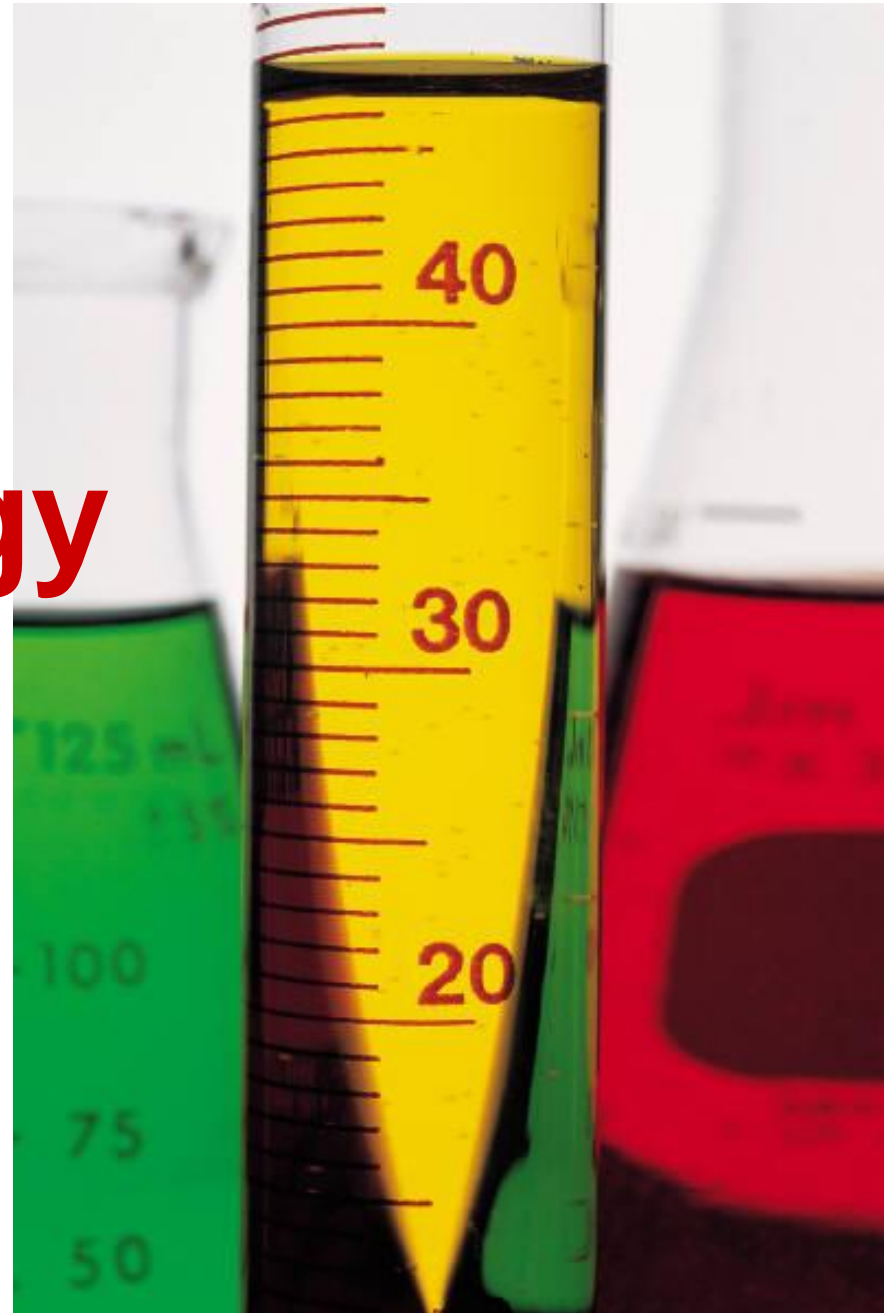


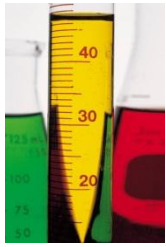
Impact of Biotechnology

- **The NC Biotechnology Center predicts that the biotechnology industry in the state will contribute more than \$25 billion in annual income each year within the next 25 years.**



Pioneers in Biotechnology

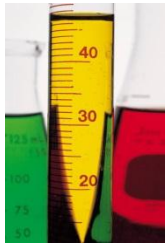




Antony van Leeuwenhoek

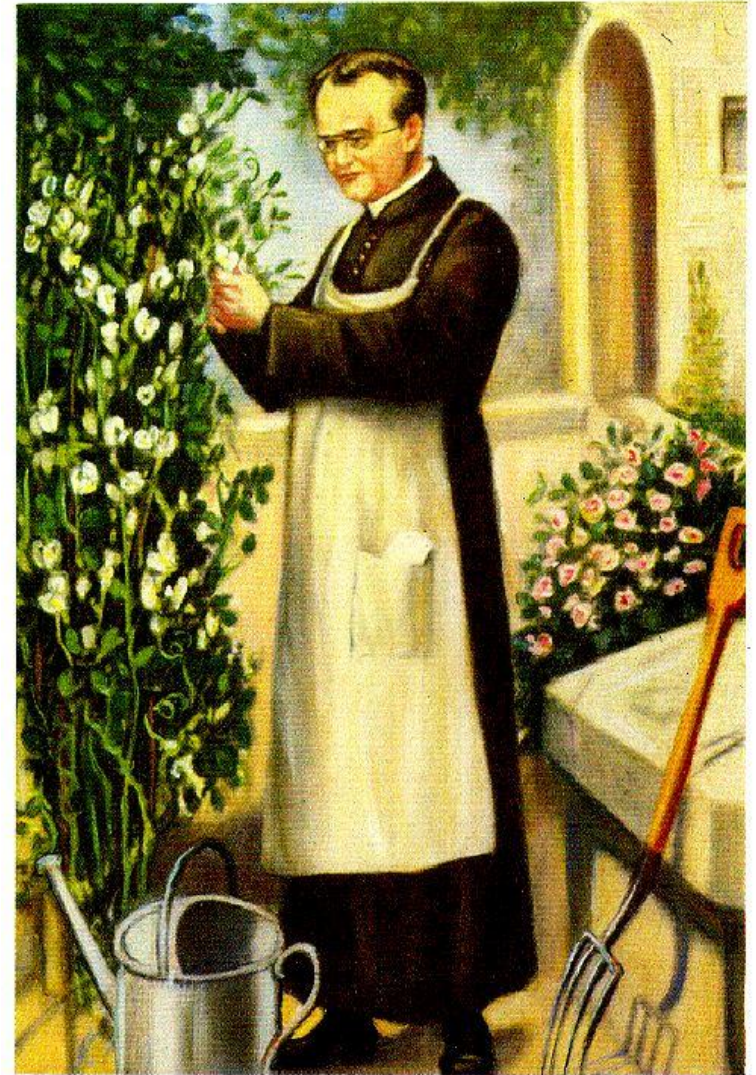
- **1675**
- **Discovers bacteria using a simple microscope**



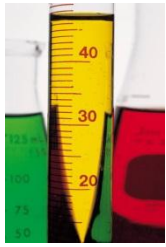


Gregor Mendel

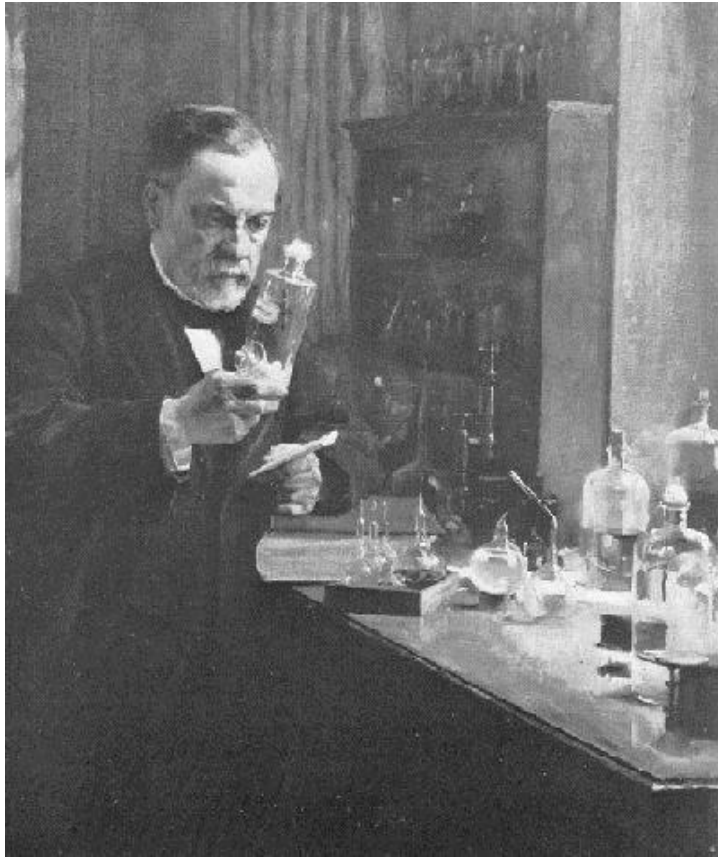
- 1863
- Austrian monk who conducted the first genetics experiments using pea plants in the mid 1800s.
- Often considered the founder of genetics.



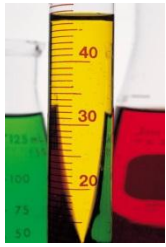
Gregor Mendel



Louis Pasteur



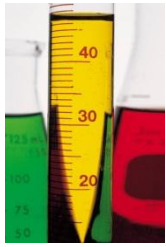
- 1870's
- Disproved the notion of spontaneous generation, describing the role of bacteria in spoilage and the scientific basis for fermentation
- Created the rabies vaccine



Robert Hooke

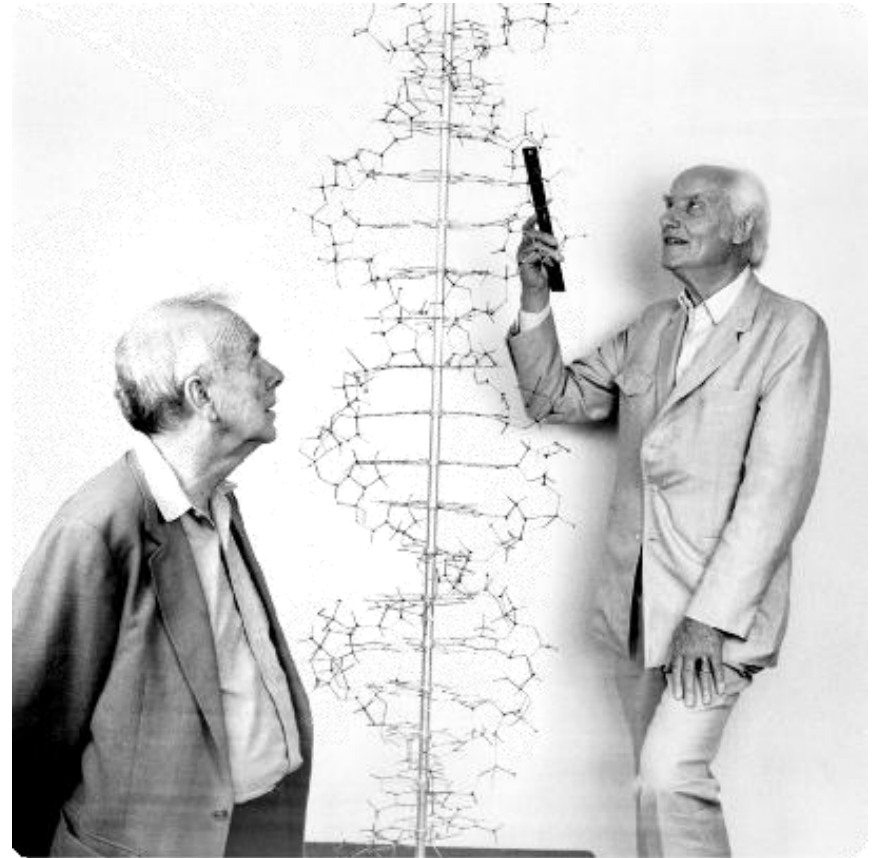
- **1665**
- **Invented the compound light microscope**
- **First to observe cells in cork**

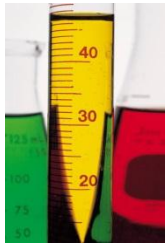




James Watson & Francis Crick

- **1953**
- **Englishmen responsible for the discovery of the double helix structure of DNA using X-ray photographs**



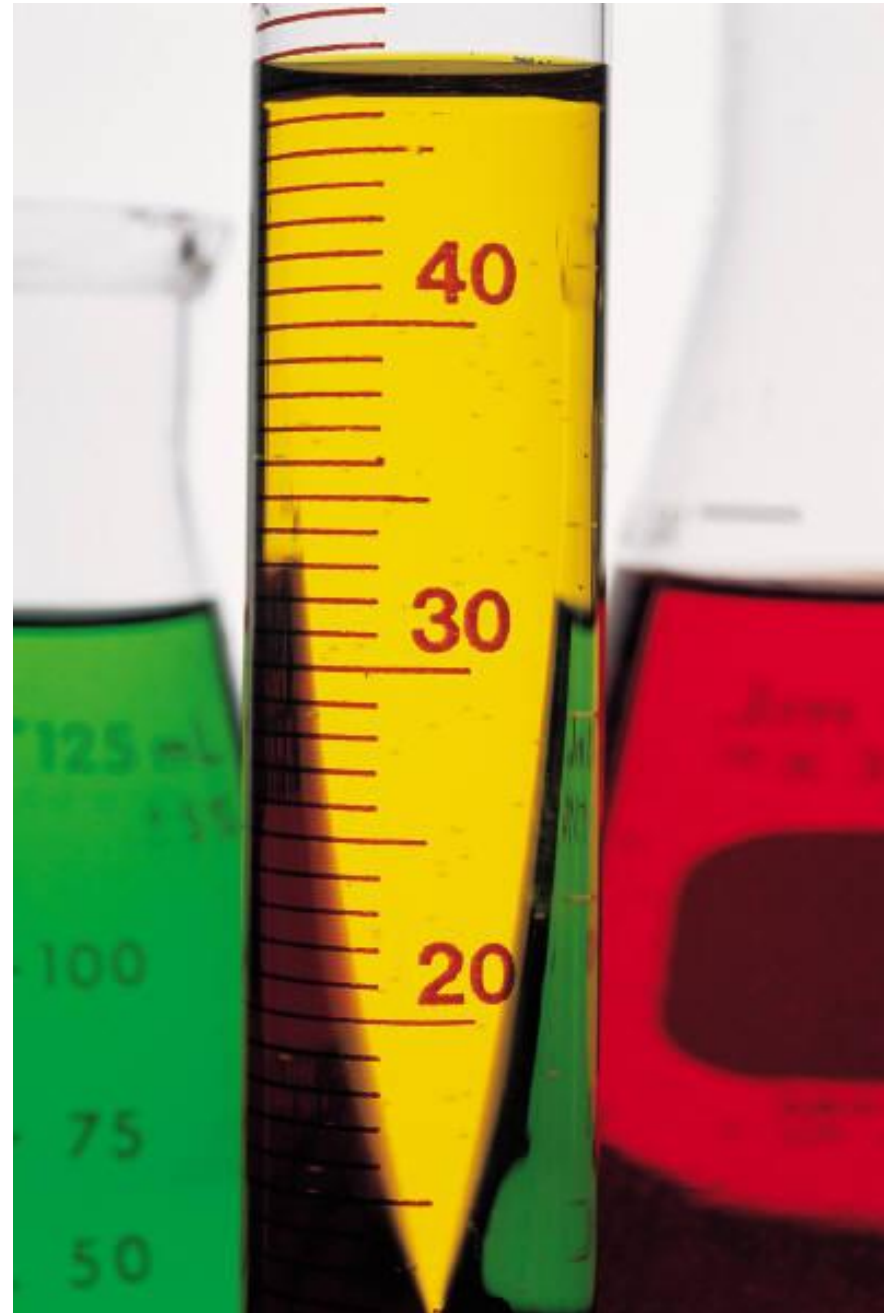


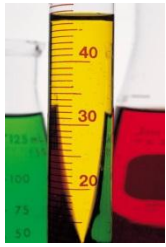
Paul Berg



- **1972**
- **Stanford University scientist who first developed recombinant DNA technology, a method for insertion of genetic material from one organism into another.**

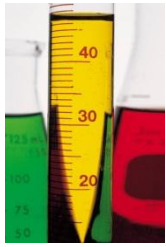
Historical Development of Biotechnology





1750 B.C.

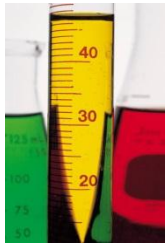
- **Origins of “biotechnology” emerge in methods of food production and plant and animal breeding**
 - **Use of bacteria to produce cheese (food preservation)**
 - **Use of natural enzymes in yogurt**
 - **Use of yeast to produce bread**
 - **Use of fermentation for producing wine and beer**



1869

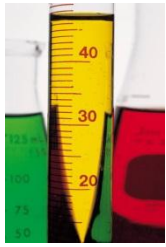
- **DNA is discovered in trout sperm by German Miescher**





1919

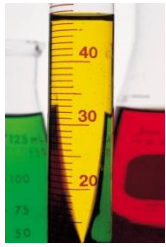
- **The word “biotechnology” is first used by a Hungarian agricultural engineer.**



1940's-1950's

- **Widespread work is undertaken to investigate the structure and function of DNA**

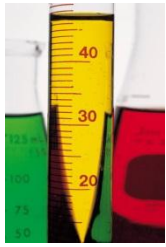




1980

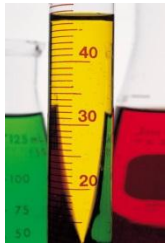


- **The U.S. Supreme Court approves the patenting of genetically altered organisms.**



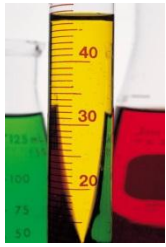
1980's-1990's

- **A variety of GMO's and biotechnology techniques are introduced in fields from agriculture to medicine**
 - **Recombinant DNA technology-extracts DNA from one organism for use in another, allowing more rapid and specific improvements in plants and animals**
 - **Plant Tissue Culture-gains widespread acceptance as a method to quickly and cheaply produce genetically identical plants**



1990's

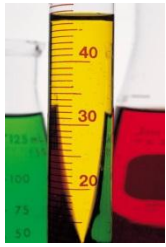
- **First transgenic organisms (GMO's) are introduced in widespread agricultural production, particularly in the area of crops.**
 - **Bt corn and soybeans are introduced offering “natural” insect resistance by the introduction of a gene from the bacterium *Baccillus thuringensis***



1997

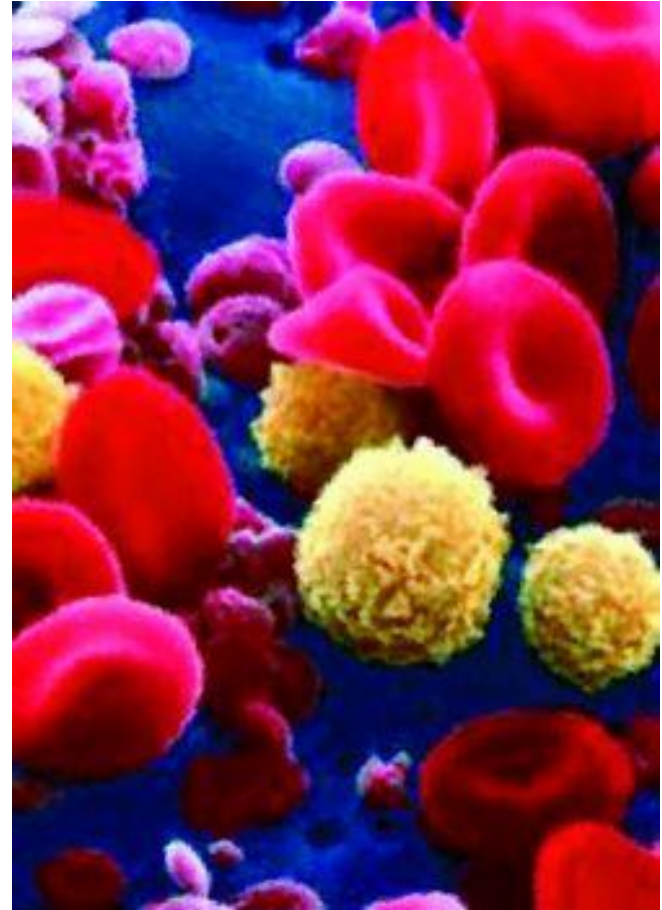
- **Dolly is the first animal cloned from diploid cells is produced in Scotland**



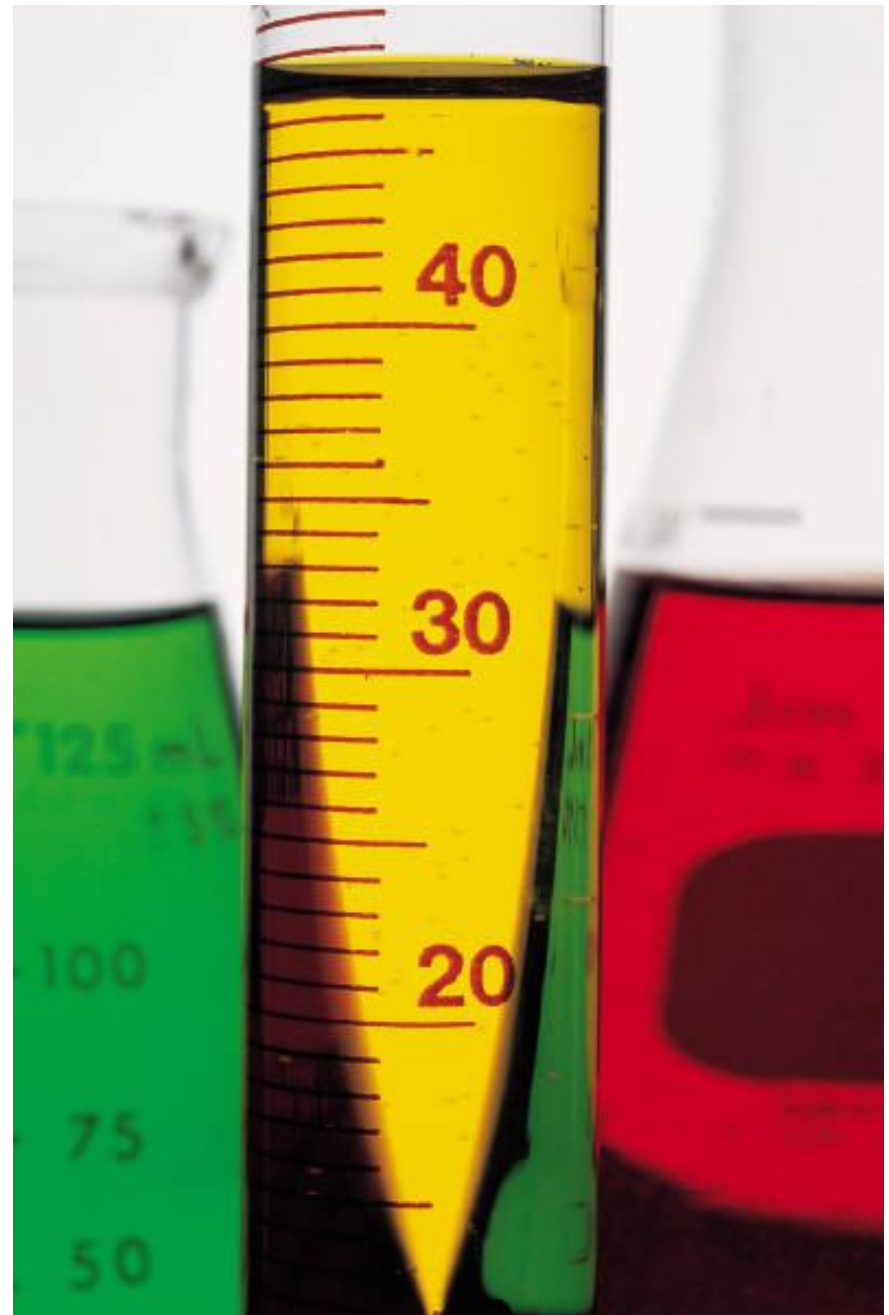


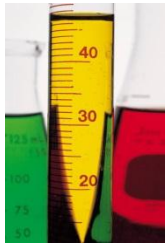
Late 1990's-Early 2000's

- **Human cloning is outlawed in the U.S. and the first concerns over the use of human stem cells in research begin to arise.**



Biotechnology and Agriscience





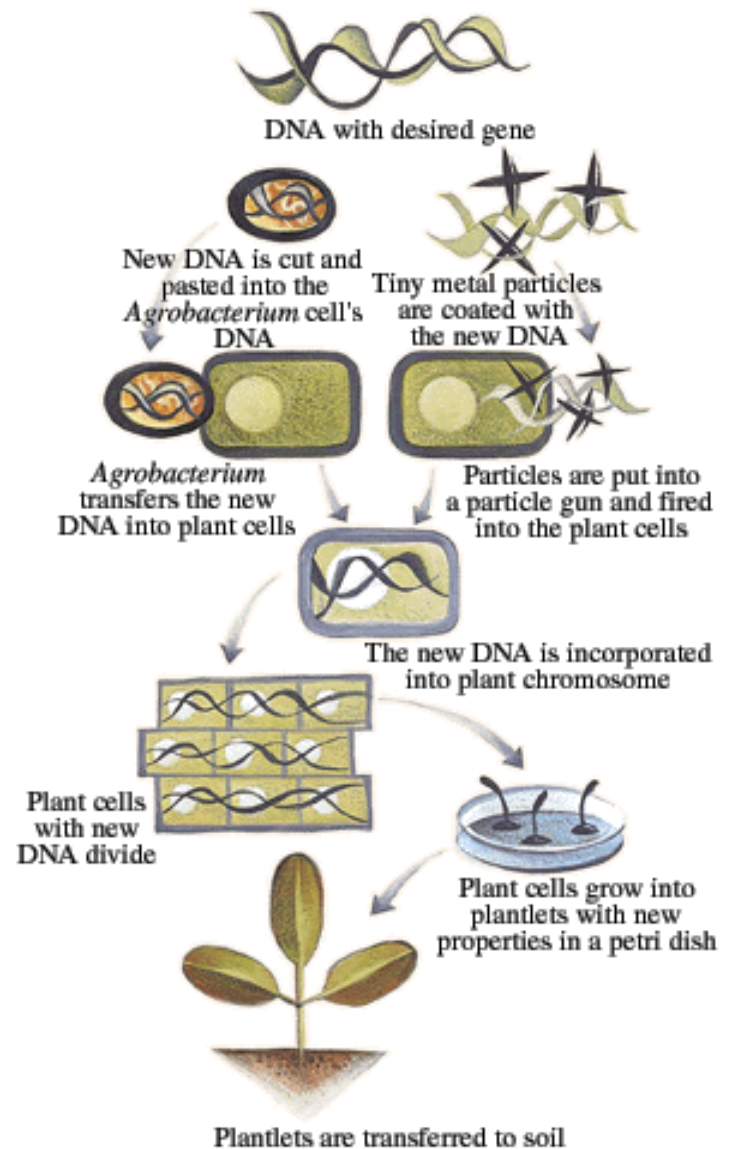
Biotechnology and Agriscience

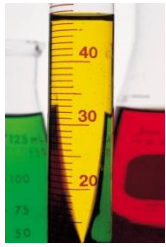
- **There has been increased activity and research between different agricultural areas with common research techniques and goals**
 - **Plant Science**
 - **Animal Science**
 - **Environmental Science**
 - **Health/Agri-Medicine**



Plant Science

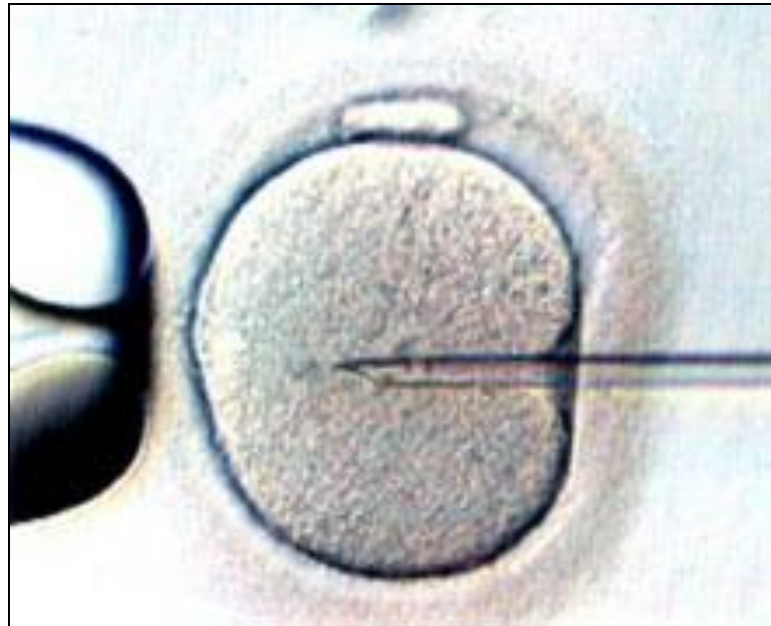
- **Wide scale production of transgenic plants impacting horticulture**

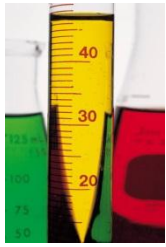




Animal Science

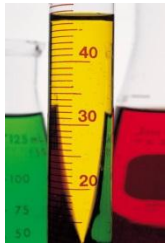
- **Increased use of methods of in vitro fertilization and artificial insemination improve selected breed programs**





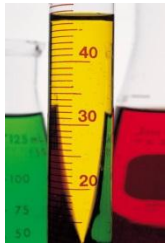
Environmental Science

- **Use of biotechnology techniques in environmental science for cleaning contaminants and protecting endangered species**
 - **Bioremediation-use of natural organisms to clean contaminants**



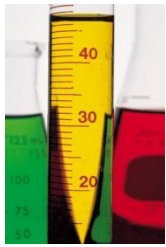
Environmental Science

- **Immunoassay tests are used to test for the presence of contaminants in soil, water and even blood**
- **Installation of biological barriers to prevent the transfer of harmful microorganisms between production facilities**
 - **Example: Tire wash channels**



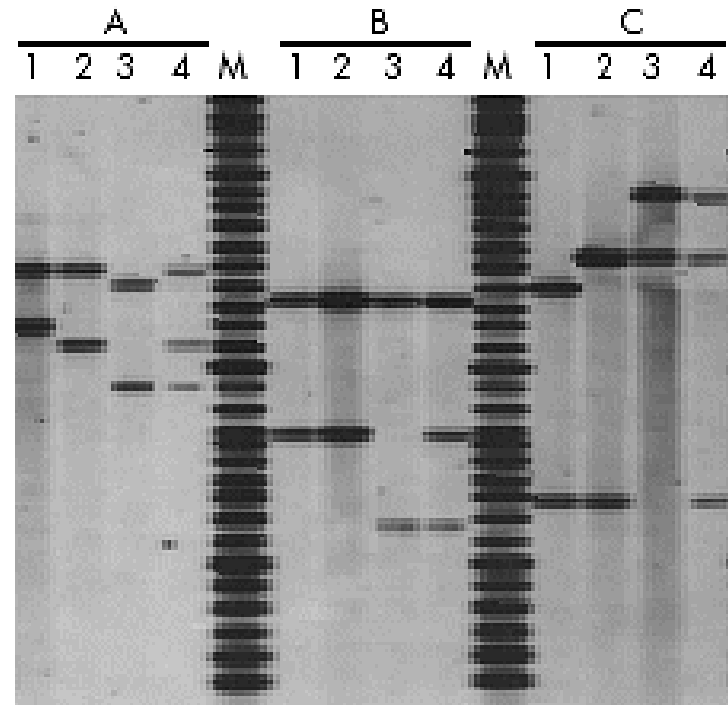
Health/Agri-medicine

- **Pharming-the creation of plants and animals capable of producing medical substances**
- **The use of biological barriers to prevent the spread of harmful microorganisms that could contaminate food sources**

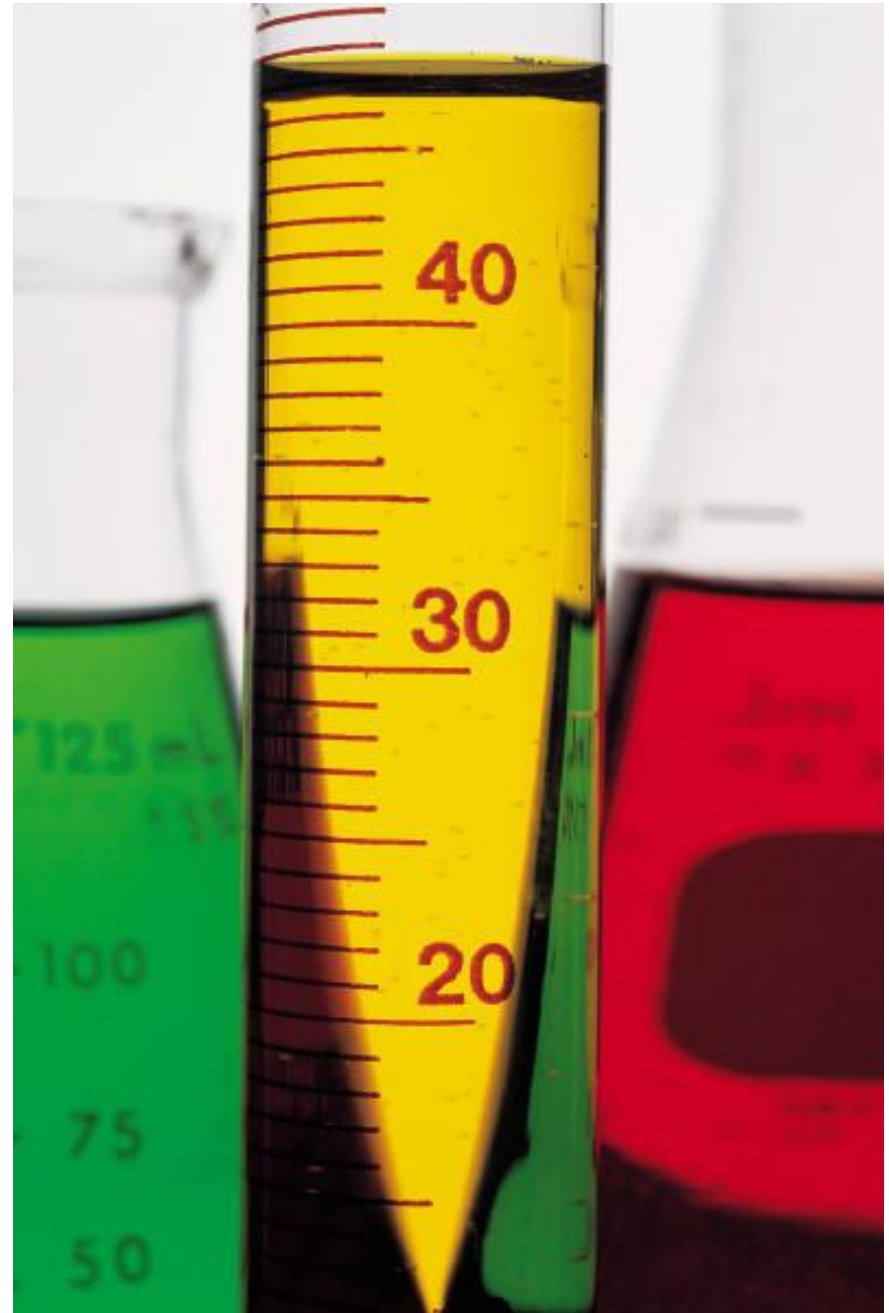


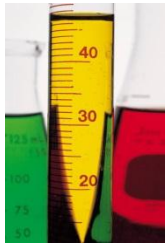
Health/Agri-medicine

- **DNA analysis/paternity testing has emerged as a technique to test the genetic ancestry of animals**



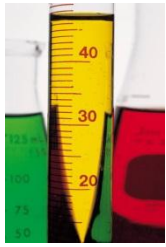
Problems with Biotechnology in Agriculture





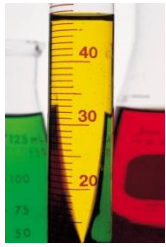
Problems with Biotechnology

- **Transfer of genes found in transgenic organisms to natural populations.**
 - **Terminator genes have been used to minimize this risk**



Problems with Biotechnology

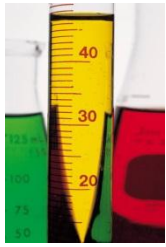
- **Unexpected impacts of genetically modified organisms and biotechnology processes on other organisms and the environment**



Problems with Biotechnology

- **Expense of the utilization of many biotechnology techniques**
 - **Cost of producing transgenic animals (There are transgenic fish, but no livestock yet.)**

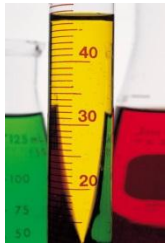




Problems with Biotechnology

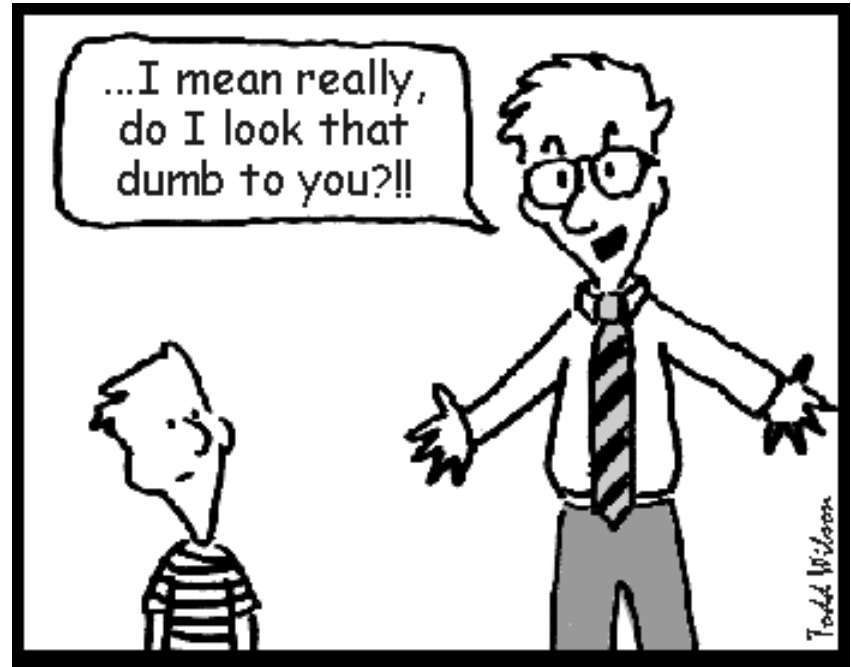
- **Concerns over the safety and ethics of incorporating GMO's into food for human consumption**
 - **Allergens**
 - **Example: The use of Starlink corn in taco shells not approved for human consumption**





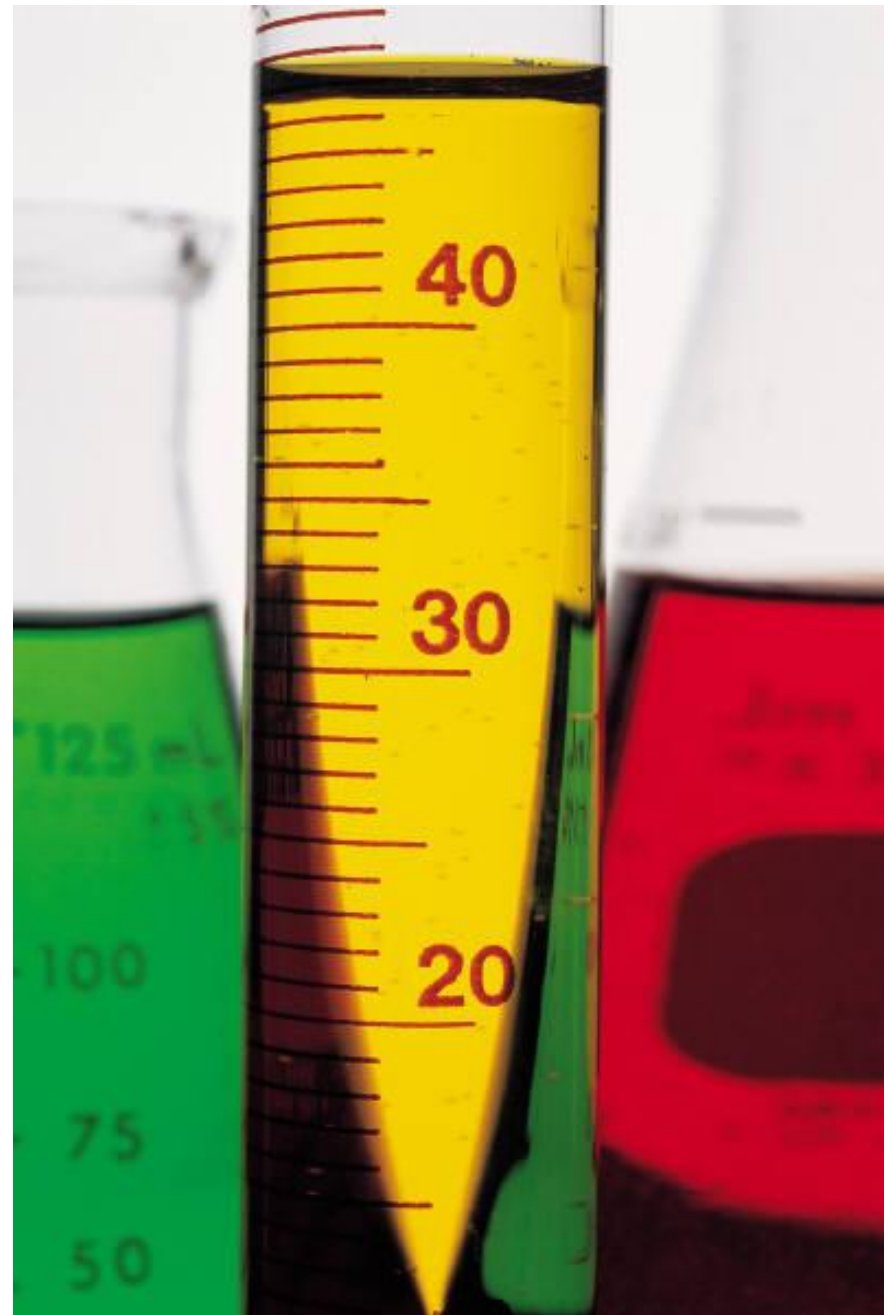
Problems with Biotechnology

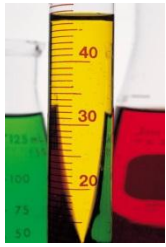
- **Lack of education among both consumers and producers concerning biotechnology processes and products**



Seven-year-old Bobby Taylor was about to make a serious tactical error.

Biotechnology Terms





Biotechnology Terms

- **Use your biotechnology books to define the following terms:**
 - **Cloning**
 - **Clonal Offspring**
 - **Deoxyribonucleic acid**
 - **Genetics**
 - **Genetic Engineering**
 - **GMO**
 - **Ribonucleic Acid**
 - **Transgenic Organism**