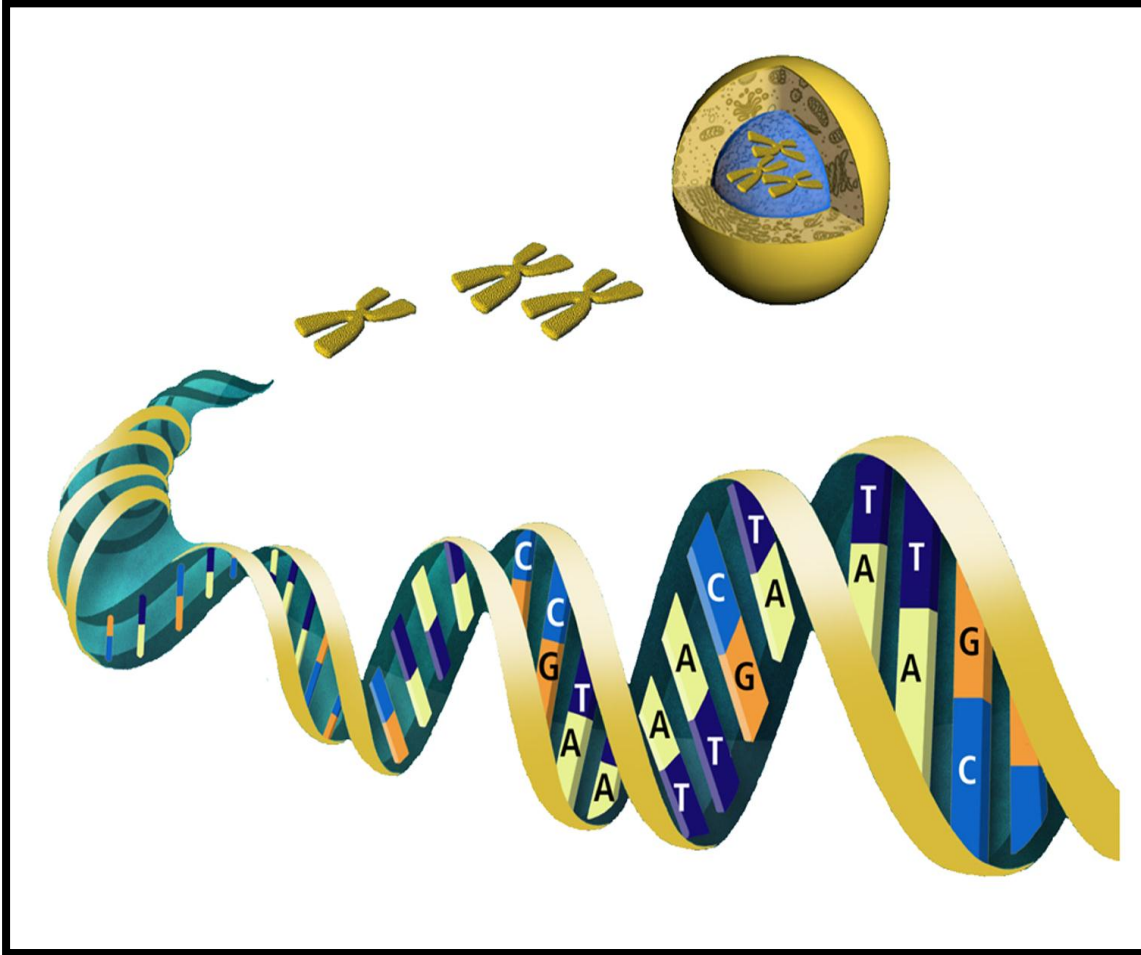


A decorative border at the top of the slide features various blue silhouettes of plants, including tall grasses, ferns, and flowering stems with small circular buds. The silhouettes are arranged in a dense, horizontal band.

# How Genes Impact Plant Propagation

Dr. David G. Clark, Professor  
UF Environmental Horticulture

# Genes



Provide the physical mechanism for reproduction of traits

Provide information for controlling expression of traits

# Pre-Mendel



Accounting for  
species diversity

Carolus Linnaeus

- (17<sup>th</sup> C.) systematic hierarchy for classifying living things (taxonomy)

# Pre-Mendel



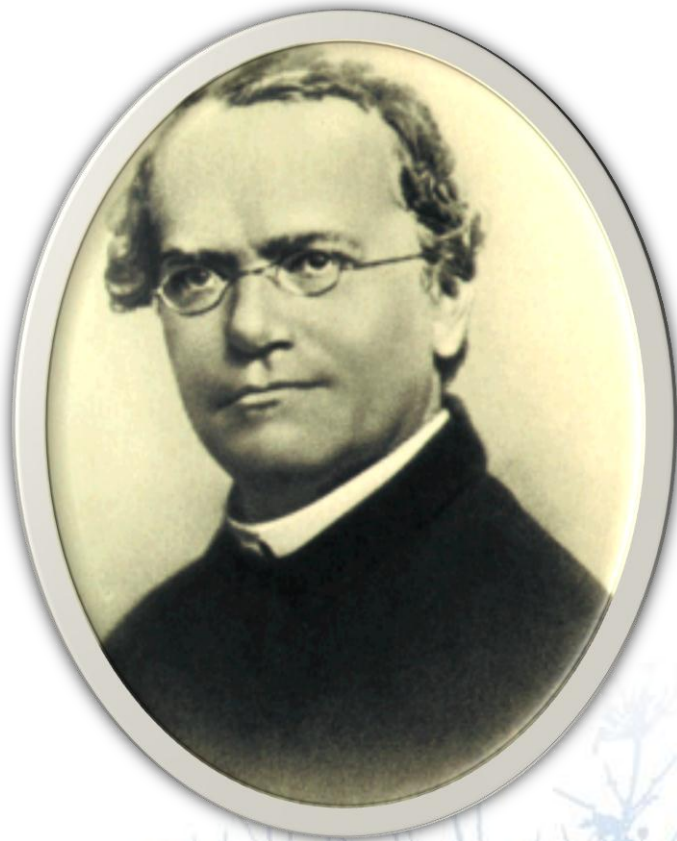
## Species Diversity

### Charles Darwin –

- *Origin of Species* (1859)
- Theory of evolution, survival of the fittest, adaptive change
- Visual inspection and Mass Selection



# Then came Mendel...



Mendelian Genetics marked the start of an era in which selection became based on hereditary principles

Predictability



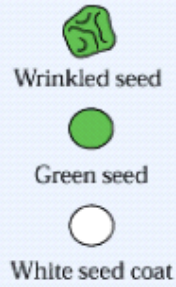
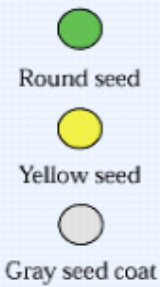
# Mendelian Genetics

*How are traits passed from one generation to the next?*

Mendel (1866)

- *Experiments in Plant Hybridization*
  - was the first to relate the outward appearance of an organism (phenotype) to its inner genetic constitution (genotype)

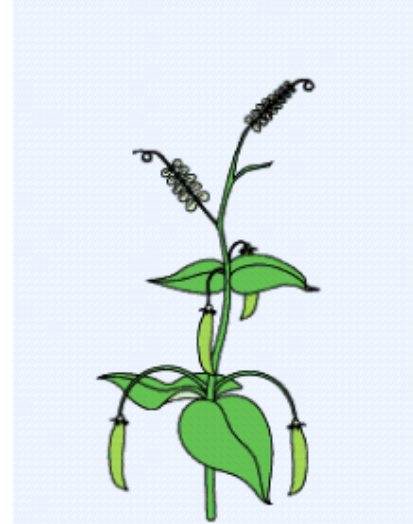
# Mendelian Genetics



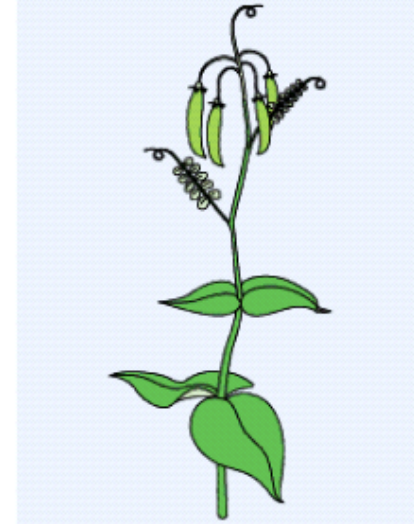
Long stem



Dwarf



Axial flowers and pea pods



Terminal flowers and pea pods

**Mendel followed inheritance of eight traits.**



# Mendel's Garden



**Brno, Czech Republic**



# DNA-based Genetics



*What is the structure of a DNA molecule?*

Watson and Crick

- DNA structure = function

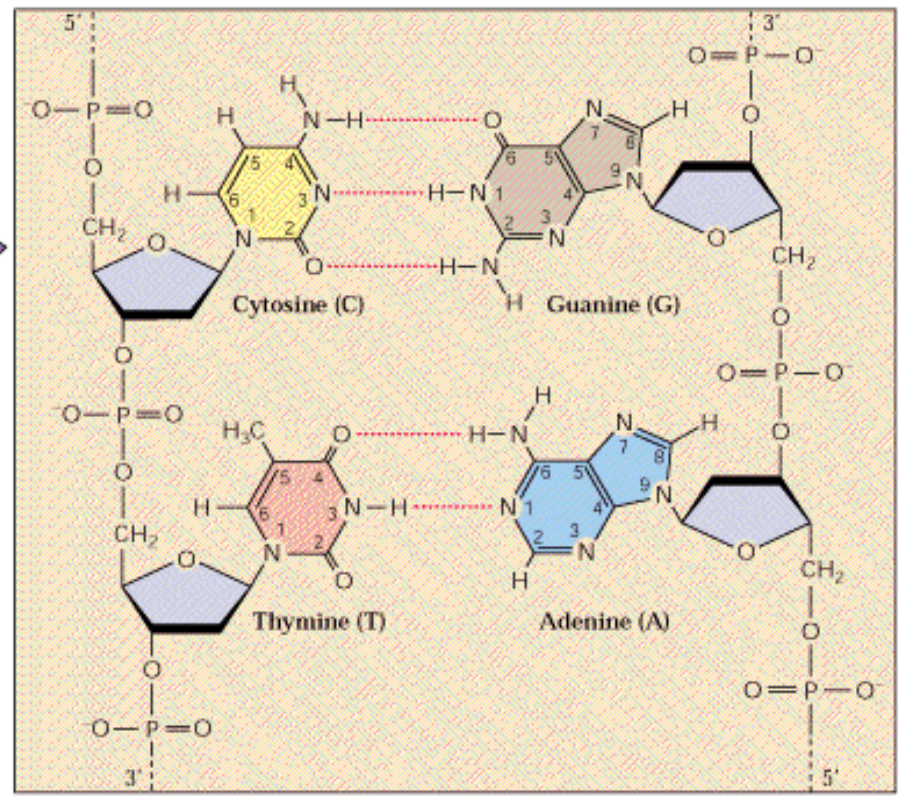
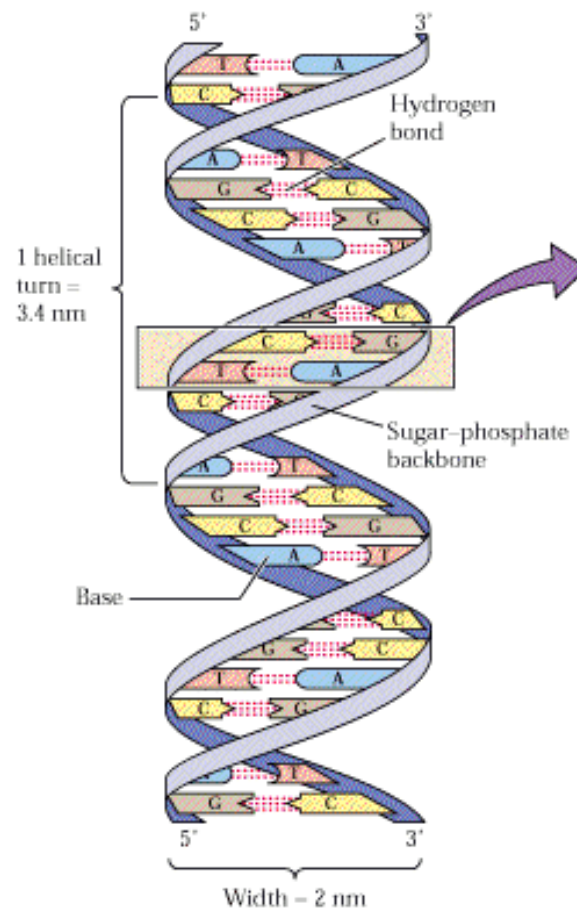
# DNA-based Genetics

April 2, 1953 - Watson and Crick

- Published a paper in Nature solving the structure of DNA
- This structure was the key to unlocking the technology of life
- It is perhaps the most important biological discovery of the 20<sup>th</sup> century - this was the start of the biotechnology era



# Watson and Crick's Double Helix



The DNA Double Helix



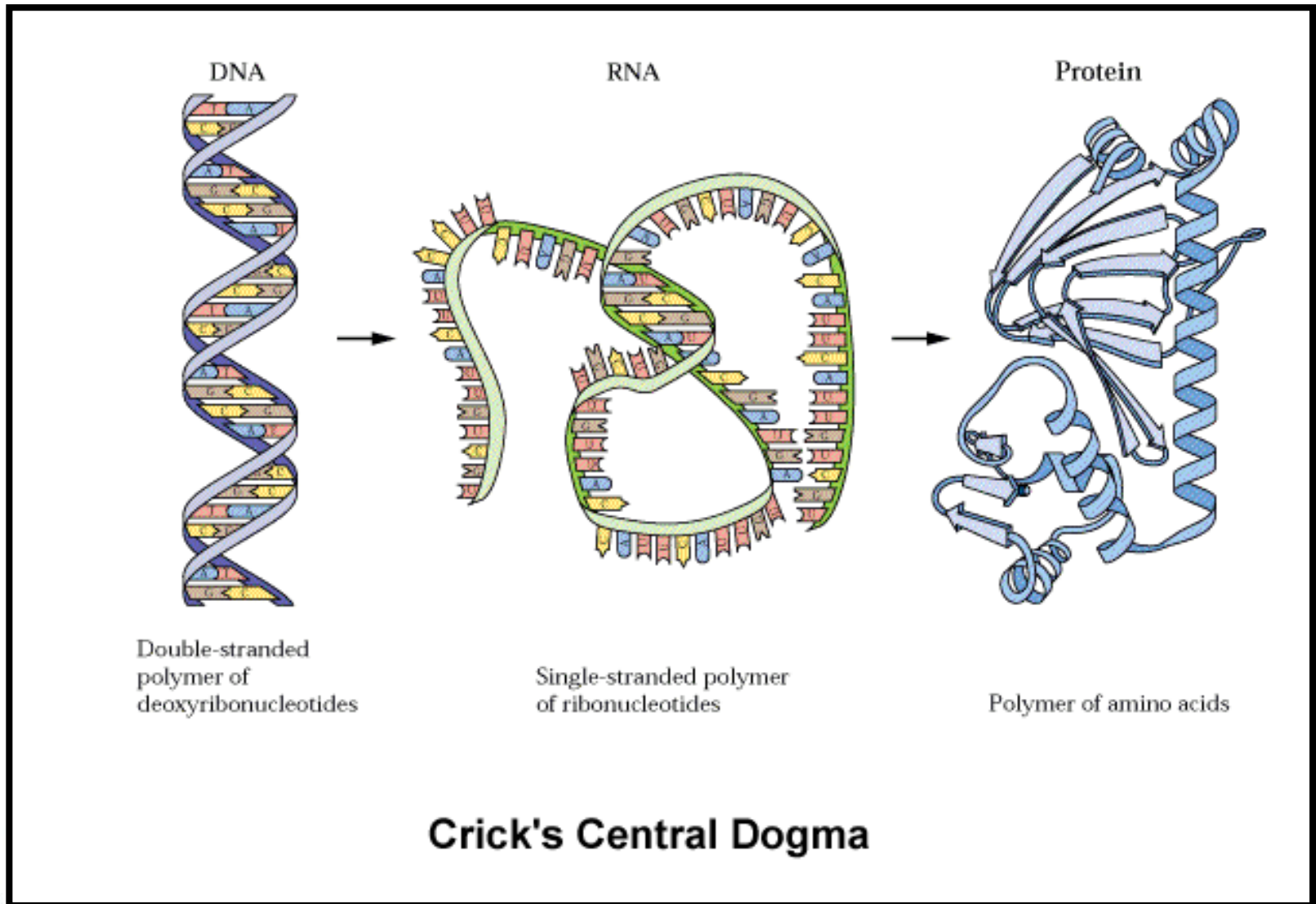
# Implications of Watson & Crick

DNA embodied the organizing thesis of molecular biology

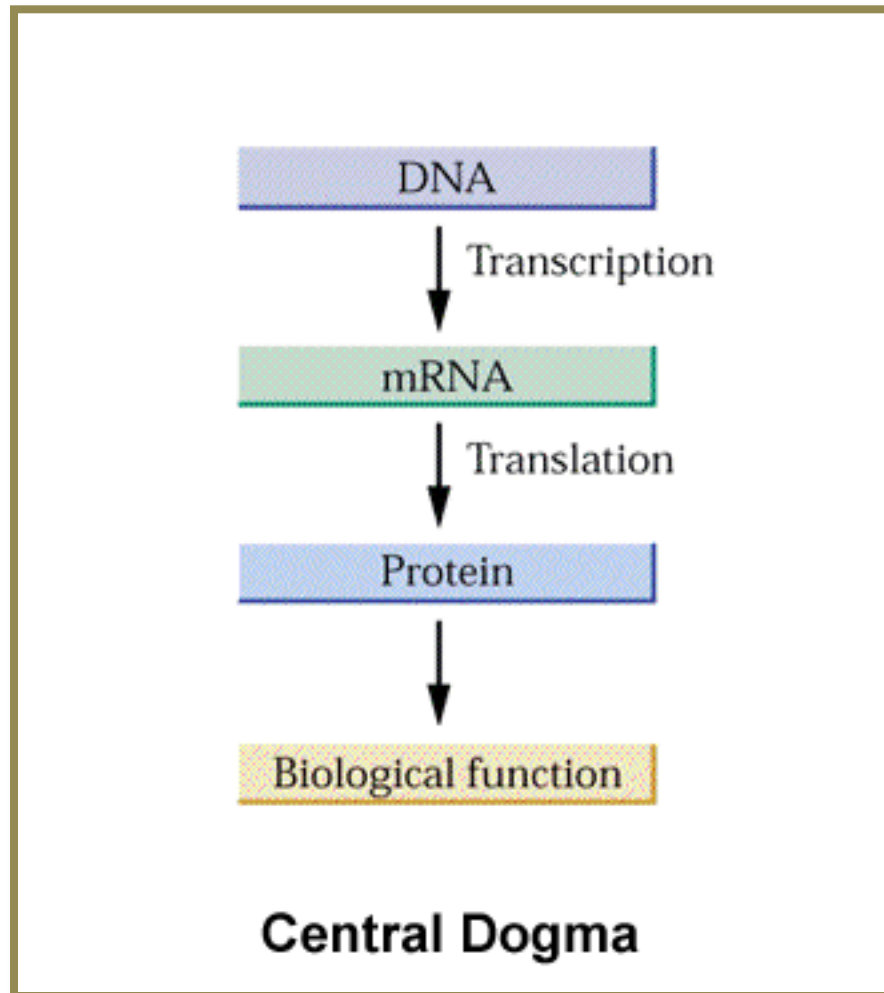
Understanding the structure of a molecule gives clues to its biological function



# After Watson & Crick

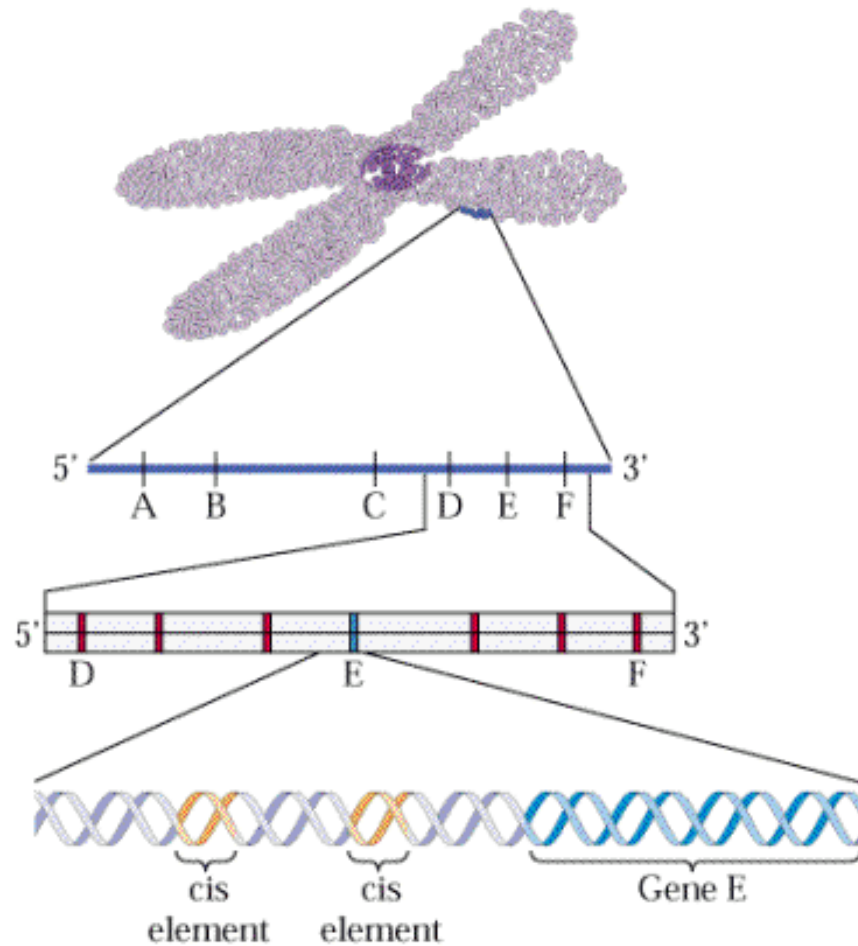


# After Watson & Crick



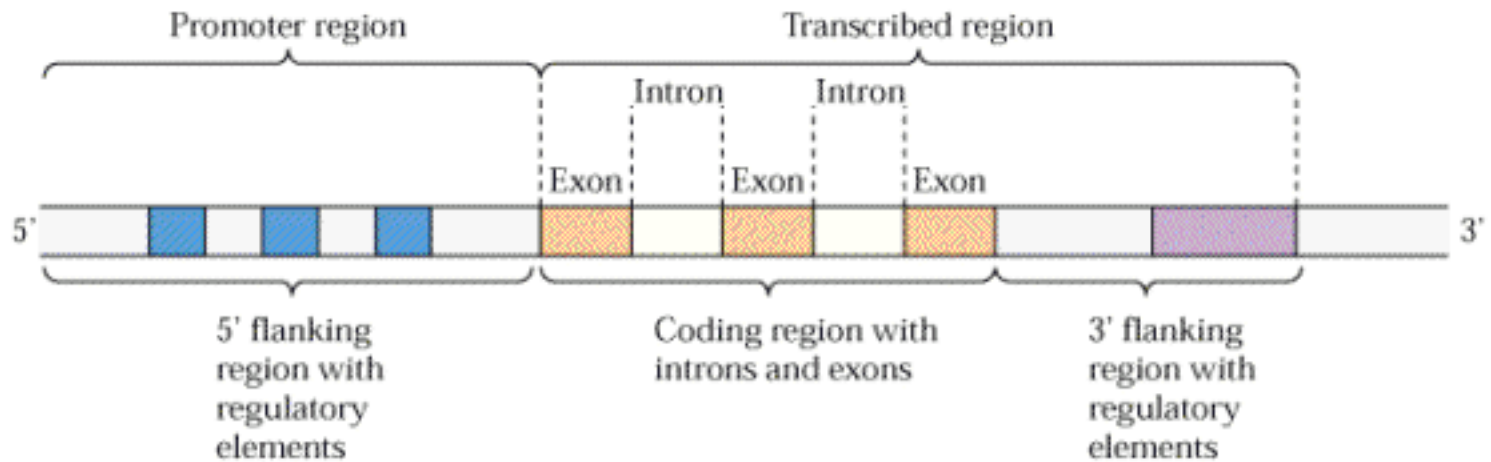


# What is a gene?



**Levels of genetic and molecular organization**

# What is a gene?



**The structure of a gene**



# Regulation of Genes

Cell differentiation is a function of regulated gene expression

Plant cells are totipotent

- every cell has the genetic potential to regenerate into a fully differentiated plant





# How do different cell types occur?

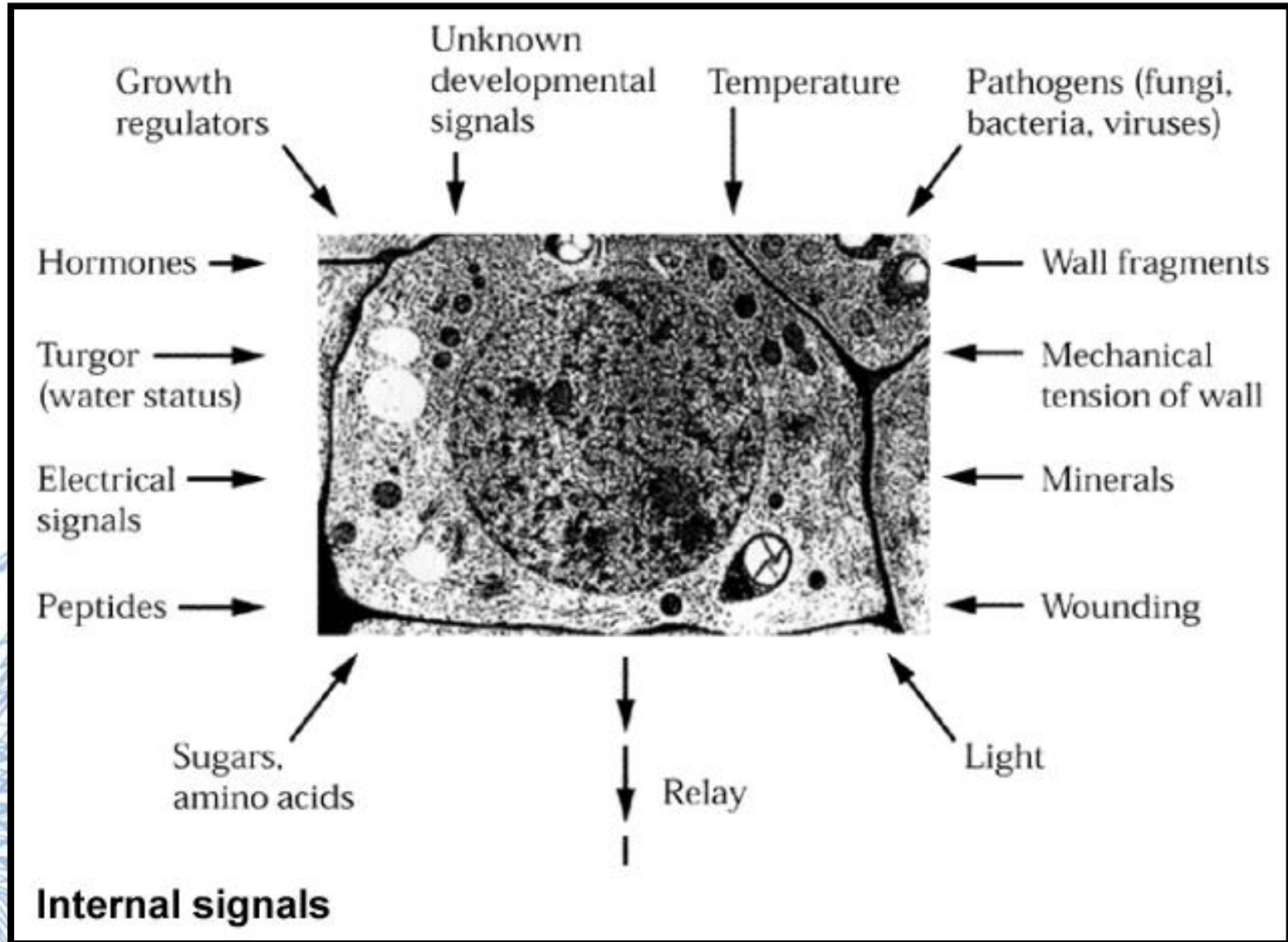
Not all genes are active in all cells at all times

Gene expression

- Regulated by development and environment
- Controlled at many levels

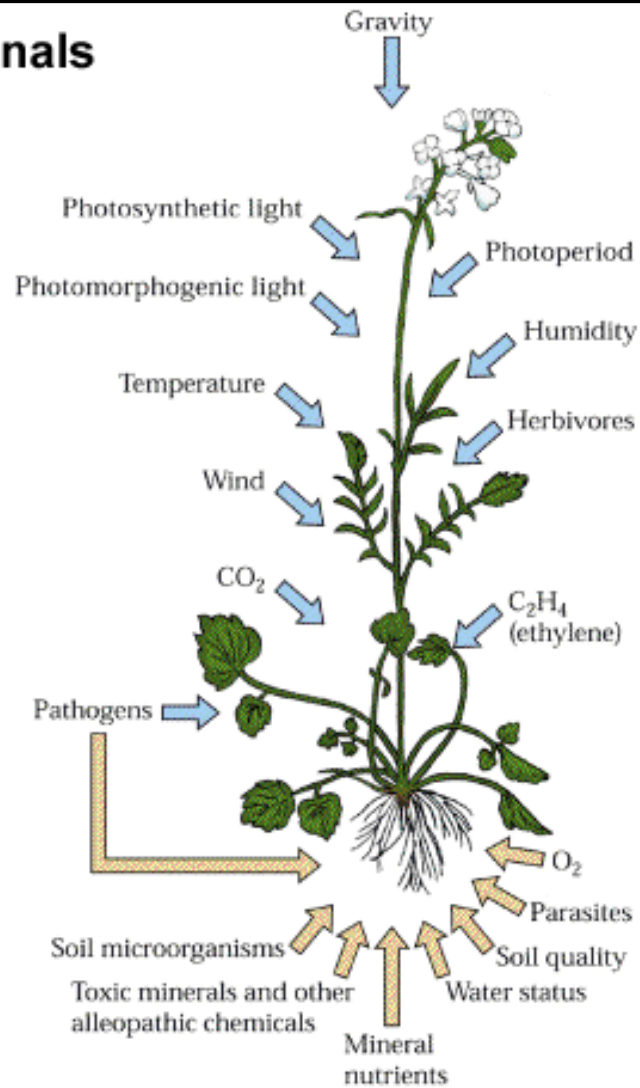


# Regulation of genes

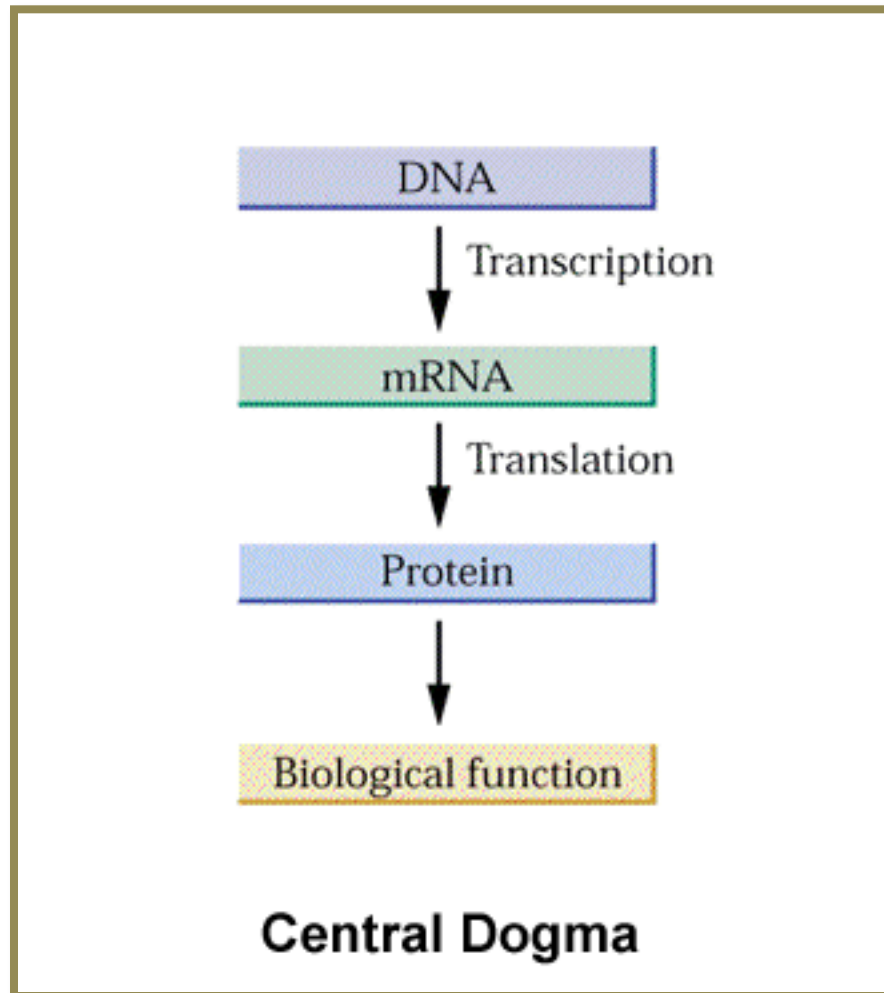


# Regulation of genes

## Environmental signals



# After Watson & Crick





# Why is this important?

Enzymes are proteins

Enzymes catalyze biochemical reactions

Biochemical reactions determine how plants respond to external and internal stimuli

# Biotęchnology

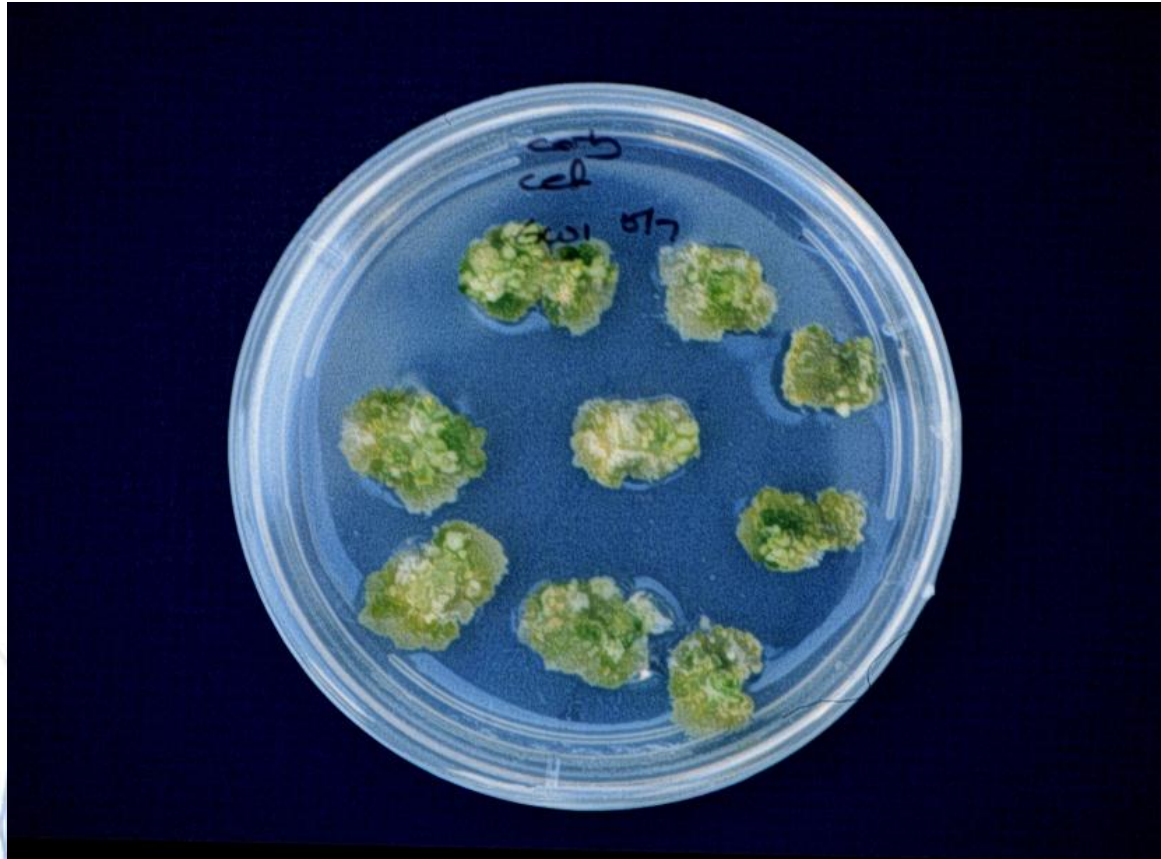
How we actually use all of this knowledge to make a difference

- Cell and Tissue Culture
- Recombinant DNA technology



# Cell and Tissue Culture

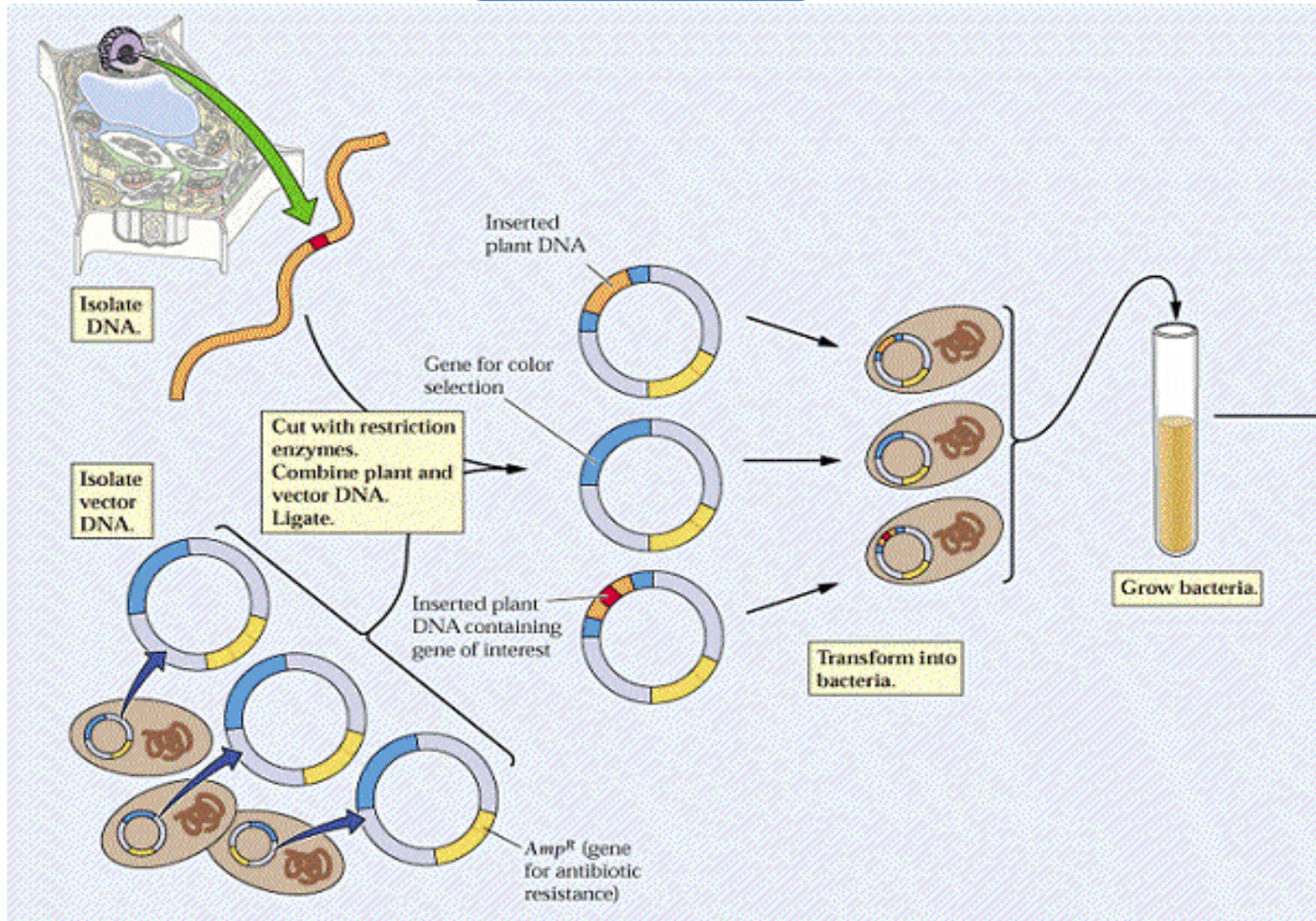
Micropropagation - aseptic





# Recombinant DNA Technology

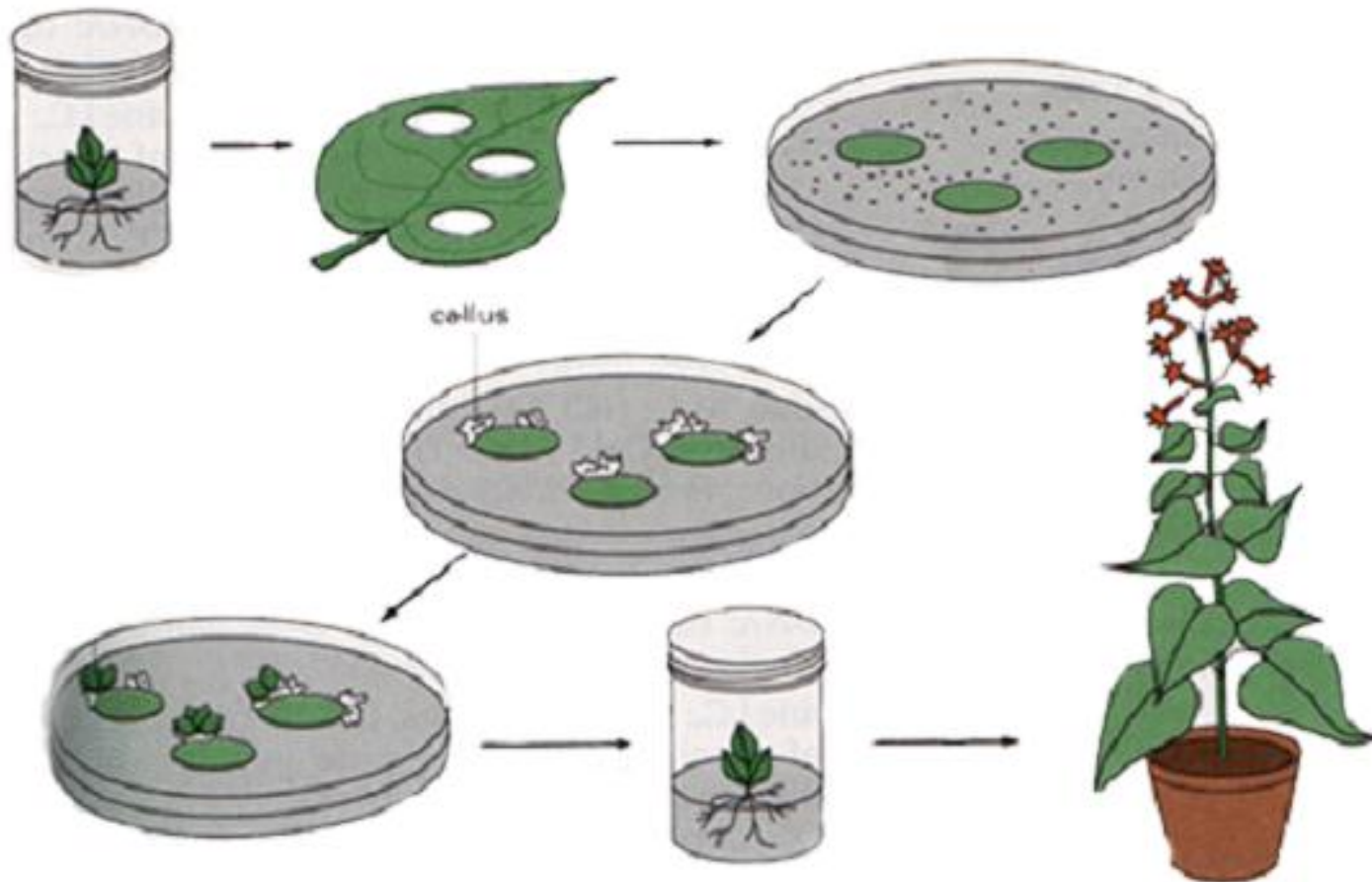
## Cloning





# Recombinant DNA Technology

## Transgenic Plants



# Bright Futures

We are just now seeing the tip of the iceberg in plant biotechnology

The next decade will prove to be a time of biotechnology applications to new crops

We need to know how to efficiently propagate new biotech plants: sexually and asexually



# Why is this important to me now?

Lots of genetic variability exists

- Seed Propagation





# Why is this important to me now?

Lots of genetic variability exists

- Vegetative Propagation





# The take-home point

Genetic variability  
can be utilized

- Control of seed germination
- Control of root formation
- Different varieties perform differently
- TIMING is everything!



# Understanding Genetics

Essential for:

- Understanding physiology
- Making plants do what we want, when we want

