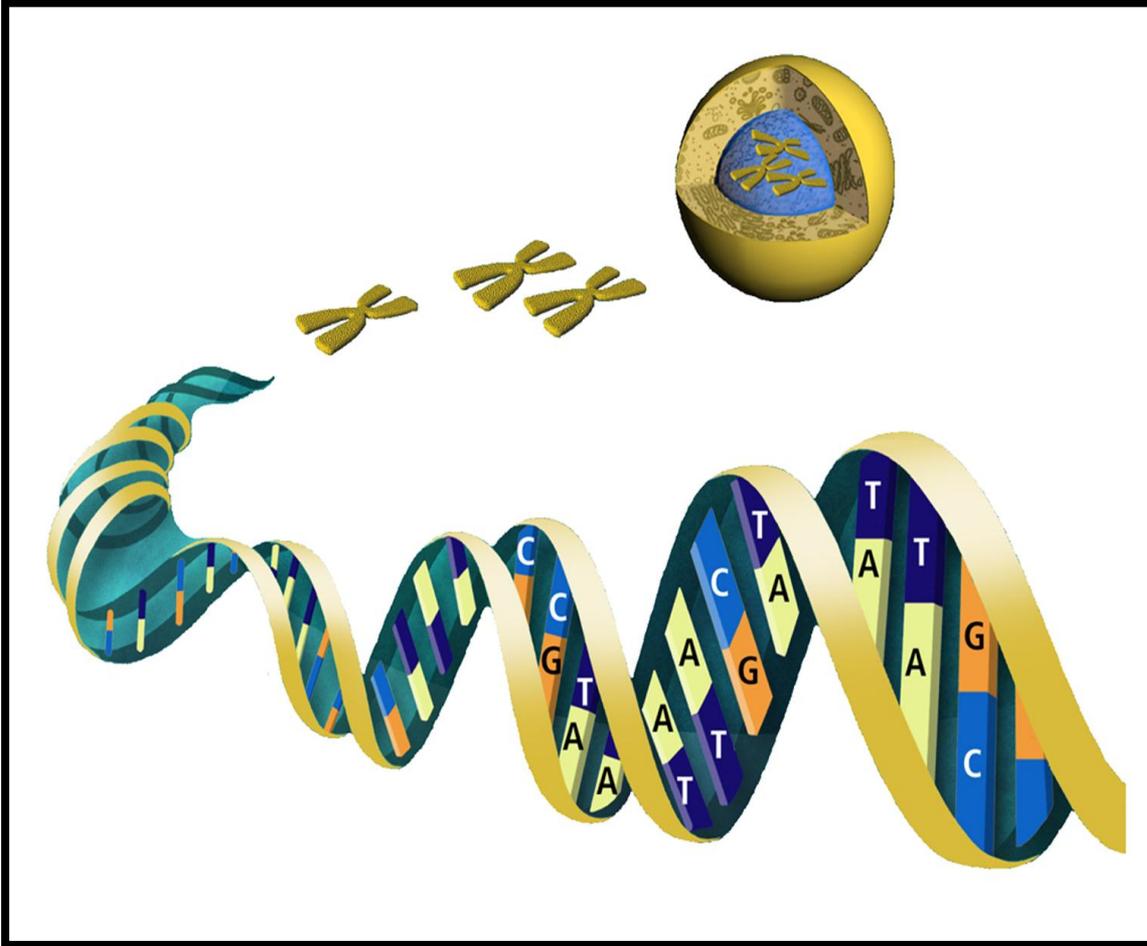
A detailed blue botanical illustration of various plants and flowers, including tall grasses, daisy-like flowers, and other leafy plants, arranged horizontally across the top of the slide. The illustration is rendered in a light blue color against a white background.

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

- (17th C.) systematic hierarchy for classifying living things (taxonomy)

Pre-Mendel

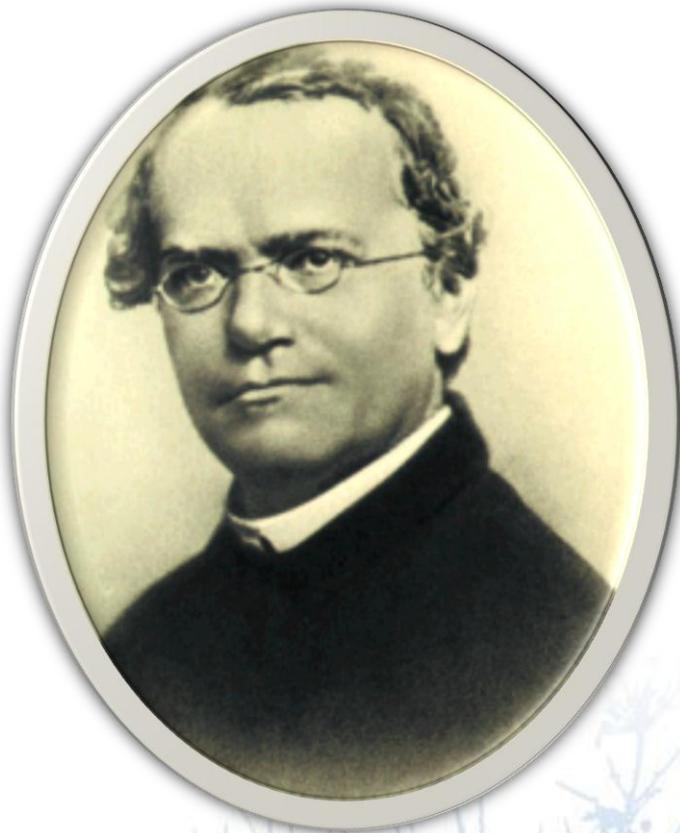


Species Diversity

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



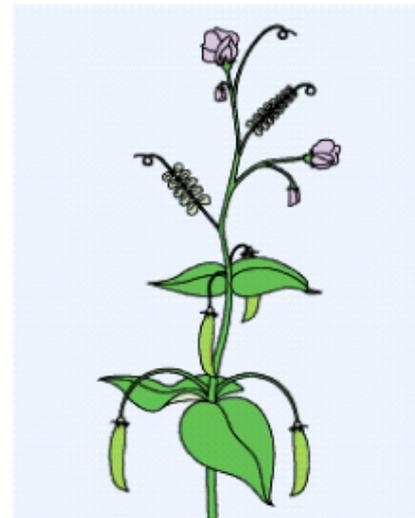
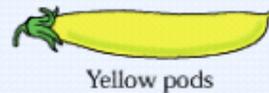
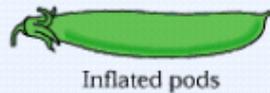
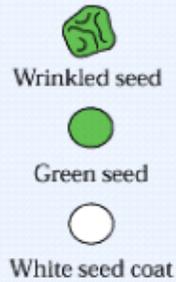
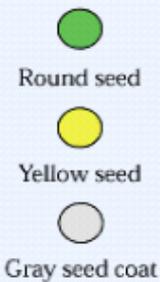
Mendelian Genetics

How are traits passed from one generation to the next?

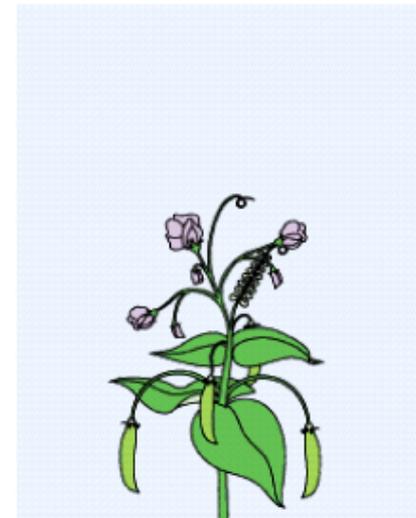
Mendel (1866)

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

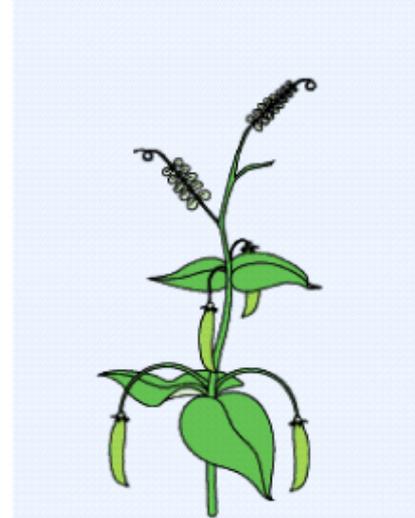
Mendelian Genetics



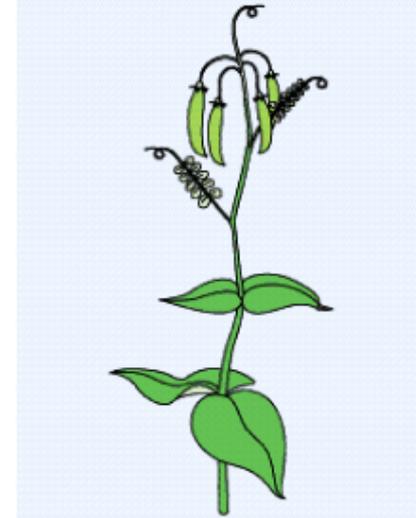
Long stem



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

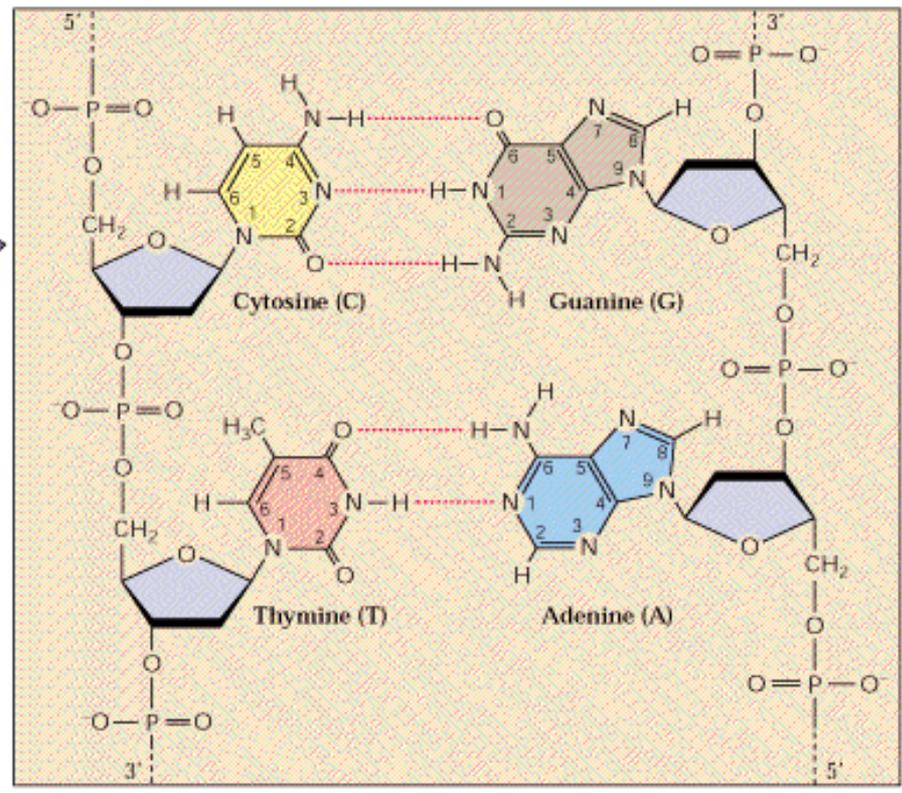
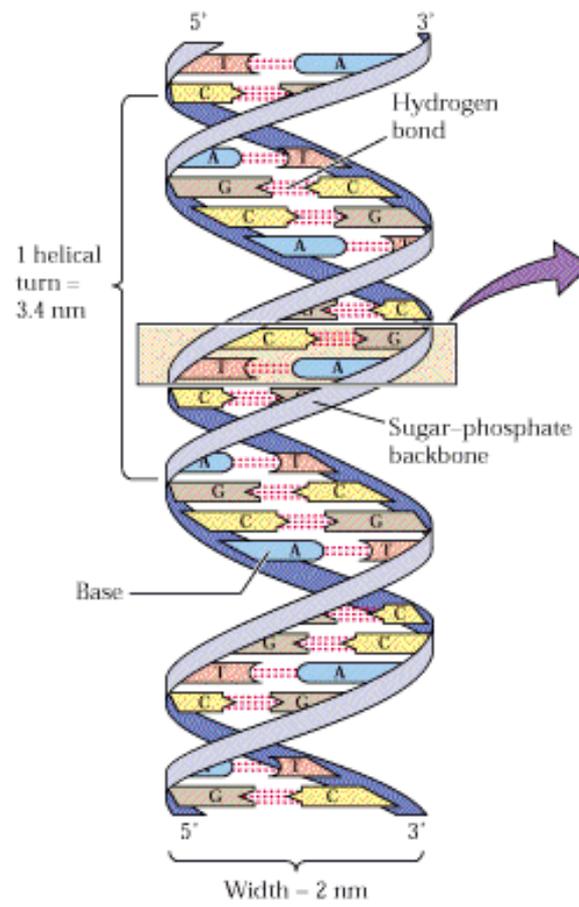
- DNA structure = function

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 20th century - this was the start of the biotechnology era

Watson and Crick's Double Helix



The DNA Double Helix

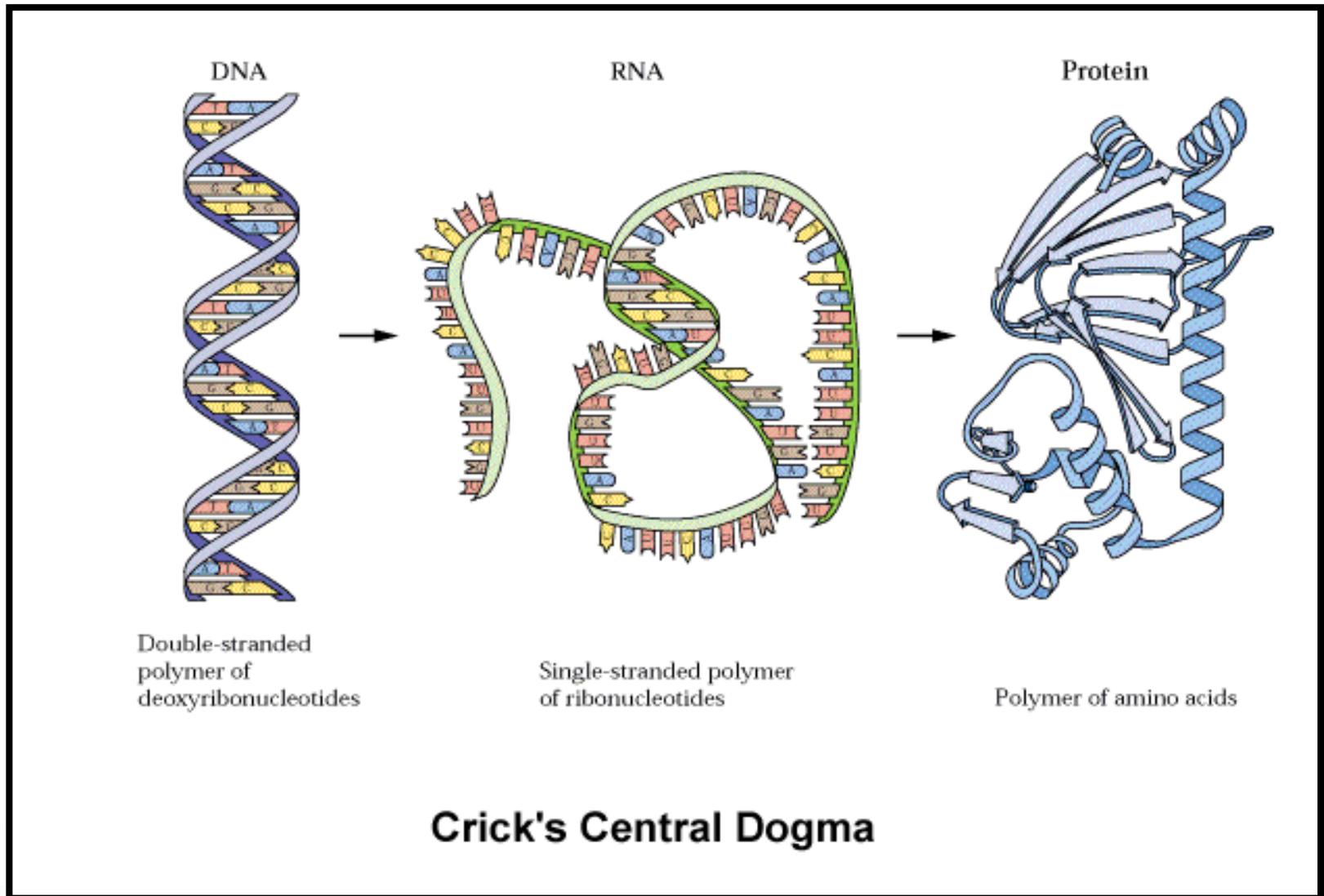
Implications of Watson & Crick

DNA embodied the organizing thesis of molecular biology

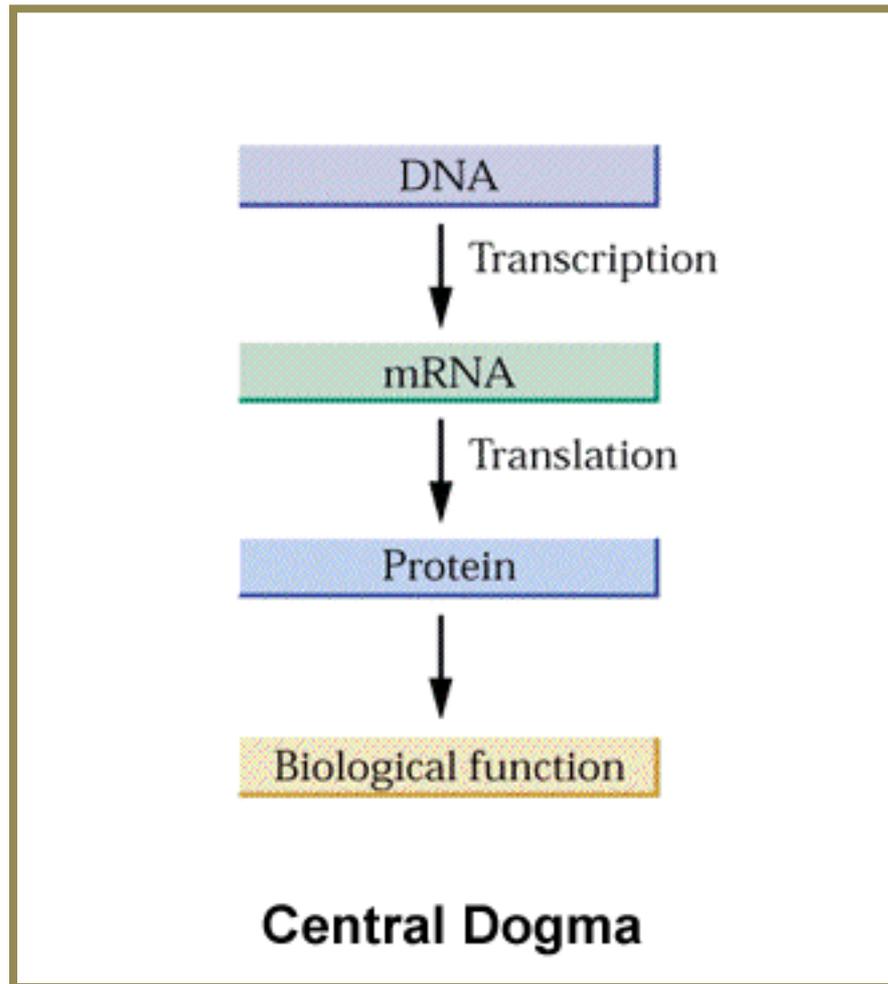
Understanding the structure of a molecule gives clues to its biological function



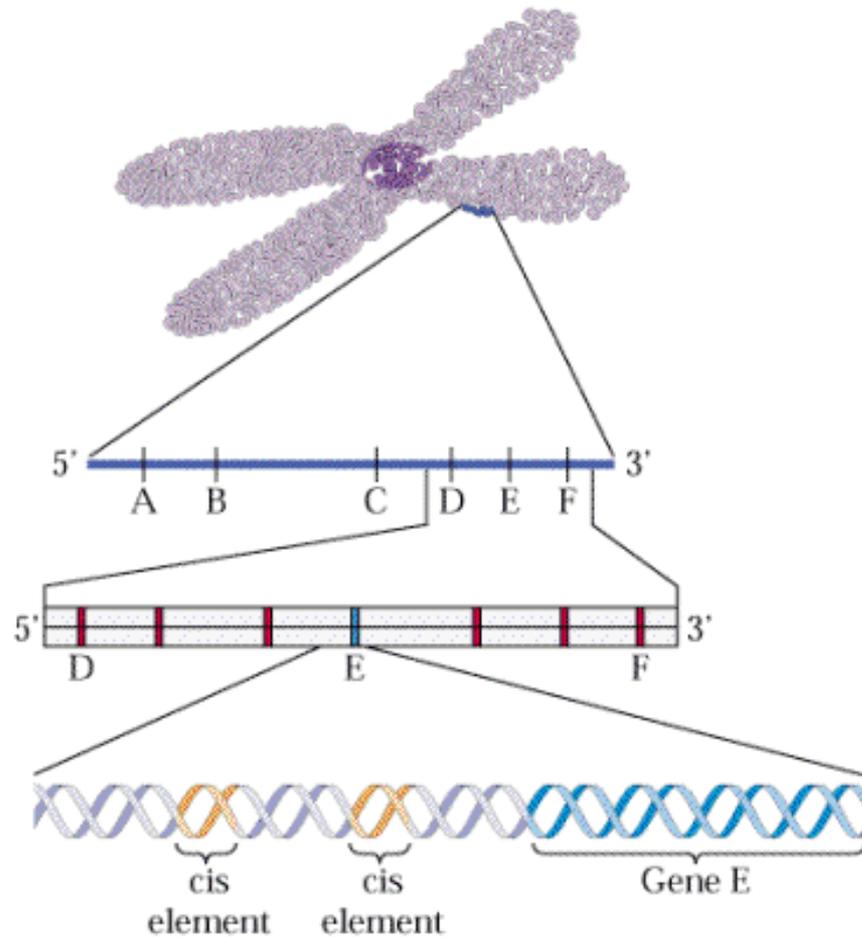
After Watson & Crick



After Watson & Crick

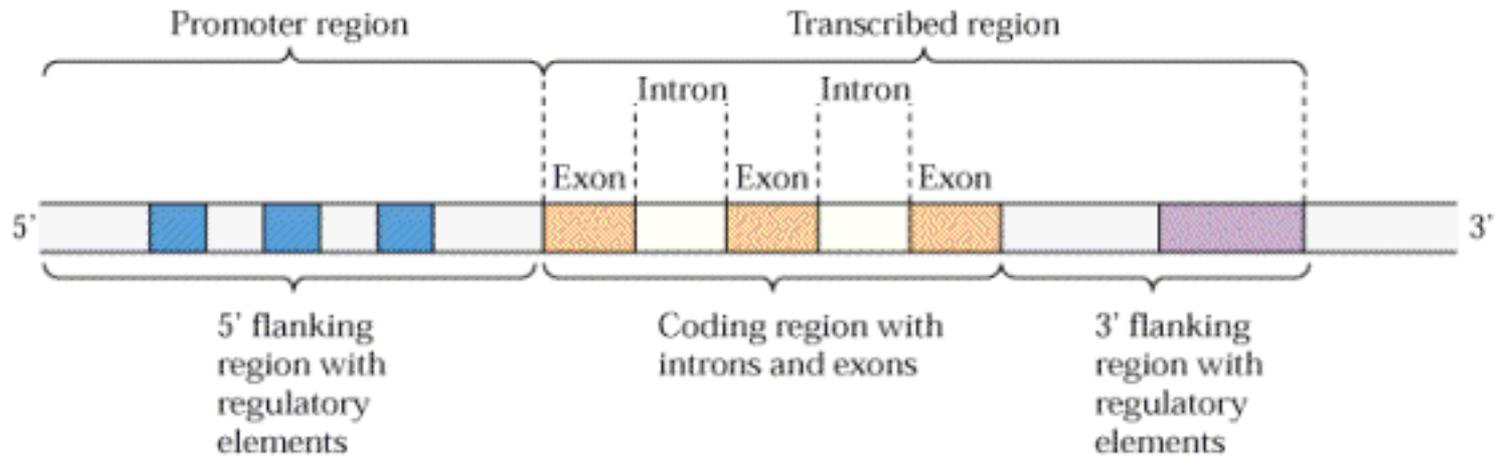


What is a gene?



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?

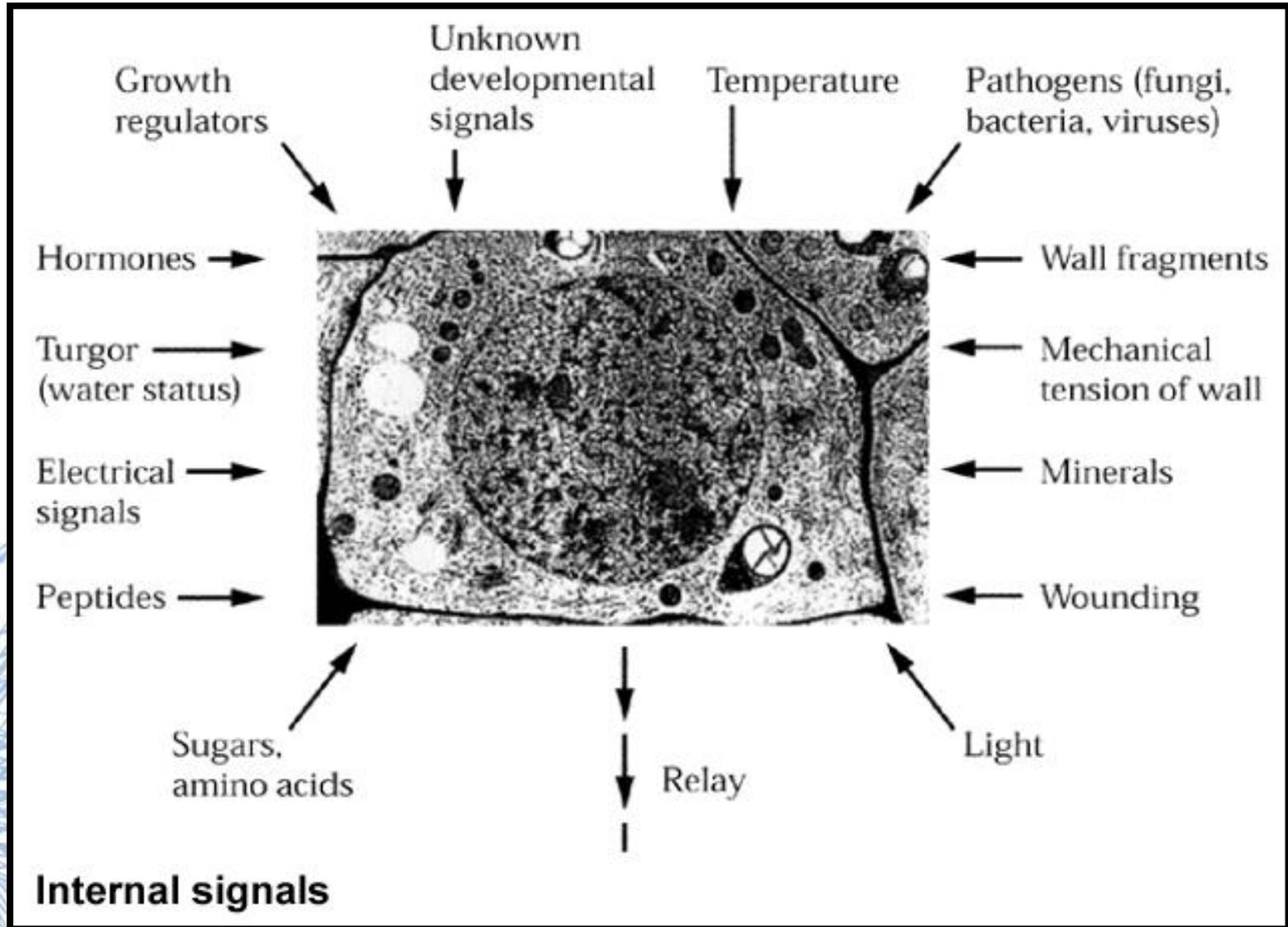
Not all genes are active in all cells at all times

Gene expression

- Regulated by development and environment
- Controlled at many levels

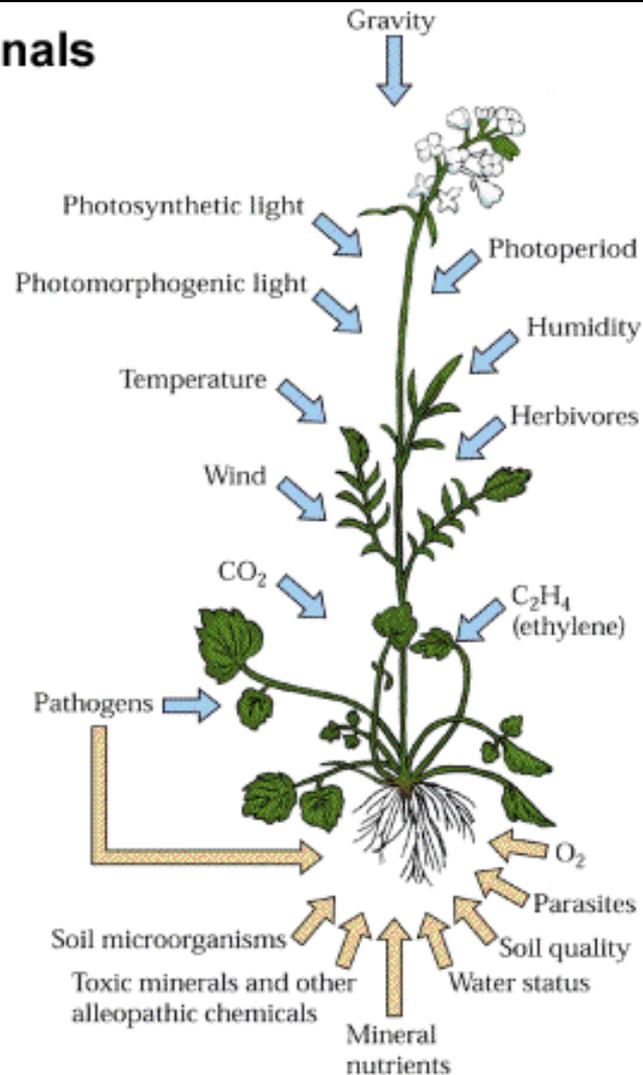


Regulation of genes

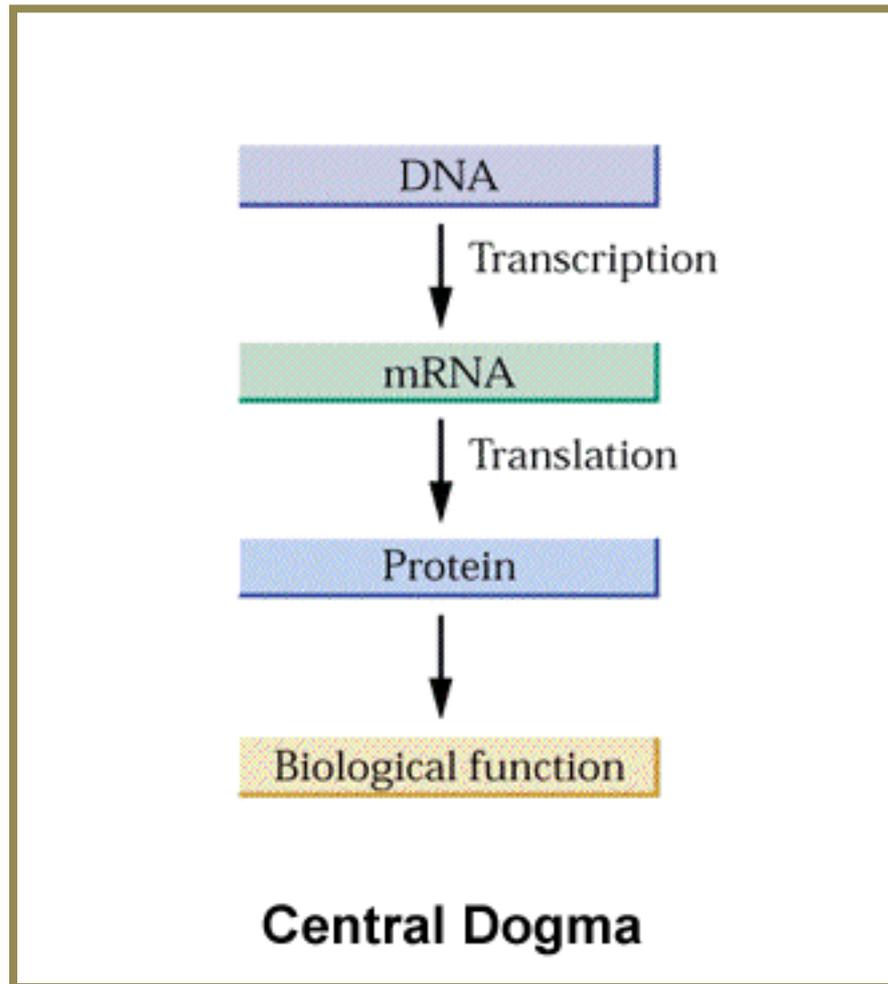


Regulation of genes

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

Biotεchnology

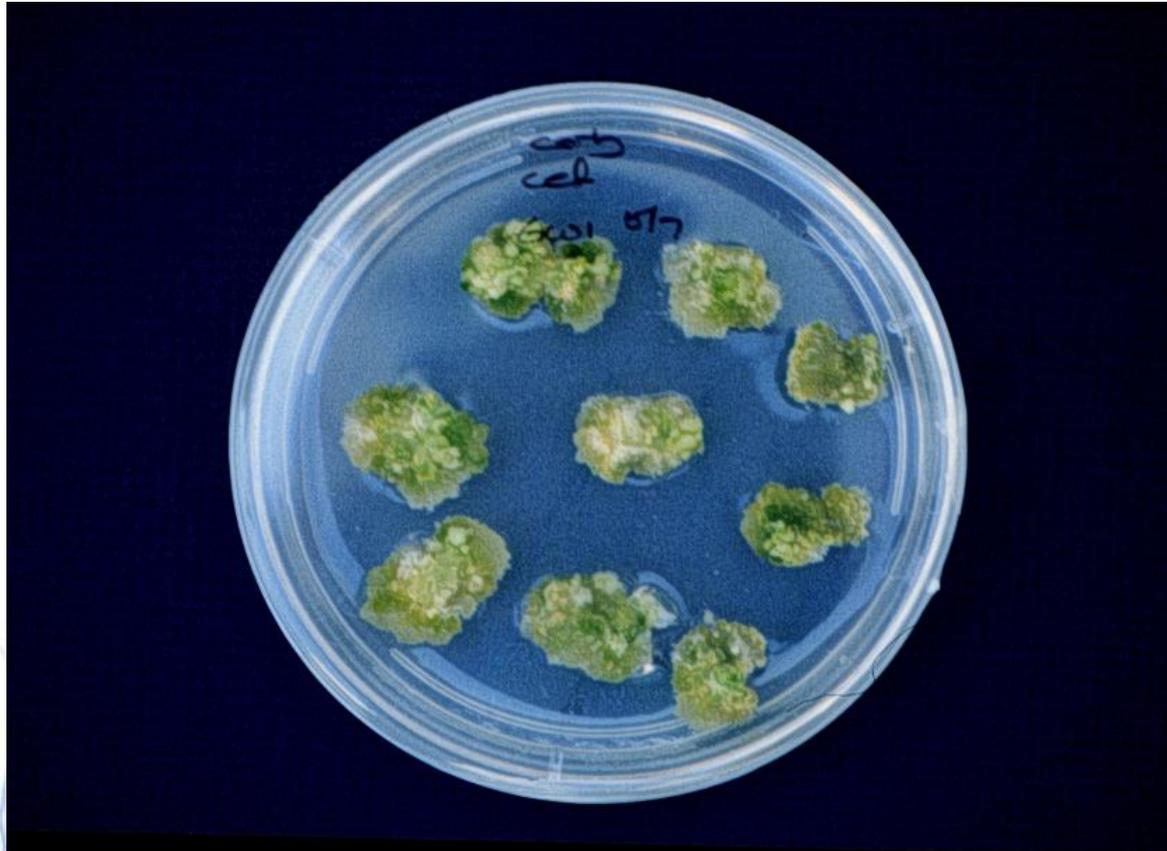
How we actually use all of this knowledge to make a difference

- Cell and Tissue Culture
- Recombinant DNA technology



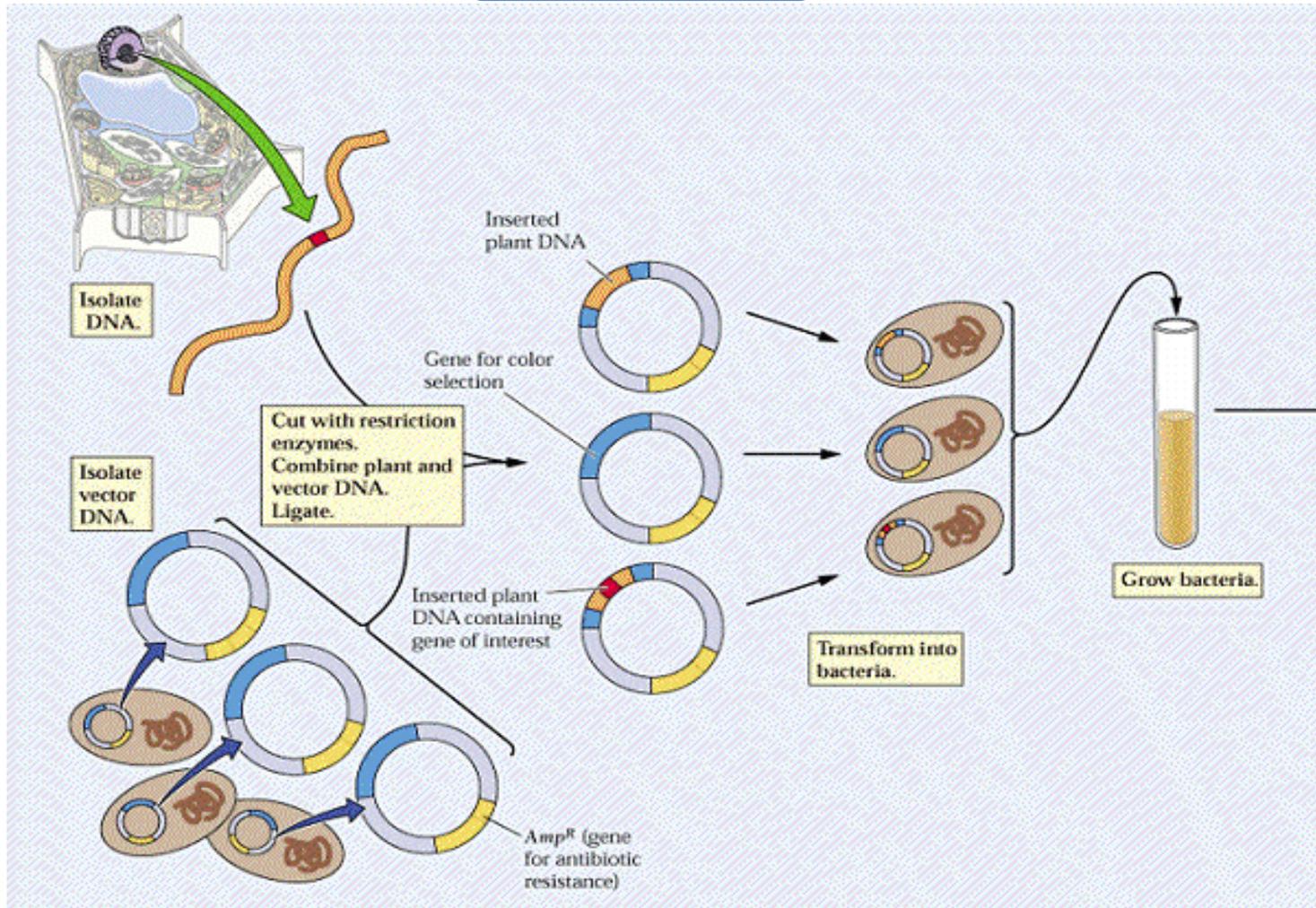
Cell and Tissue Culture

Micropropagation - aseptic



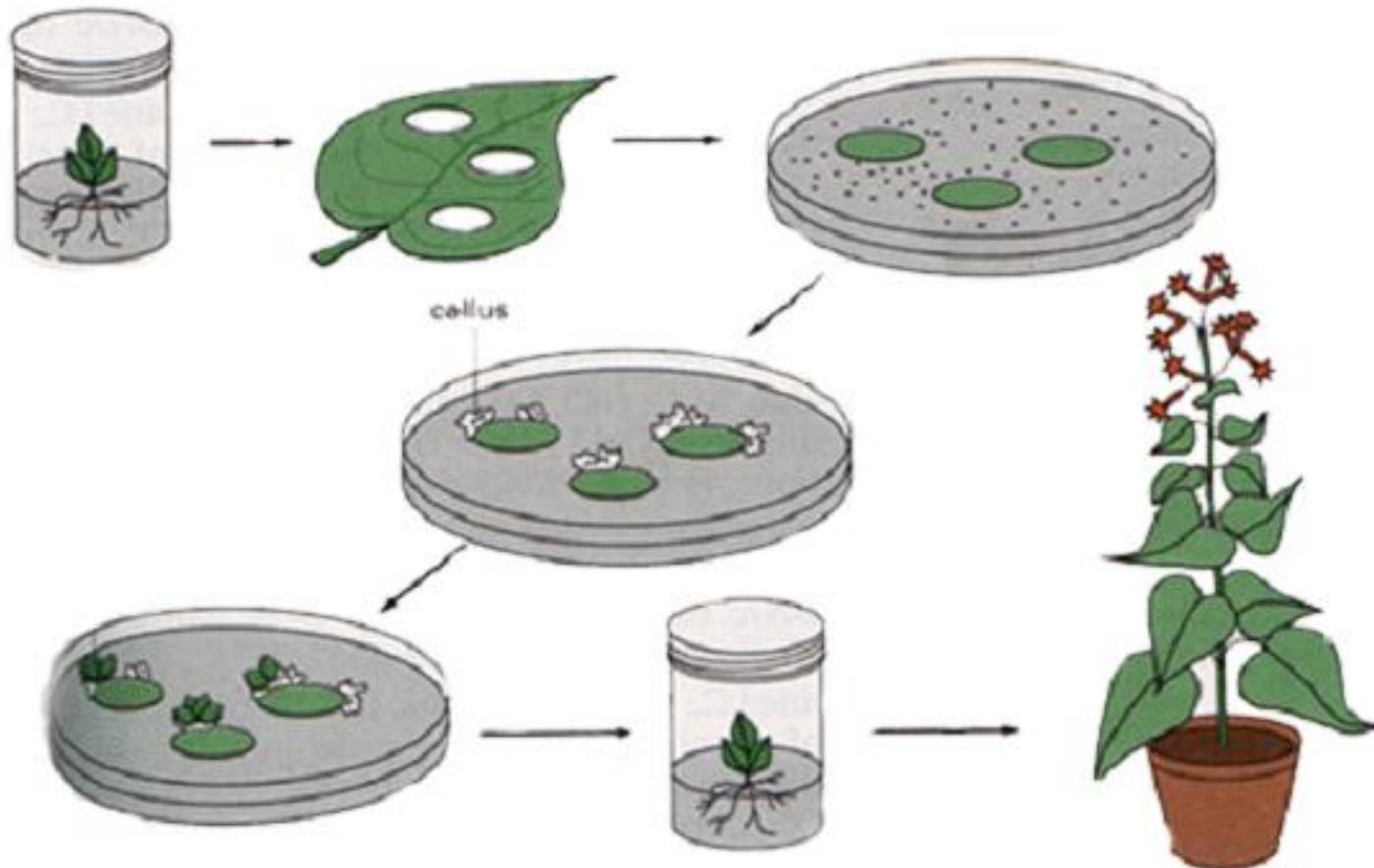
Recombinant DNA Technology

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

