



Study of Life

Themes & Concepts

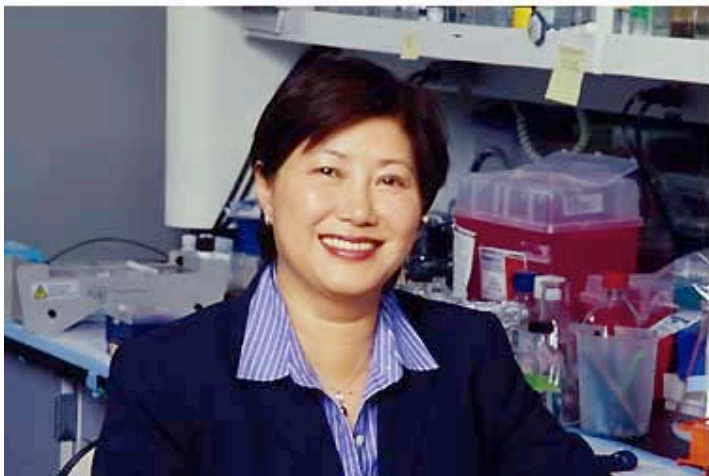


AP Biology

Themes

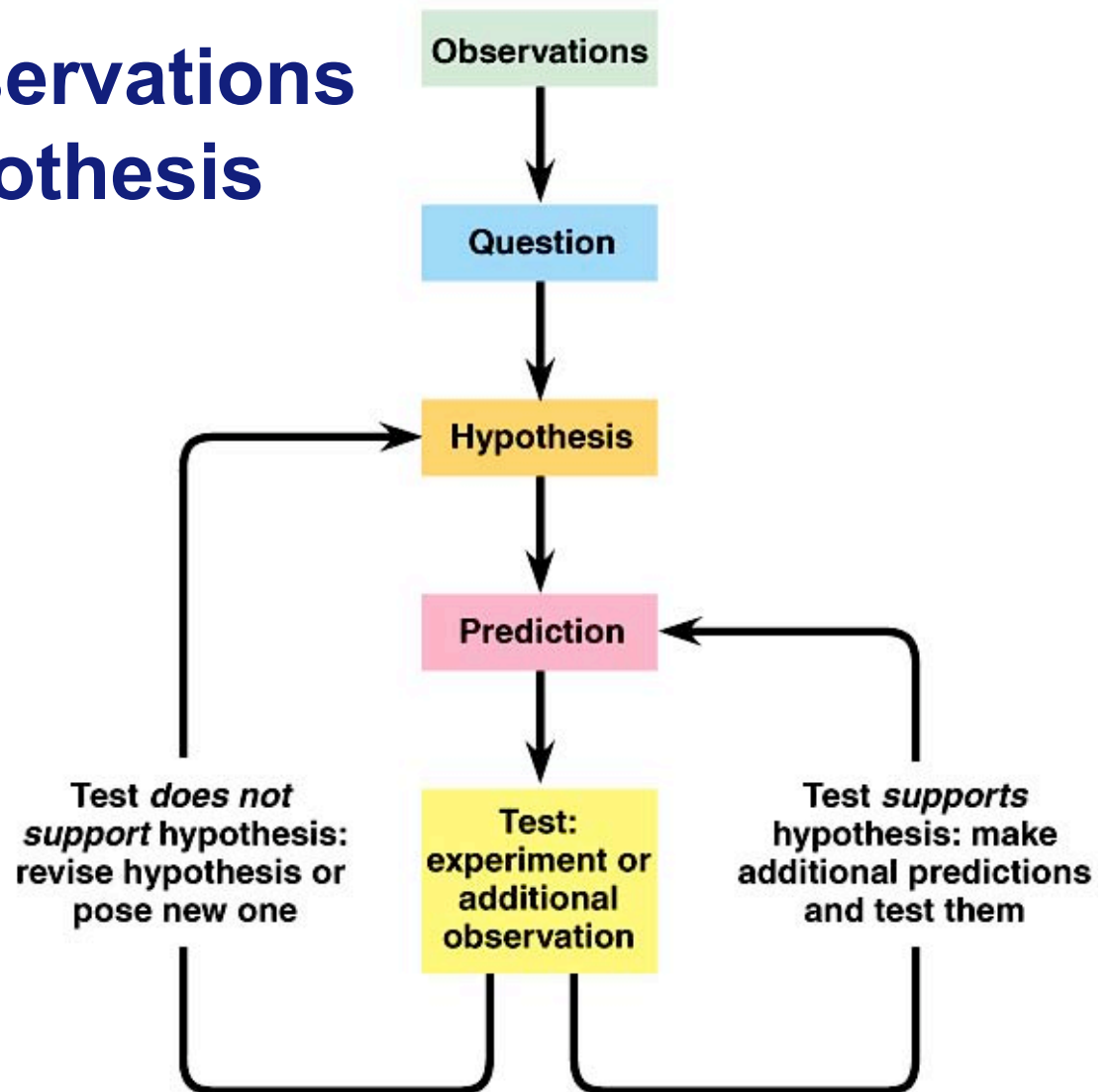
- **Science as a process of inquiry**
- **Evolution**
- **Energy transfer**
- **Continuity & Change**
- **Relationship of structure to function**
- **Regulation**
- **Interdependence in nature**
- **Science, technology & society**

Science as a process of inquiry



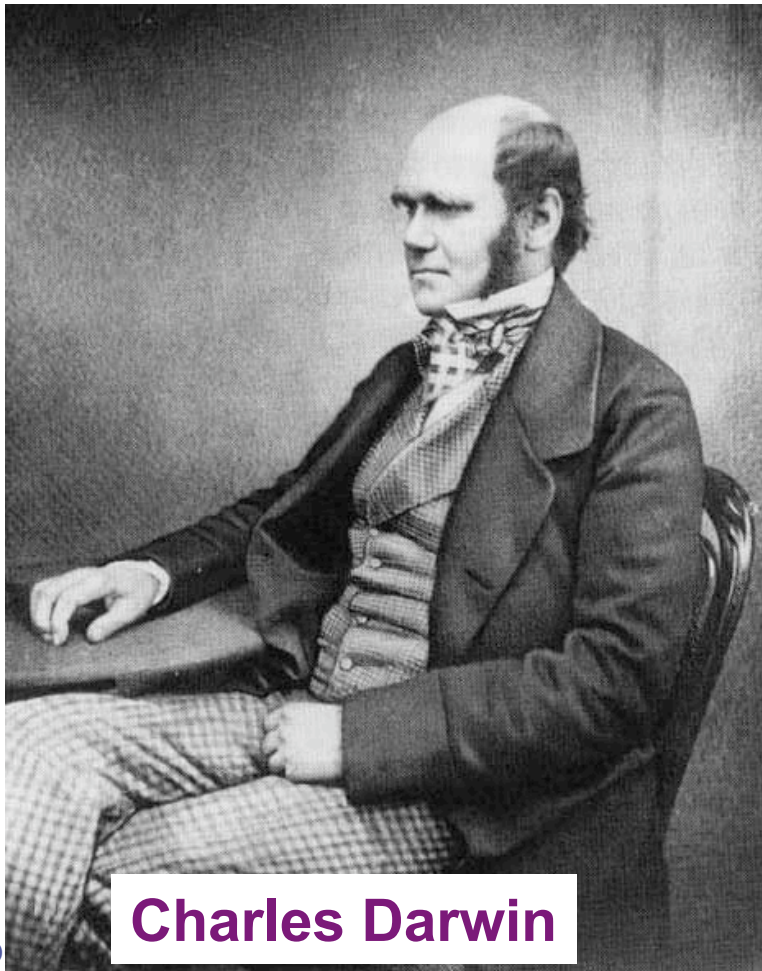
Science as a process of inquiry

- repeatabable observations & testable hypothesis

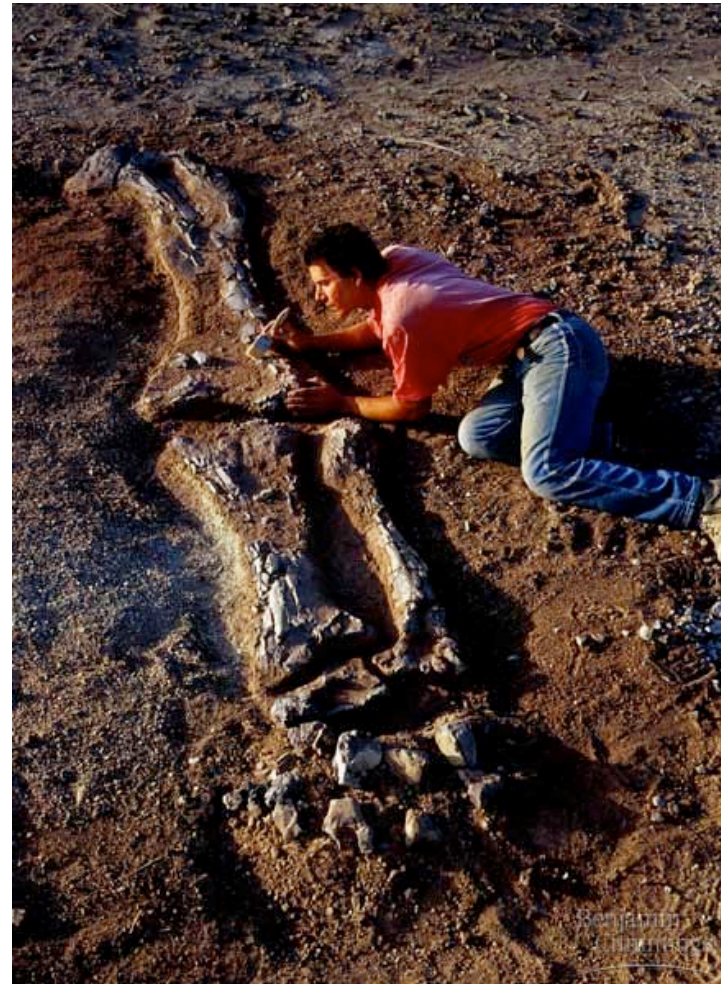


Evolution

- Core theme of biology

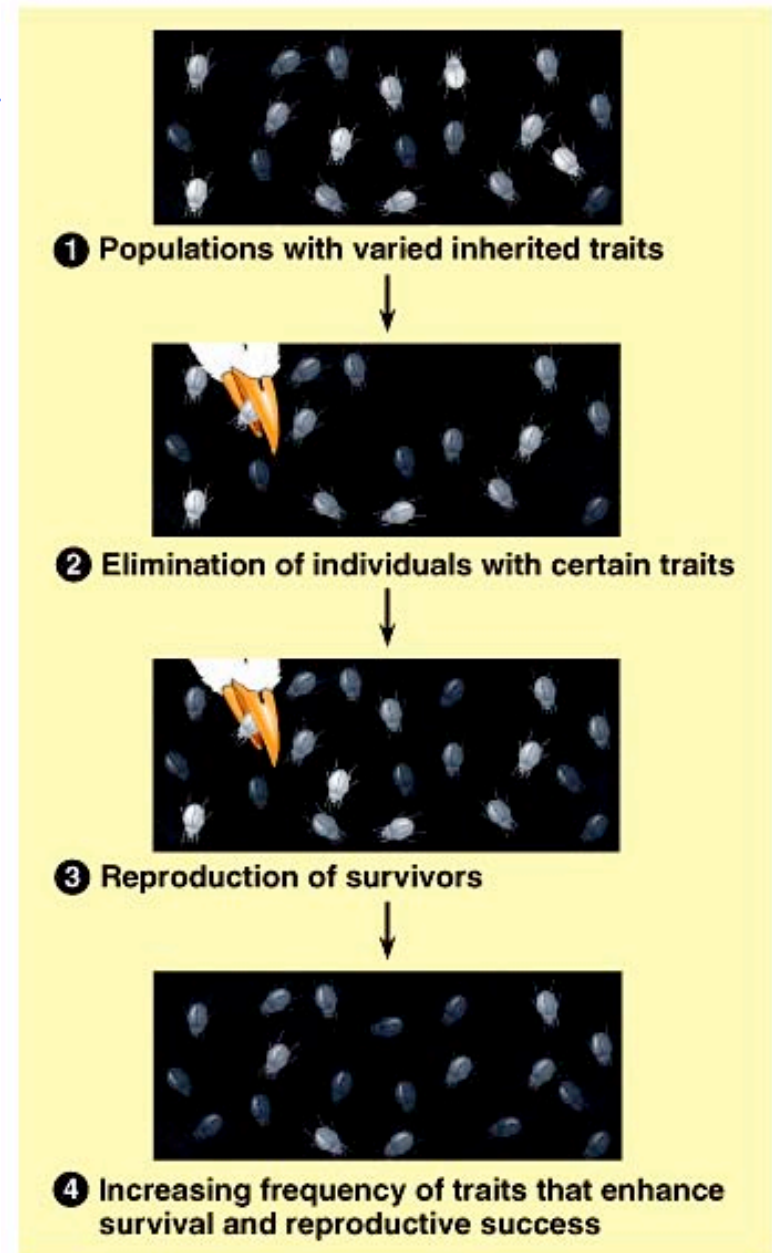


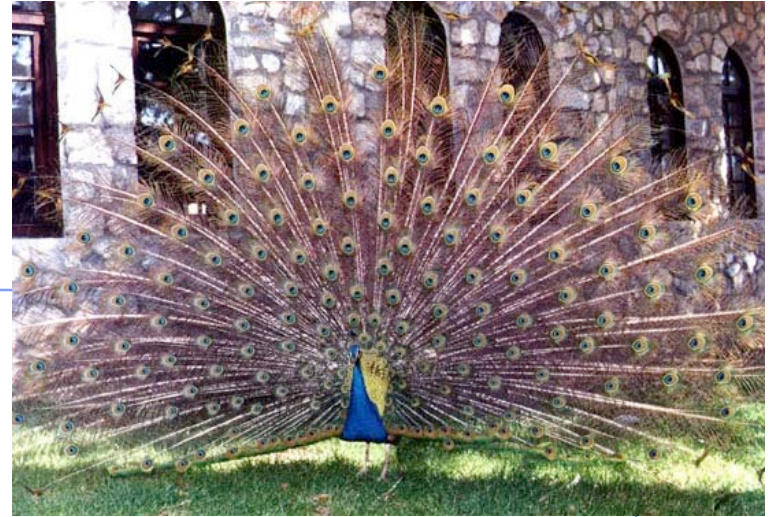
Charles Darwin



Natural selection

- Evolutionary adaptation is a product of natural selection





**Nothing in biology makes sense
except in the light of evolution.**

— Theodosius Dobzhansky

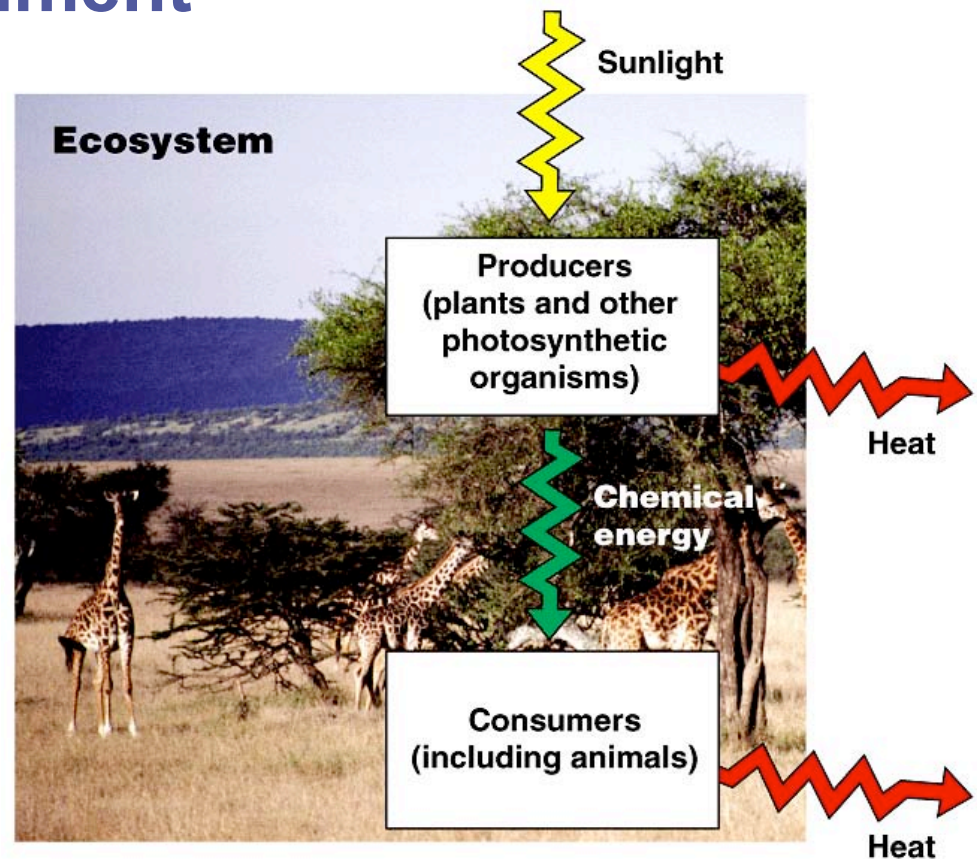
Natural selection

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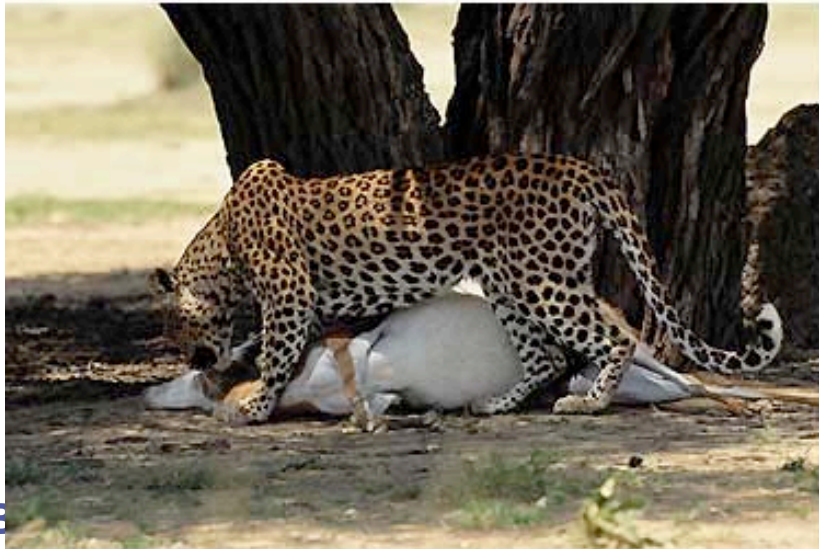
Energy transfer

- Life is an open system
 - ◆ organisms continuously interact with the environment
 - ◆ stuff comes in stuff goes out
 - ◆ energy is used



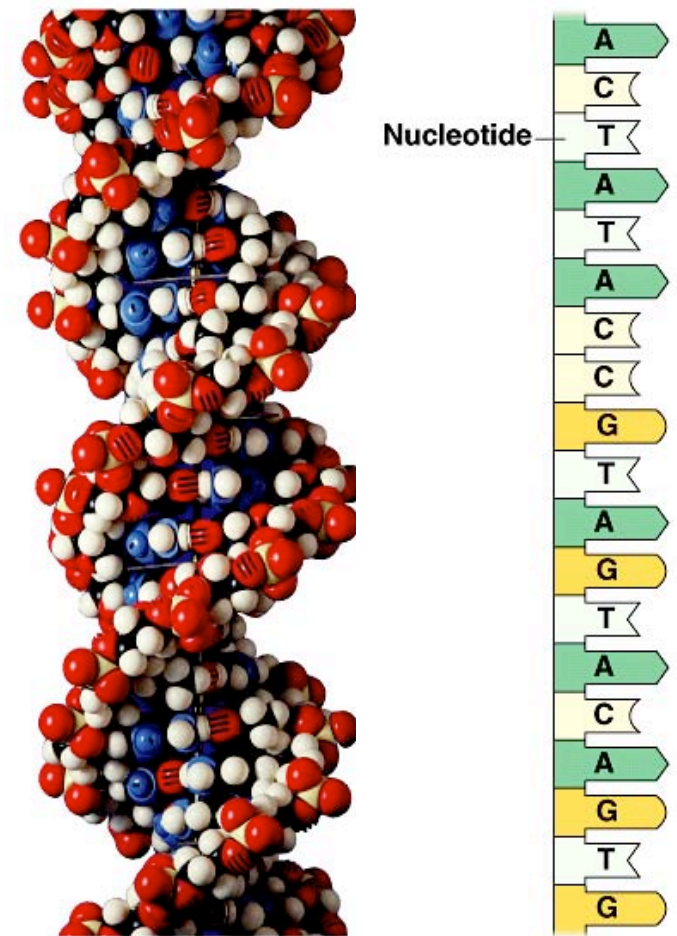
Entropy rules!

Energy utilization



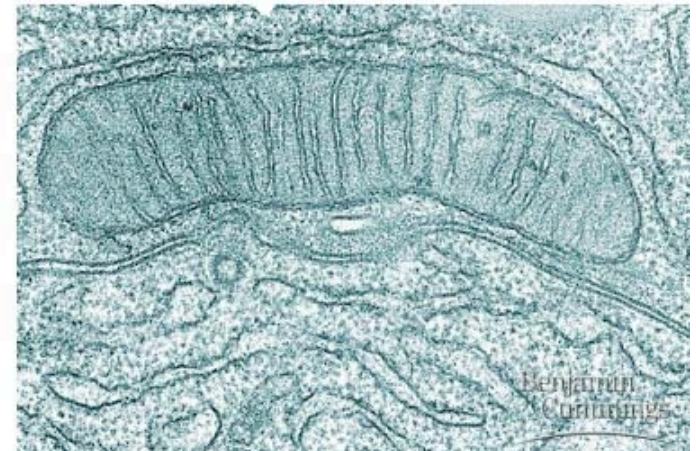
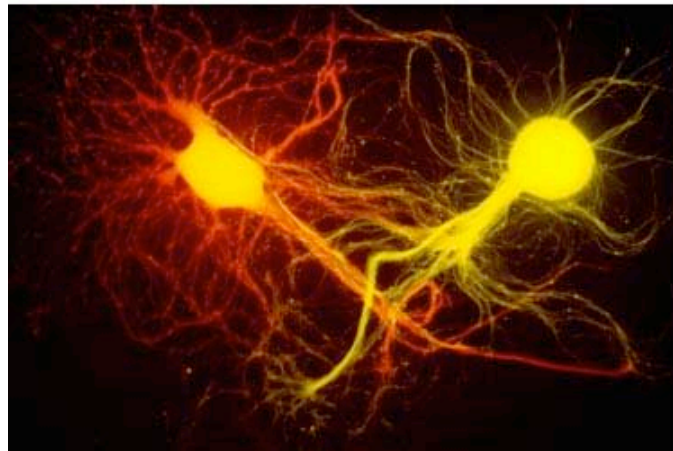
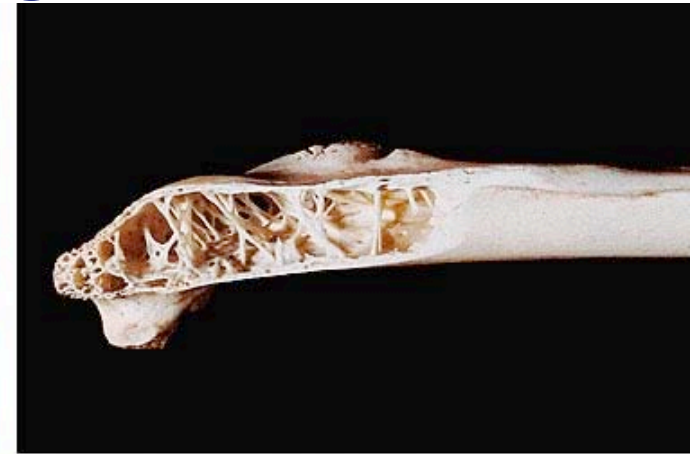
Continuity & change

- **Continuity of life is based on heritable information in the form of DNA**
 - ◆ **DNA – the genetic material – carries biological information from 1 generation to the next**



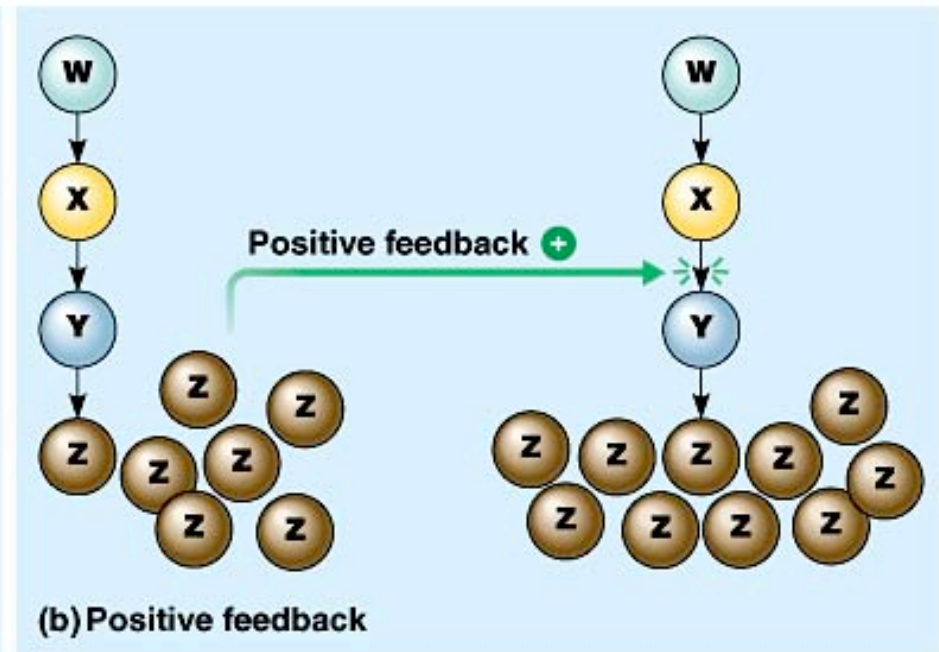
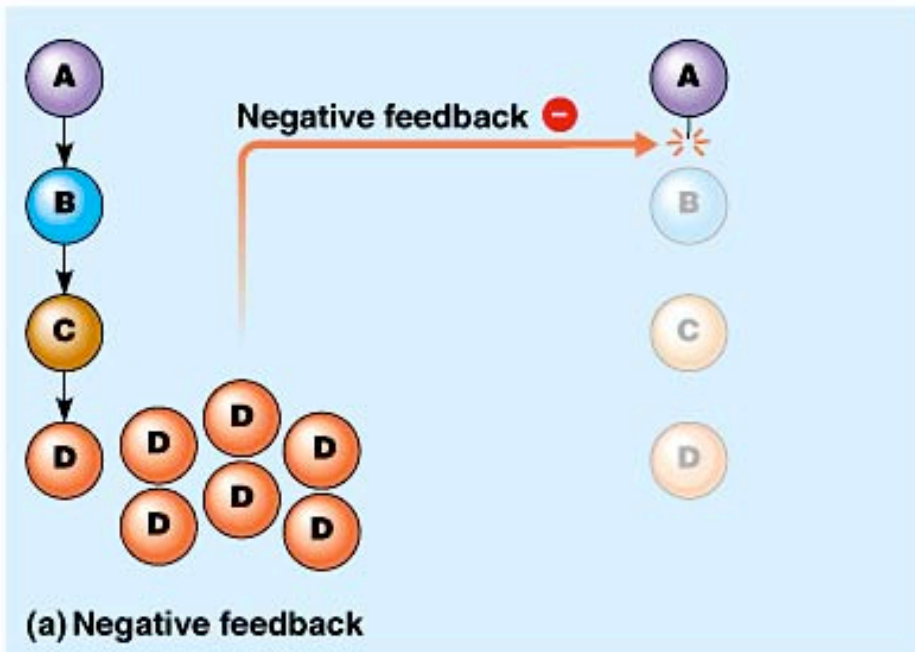
Form follows function

- Structure & function are correlated at all levels of biological organization



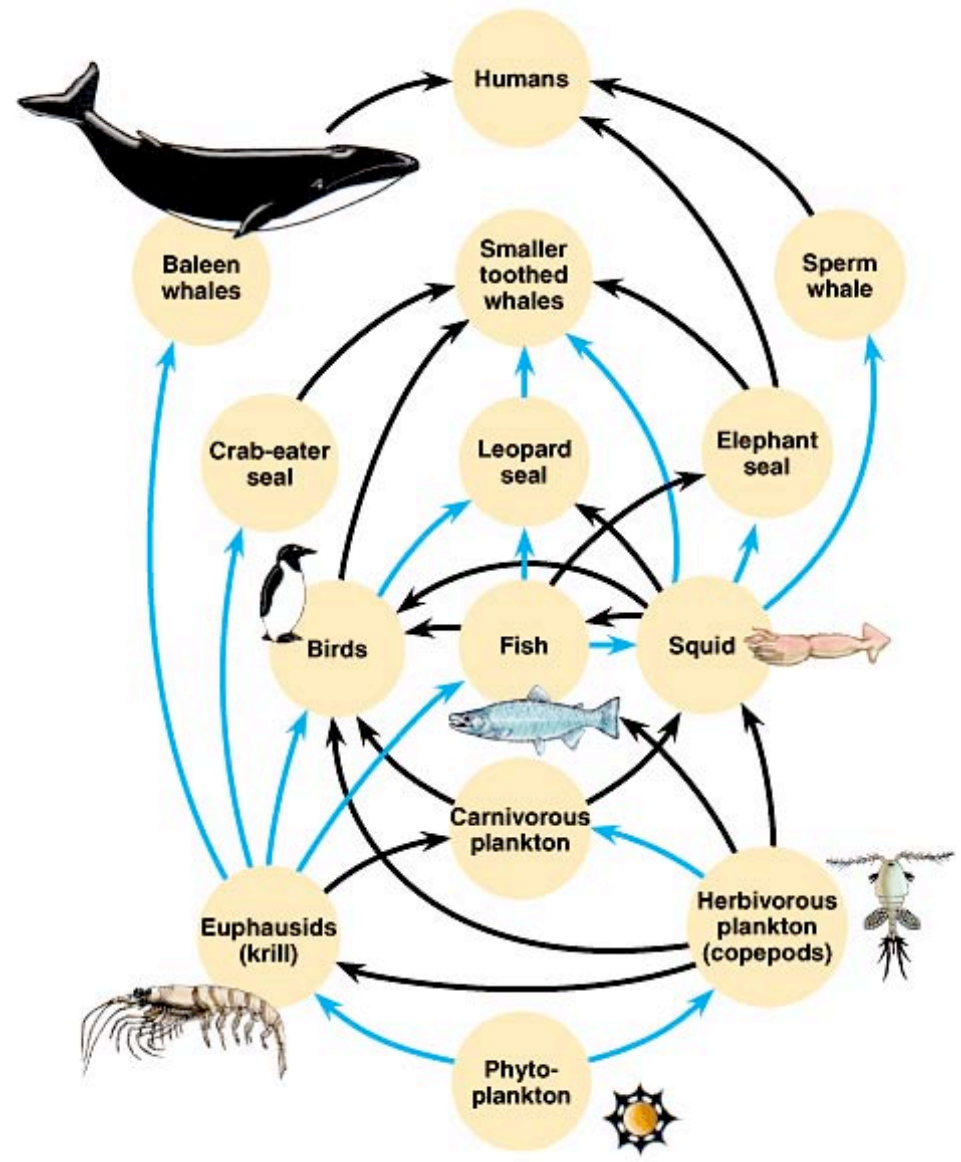
Regulation

- Regulatory mechanisms ensure a dynamic balance through feedback



Interdependence

- No organism is an island standing alone



Science, technology & society

- Science & technology must function within the framework of society
 - ◆ ethics



Benjamin Cummings



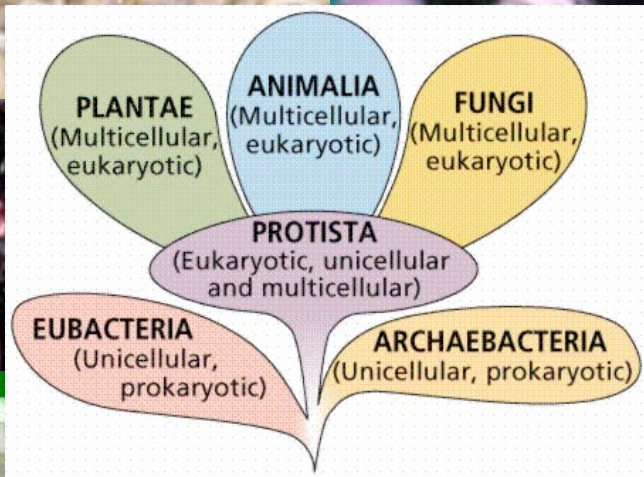
Umbrella concepts

Recurring principles & ideas

Diversity & unity

- Dual aspects of life on Earth





Unity of life

What do organisms have in common?

Why do similarities exist?



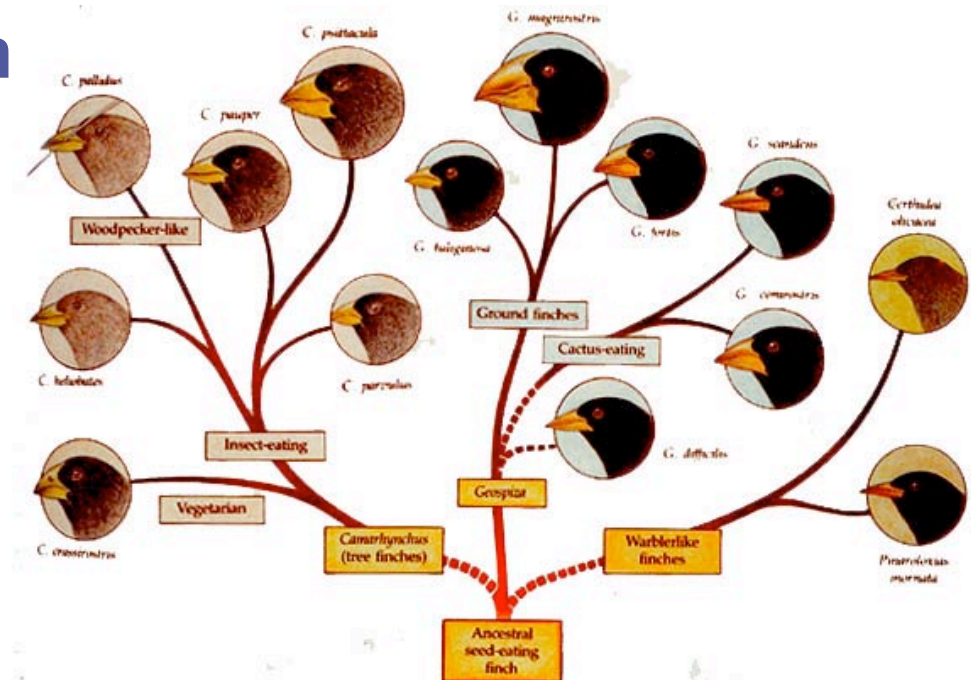
Evolution explains diversity & unity

■ Unity

- ◆ evolutionary relationships
- ◆ connected through a common ancestor

■ Diversity

- ◆ natural selection
- ◆ adaptations in different environments



Properties of life

order



reproduction

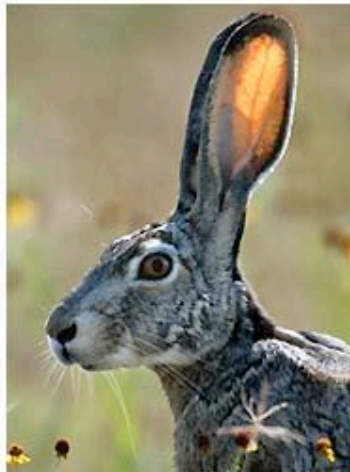


growth & development



energy utilization

response

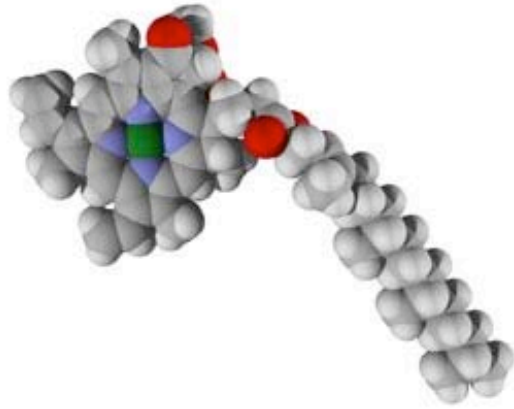


homeostasis

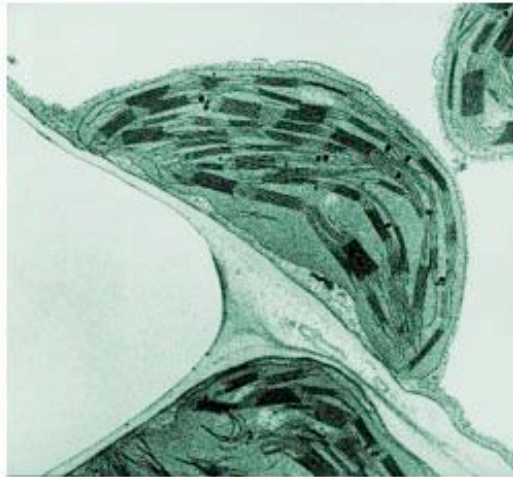


evolutionary adaptation

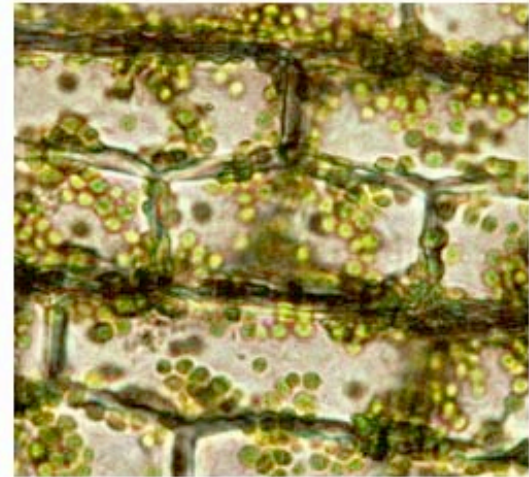
Levels of organization



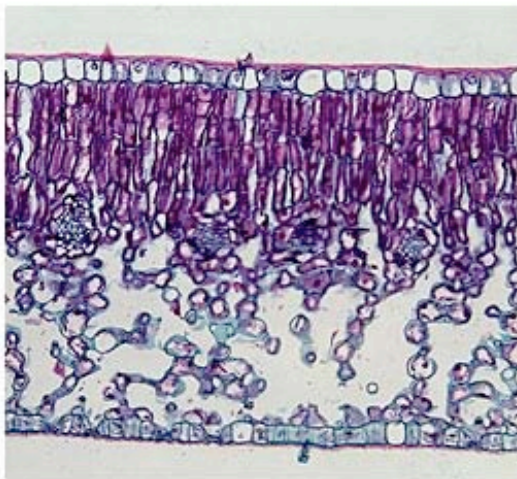
Molecule



Organelle



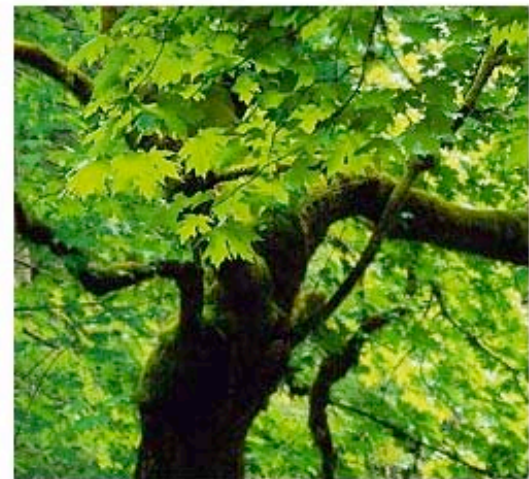
Cells



Tissues



Organ

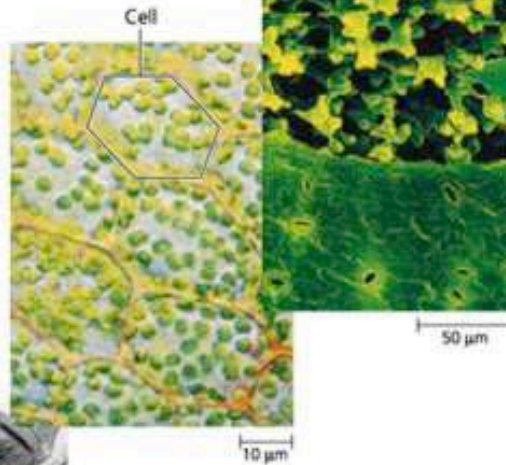


Community

Each level has emergent properties

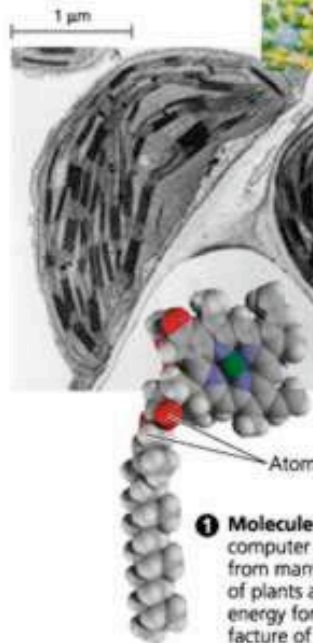
4 Tissue. In multicellular organisms, cells are usually organized into tissues, groups of similar cells forming a functional unit. The leaf in this artificially-colored micrograph has been cut obliquely, revealing two different specialized tissues. The honeycomb-like tissue (upper half) consists of photosynthetic cells within the leaf. The dark green tissue with the small pores (lower half) is the epidermis, the "skin" of the plant. The pores in the epidermis allow carbon dioxide, a raw material converted to sugar by photosynthesis, to enter the leaf.

3 Cell. Many organelles cooperate in the functioning of the living unit we call a cell. Chloroplasts are evident in these leaf cells.



5 Organ. The maple leaf, a plant organ, has a specific organization of many different tissues, including photosynthetic tissue, epidermis, and the vascular tissue that transports water from the roots to the leaves.

6 Organism. A maple tree is a member of a biological community that includes many other species of organisms.

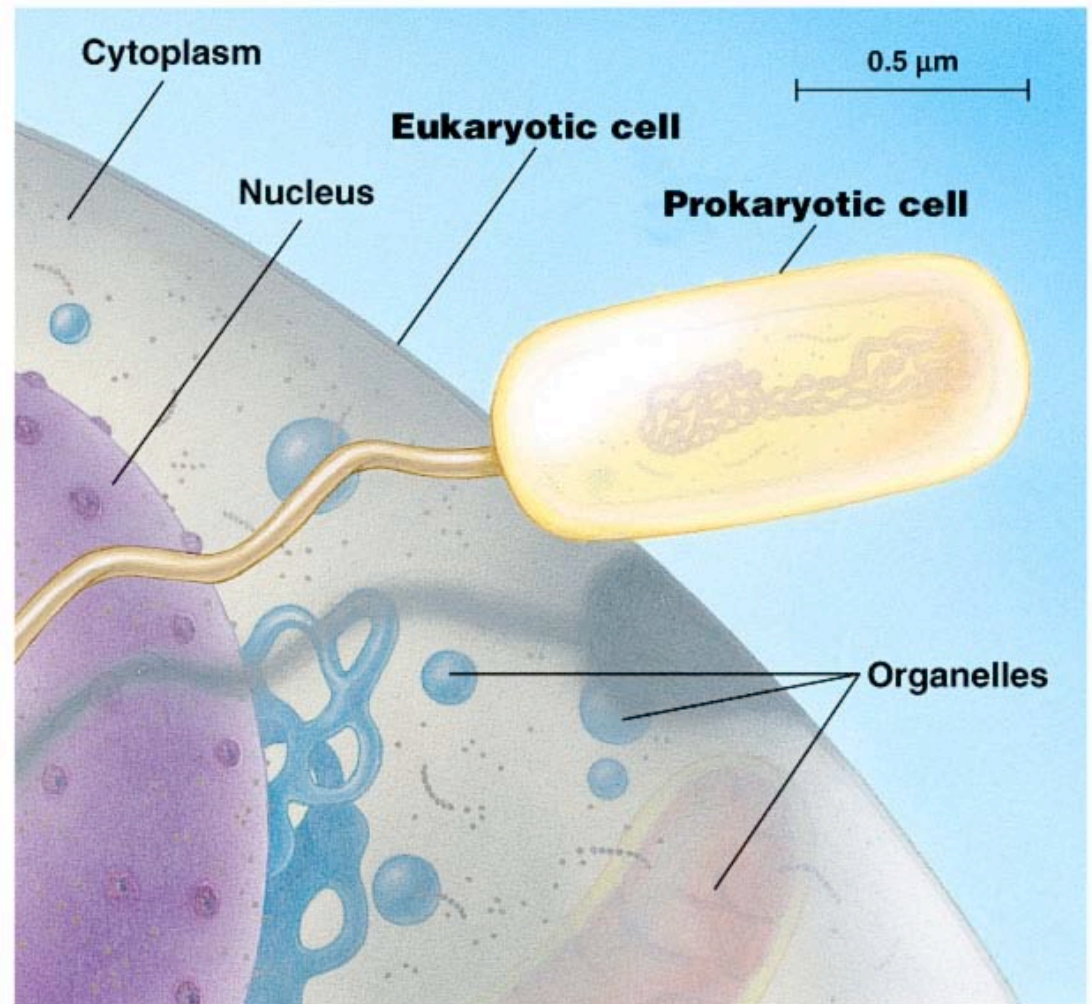


2 Organelle. The process of photosynthesis requires the participation of many other molecules organized within the cellular organelle called the chloroplast (the large structure in this micrograph, a photograph taken with a microscope).

1 Molecule. Chlorophyll, represented here by a computer graphic model, is a molecule built from many atoms. This molecule in the leaves of plants absorbs sunlight as a source of energy for driving photosynthesis, the manufacture of food in the leaf.

Cell is basic unit of life

- **Cell theory**
 - ◆ developed with early microscopes
 - ◆ prokaryotes
 - ◆ eukaryotes





Diversity of life

**What differences are there
between organisms?**

3 Domains of Life

Bacteria, Archaea, Eukarya



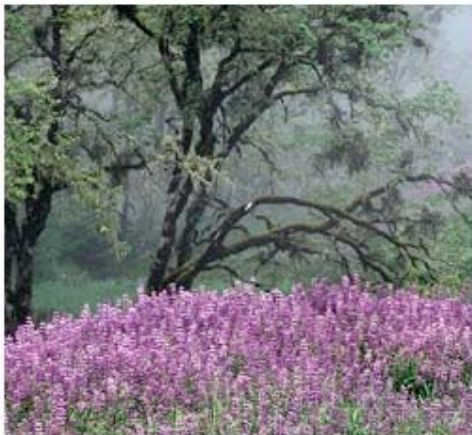
Bacteria



Archaea



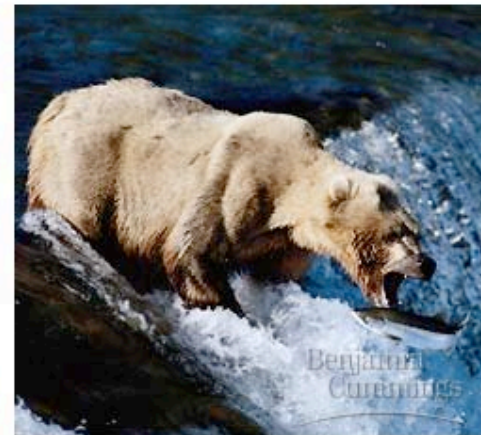
Protista



Plantae



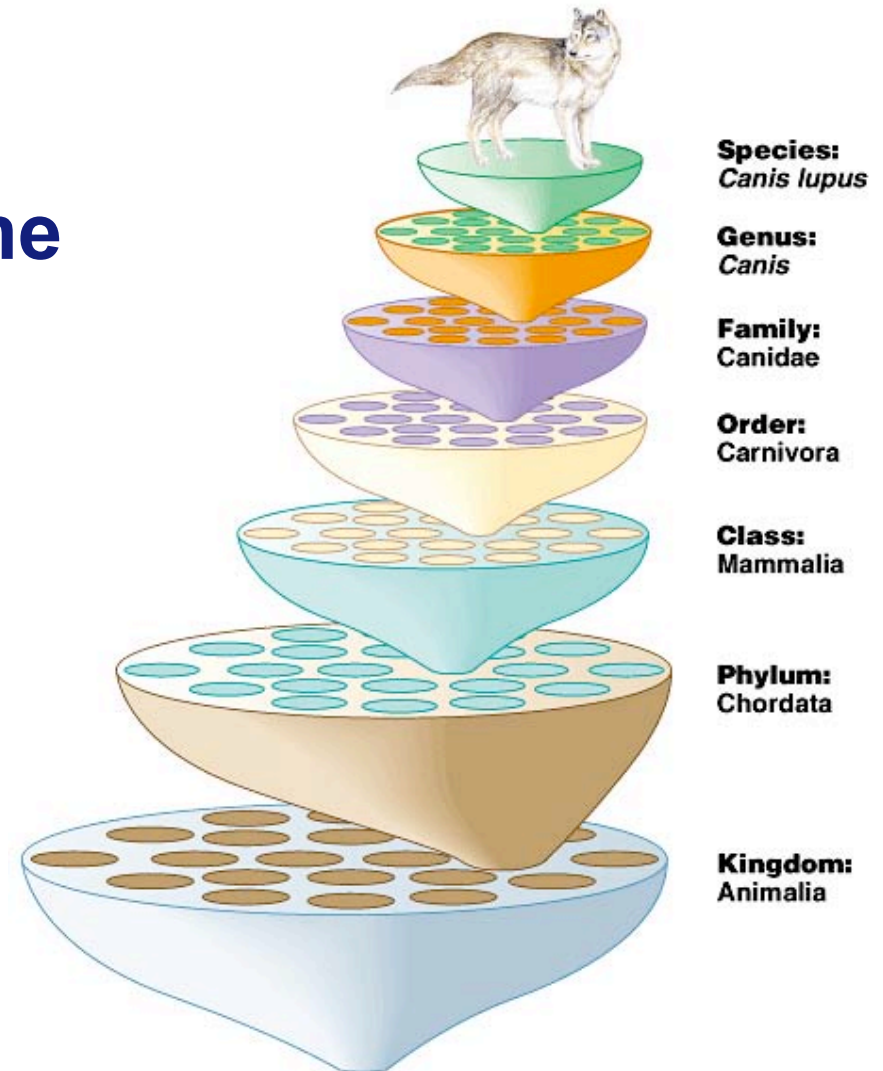
Fungi



Animalia

Organizing systems

- Making sense out of the diversity
- Hierarchical scheme



Why study themes of Biology?

- **Biology is an ever expanding body of knowledge**
 - ◆ too much to memorize it all
 - ◆ need to generalize
 - ◆ create a framework upon which to organize new knowledge
 - ◆ themes are fundamental in understanding the nature of living organisms

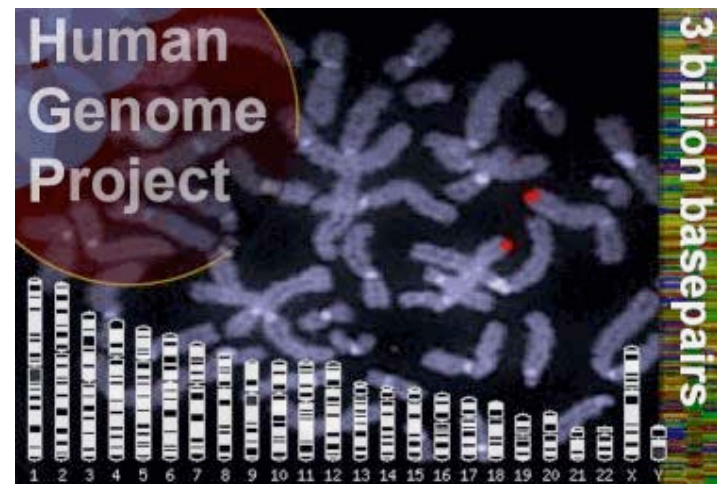
Which science is growing the fastest in new knowledge?

BIOLOGY!!



Dr. Mary Claire King

**Genomics
& proteomics
projects are
driving research**





Any Questions??