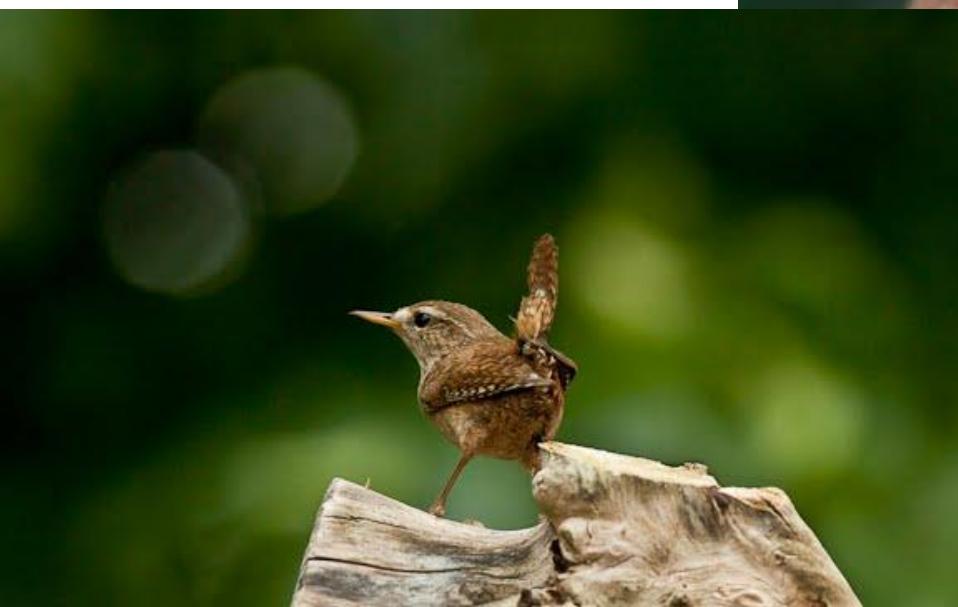


Biology 111 –



General Biology 1



Course Description

This introduction to biology covers in detail the basic biological concepts of scientific method, cell structure and function, metabolism, evolution, genetics, and ecology, accompanied by appropriate illustrations. The principles are then discussed in relation to viruses, bacteria, protozoa and plants. Laboratory exercises are chosen to complement the material presented during lecture hours.

Course Description

- Please check your schedule, you should be prepared for the lecture or lab of the day.
- You are expected to attend all lectures and labs!
- Read assigned readings prior to coming to class.
- Read over the syllabus, and ask questions!

Grading

- Grades are based on exams, quizzes and lab work.
1. 4 exams worth 100 pts each = 400 pts
 2. 14 lab assign 10 pts each = 140 pts
 3. 6 Homework Assignments = 60 pts
 4. Scientific Lit summaries = 40 pts
 5. 2 Lab reports 50 pts each = 100 points

Total points for this course = 740 points

How to study for a general biology course

- There are more new vocabulary words in a basic biology course than are taught in a first semester French course.
 - Keep up with the reading, if you wait until an exam you will be quickly overwhelmed.
 - Flash cards can be your best friend
-

Finally...



Ask me if you have any questions!

Please answer these questions on a piece of paper

1. Why are you taking this course?
 2. What are your goals for taking biology?
 3. What is your favorite part of biology?
 4. How do you learn best? (pictures, writing etc.)
-

Chapter 1:

Introduction:

Themes in the Study of Life



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Overview: Inquiring About the World of Life

- **Evolution** is the process of change that has transformed life on Earth
- **Biology** is the scientific study of life
- Biologists ask questions such as:
 - How a single cell develops into an organism
 - How the human mind works
 - How living things interact in communities

What is life?

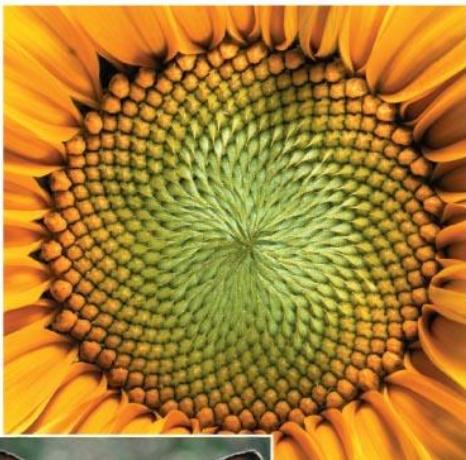
- Life defies a simple, one-sentence definition
- Life is recognized by what living things do



PLAY

Video: Seahorse Camouflage

▼Order



▲ Response
to the
environment



▲ Regulation



▲ Reproduction

▲ Energy
processing

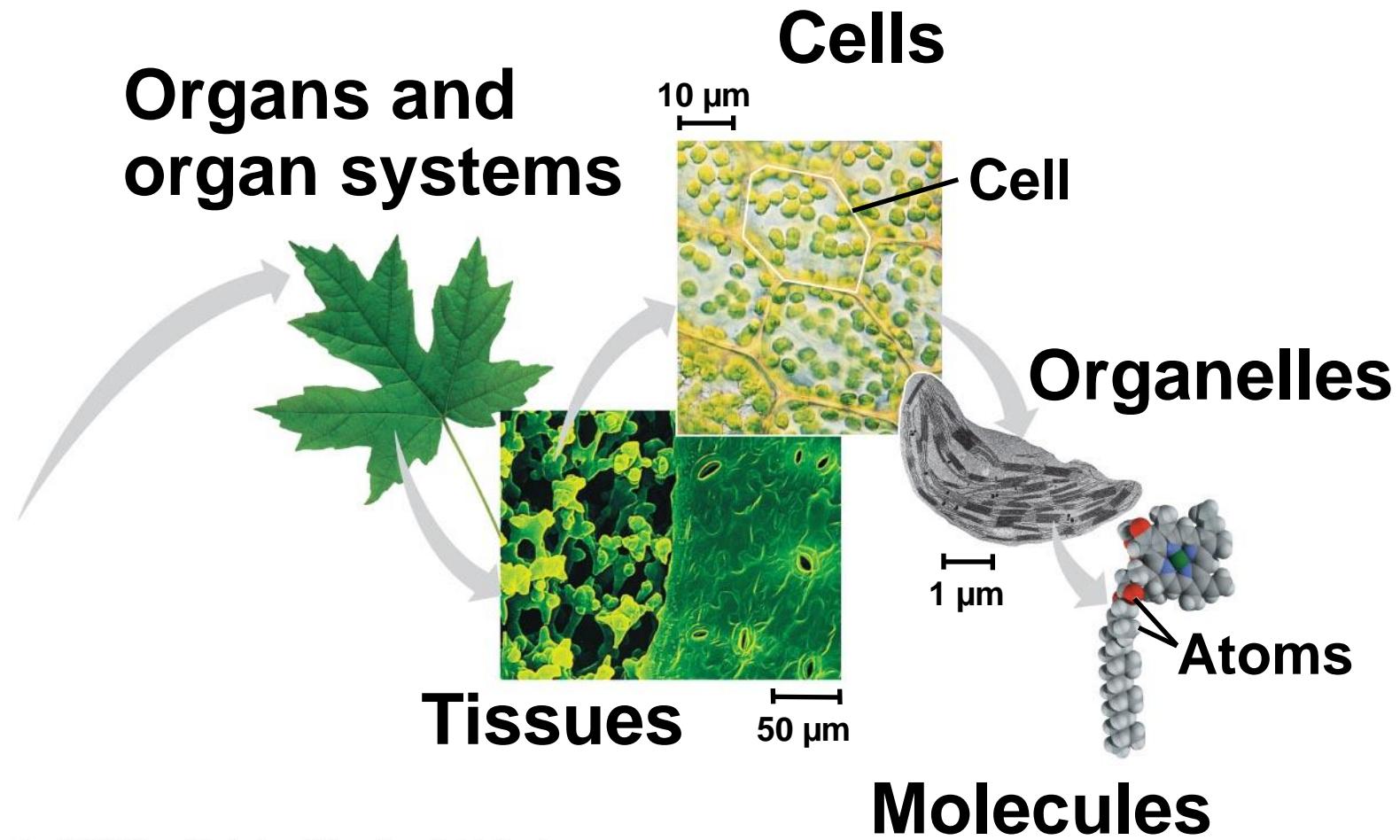
▲ Growth and
development

Evolution, the Overarching Theme of Biology

- Evolution makes sense of everything we know about living organisms
- Organisms living on Earth are modified descendants of common ancestors
- “Nothing in biology makes sense except in the light of evolution”—Theodosius Dobzhansky
- Evolution unifies biology at different scales of size throughout the history of life on Earth

Theme: New properties emerge at each level in the biological hierarchy

- Life can be studied at different levels from molecules to the entire living planet
- The study of life can be divided into different levels of biological organization



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Fig. 1-4a

The biosphere

Communities



Populations



Organisms

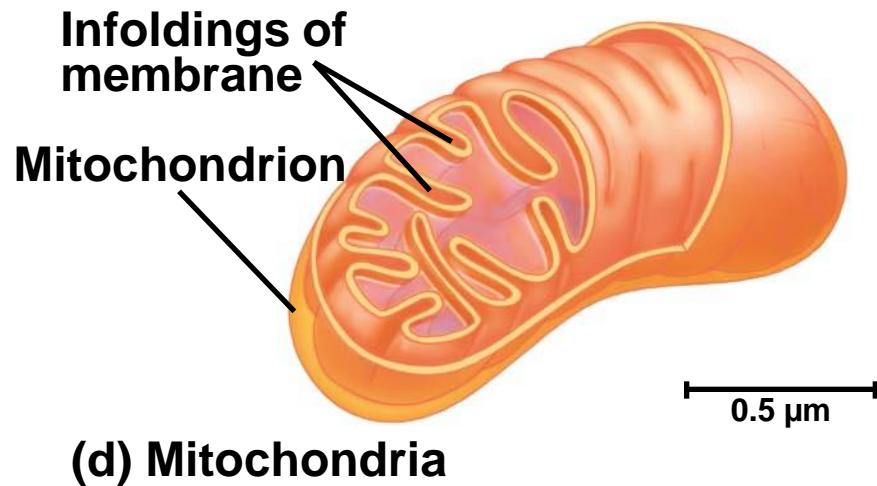
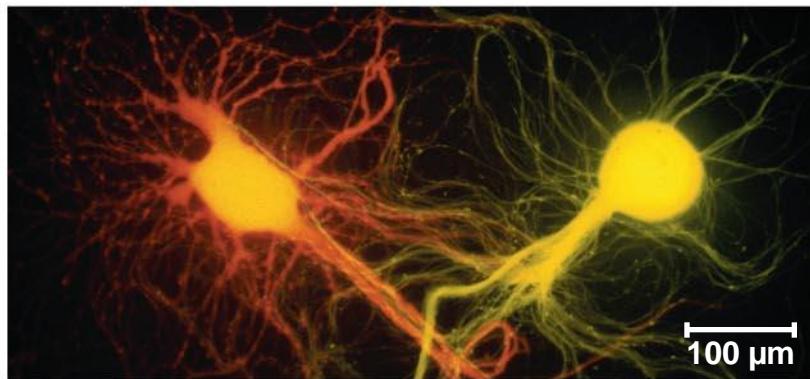


Ecosystems



Theme: Structure and function are correlated at all levels of biological organization

The structure and function of living organisms are closely related



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Fig. 1-6

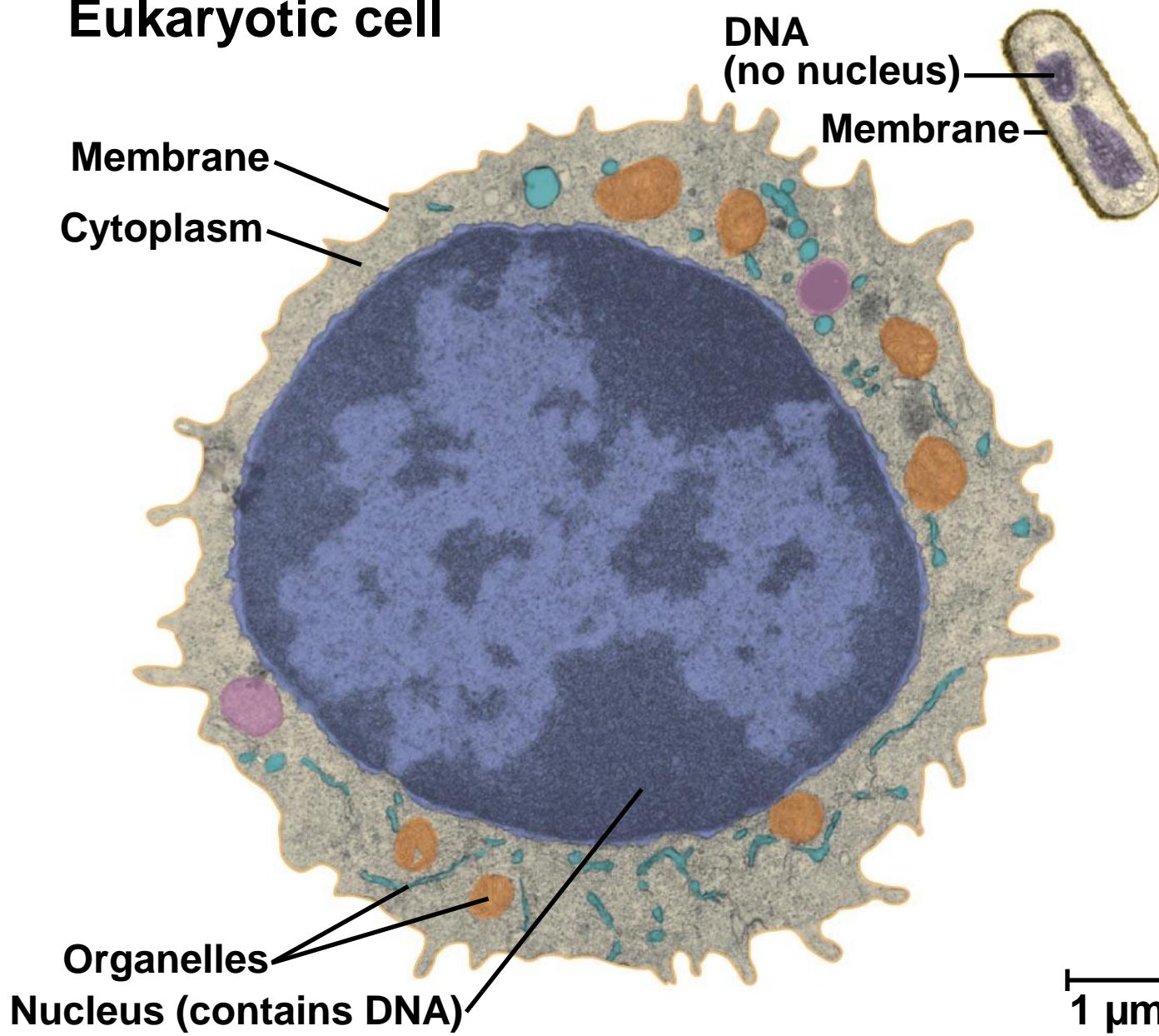
Theme: Cells are an organism's basic units of structure and function

- The cell is the lowest level of organization that can perform all activities required for life
- All cells:
 - Are enclosed by a membrane
 - Use DNA as their genetic information
- The ability of cells to divide is the basis of all reproduction, growth, and repair of multicellular organisms

Fig. 1-8

Prokaryotic cell

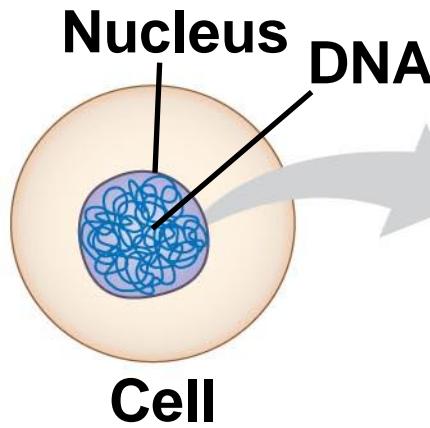
Eukaryotic cell



Theme: The continuity of life is based on heritable information in the form of DNA

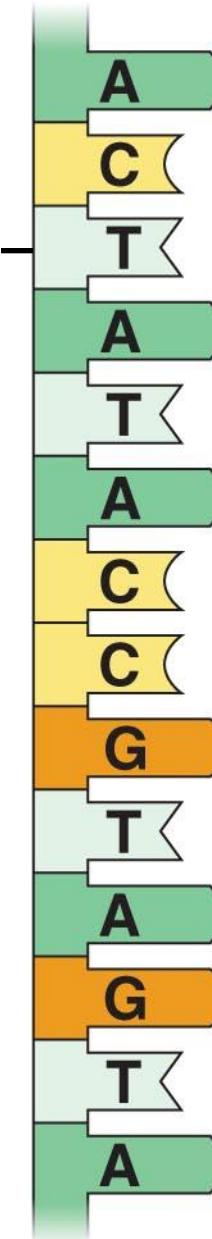
- Chromosomes contain most of a cell's genetic material in the form of **DNA** (deoxyribonucleic acid)
- DNA is the substance of genes
- **Genes** are the units of inheritance that transmit information from parents to offspring

Fig. 1-10



(a) DNA double helix

Nucleotide



(b) Single strand of DNA

Theme: Feedback mechanisms regulate biological systems

- Feedback mechanisms allow biological processes to self-regulate
- **Negative feedback** means that as more of a product accumulates, the process that creates it *slows* and *less* of the product is produced
- **Positive feedback** means that as more of a product accumulates, the process that creates it *speeds up* and *more* of the product is produced

PLAY

Animation: Negative Feedback

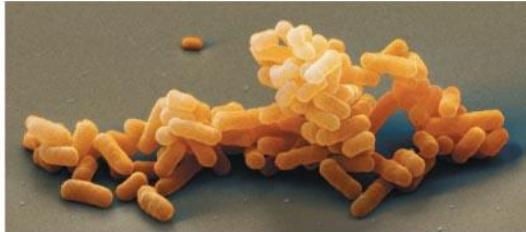
PLAY

Animation: Positive Feedback

Organizing the Diversity of Life

- Approximately 1.8 million species have been identified and named to date, and thousands more are identified each year
- Estimates of the total number of species that actually exist range from 10 million to over 100 million

(a) DOMAIN BACTERIA



(b) DOMAIN ARCHAEA



(c) DOMAIN EUKARYA



Protists

Kingdom
Plantae



Kingdom Fungi

Kingdom Animalia



Kingdom Animalia

There are 3 domains

Domain Bacteria and **domain Archaea** comprise the prokaryotes

Domain Eukarya includes all eukaryotic organisms

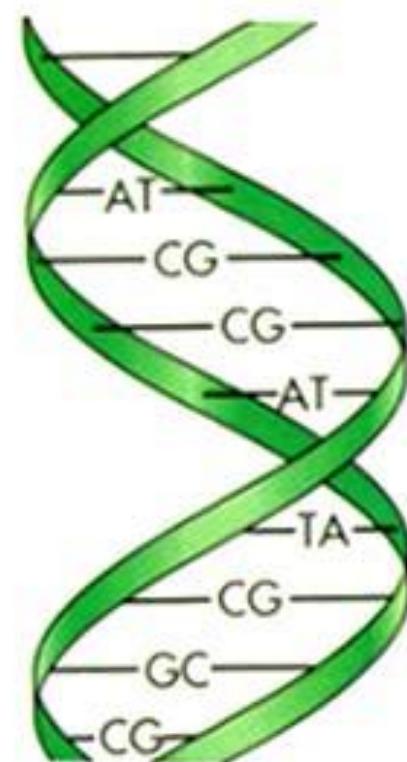
The domain Eukarya includes three kingdoms:

- Plantae
- Fungi
- Animalia

Fig. 1-15

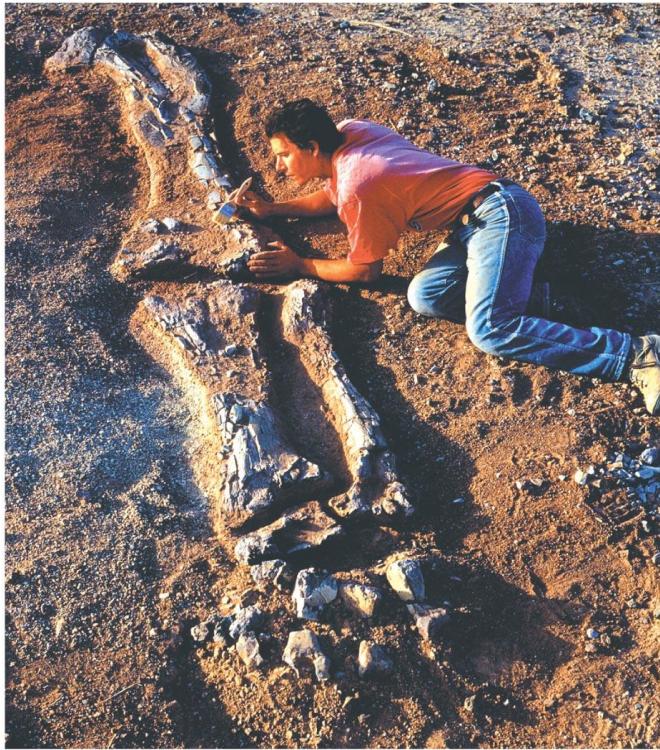
Unity in the Diversity of Life

- A striking unity underlies the diversity of life
 - DNA is the universal genetic language common to all organisms



Charles Darwin and the Theory of Natural Selection

- Fossils and other evidence document the evolution of life on Earth over billions of years



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Fig. 1-18



Charles Darwin published *On the Origin of Species by Means of Natural Selection* in 1859

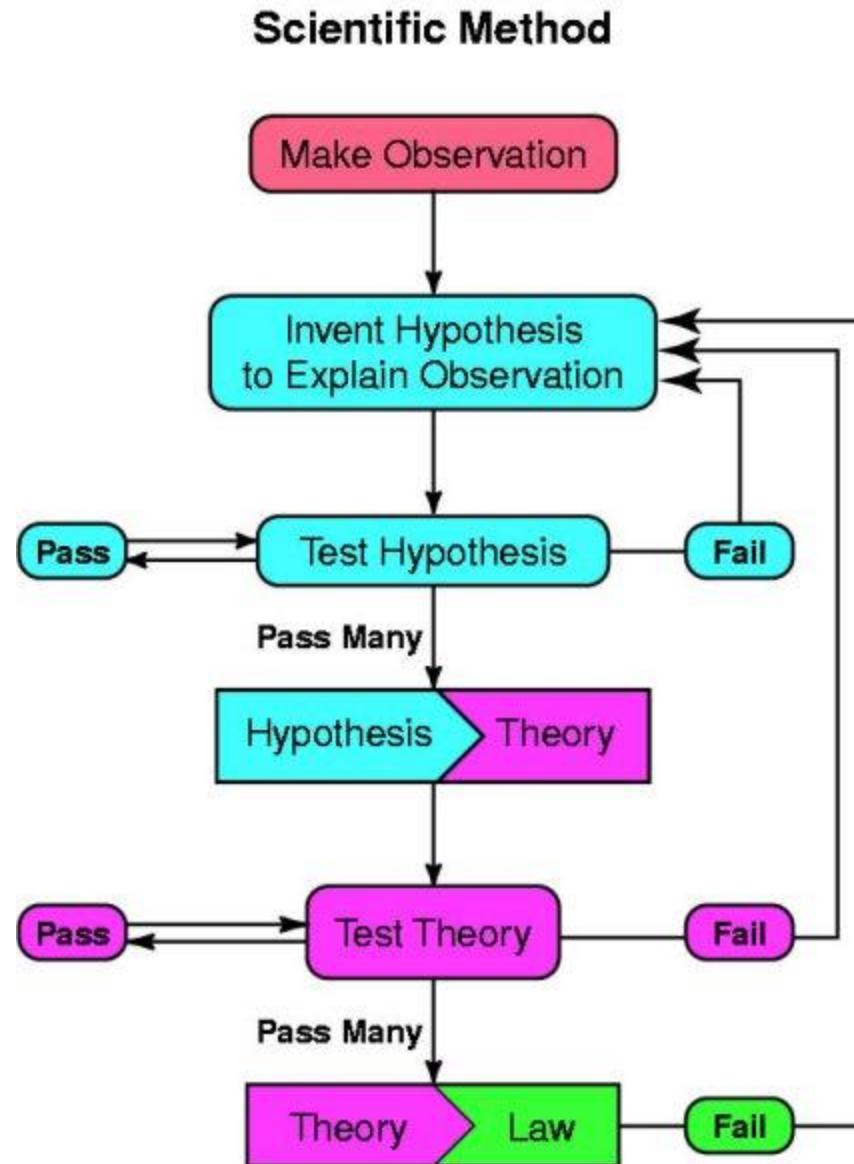


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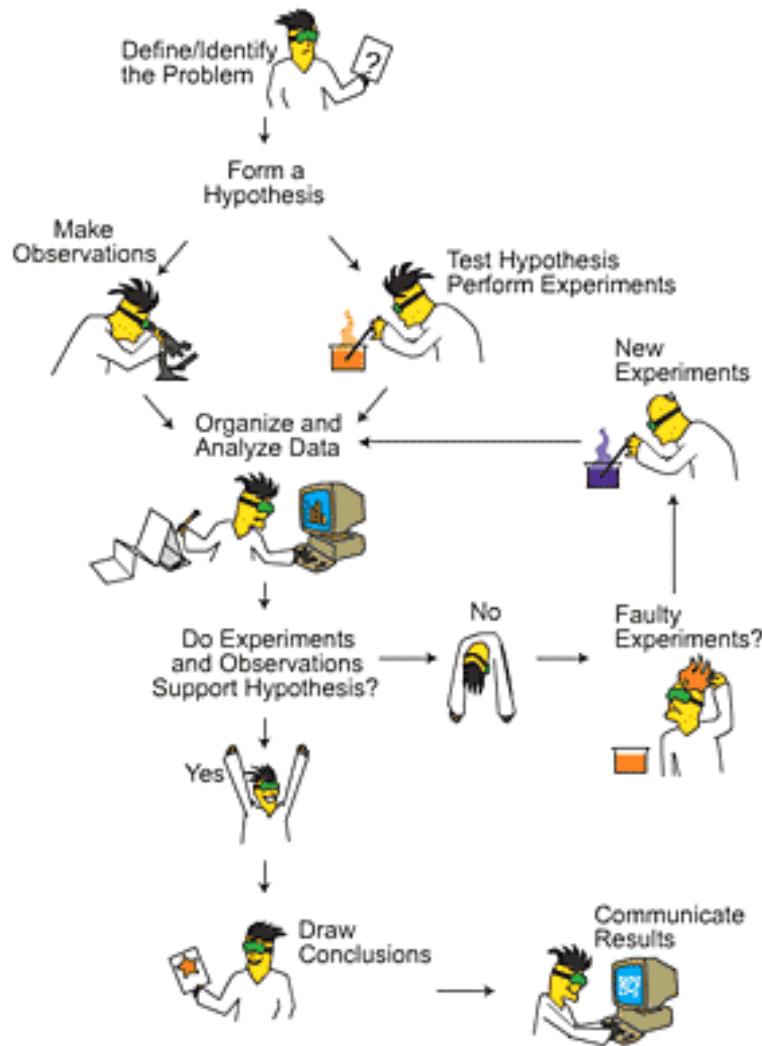
You should now be able to:

1. Briefly describe the unifying themes that characterize the biological sciences
2. Distinguish among the three domains of life, and the eukaryotic kingdoms

Lab 1: The Scientific Method



THE PROCESS OF SCIENCE



The word *science* is derived from a Latin verb meaning “to know.” .

Science is a way of knowing.

Scientific inquiry is used to ask and answer questions about nature

What is a hypothesis?

It is a tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

IT IS NOT:
an educated guess.
OR A

Prediction

(The action of predicting future events; an instance of this, a prophecy, a forecast).

Scientific inquiry is used to ask and answer questions about nature

- How is a theory different from a hypothesis? A scientific **theory** is
 - much broader in scope than a hypothesis,
 - usually general enough to generate many new, specific hypotheses, which can then be tested, and
 - supported by a large and usually growing body of evidence.

Scientists form and test hypotheses and share their results

- We solve everyday problems by using hypotheses.
 - A common example would be the reasoning we use to answer the question, “Why doesn’t a flashlight work?”
 - Using deductive reasoning we realize that the problem is either (1) the bulb or (2) the batteries.
 - a hypothesis must be **Testable** and **Falsifiable**

Scientists form and test hypotheses and share their results

- Science is a social activity with most scientists working in teams.
- Scientists share information in many ways.
- Science seeks natural causes for natural phenomena.
 - The scope of science is limited to the study of structures and processes that we can directly observe and measure.
 - Hypotheses about supernatural forces or explanations are outside the bounds of science, because they generate hypotheses that cannot be tested by science.

Scientific Method

- 1. Observation** - Ask and define the question
- 2. Preliminary Research** - Gather information and resources through observation.
- 3. Hypothesis** - Form a hypothesis.
- 4. Experimentation** - Perform one or more experiments and collect and sort
- 5. Data** - Analyze the data.
- 6. Conclusion** - Interpret the data and make conclusions that point to a hypothesis.
- 7. Retest** - Formulate a "final" or "finished" hypothesis.
- 8. Report** – Tell others about your findings

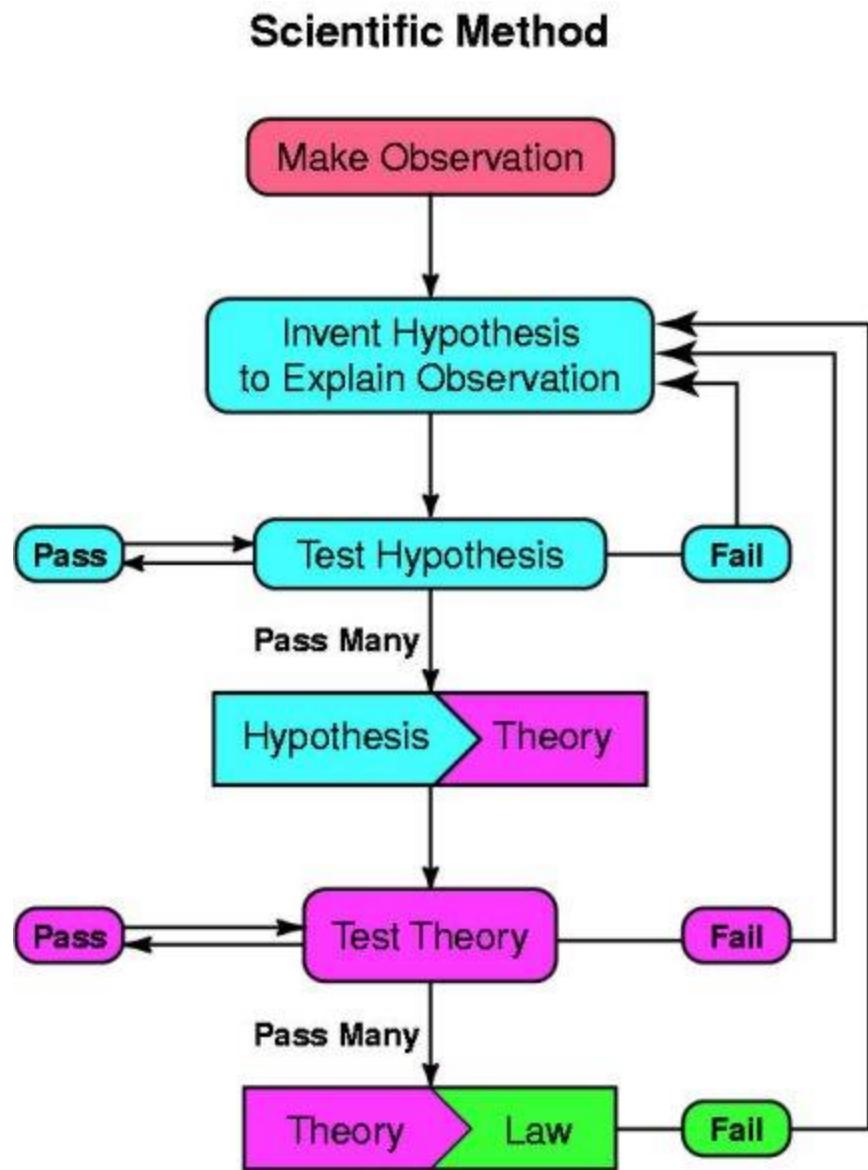
Good science **CONTROLS** experiments so that the outcome answers the question.

- Control Group – hold one group steady so that you know what no change looks like.
- In an experiment, the *independent variable* is the variable that is varied or manipulated by the researcher, and the *dependent variable* is the response that is measured.
- Dependant variable what you **measure** in the experiment and what is affected during the experiment
- Independent variable – what you are changing
- (An *independent variable* is the presumed cause, whereas the *dependent variable* is the presumed effect)

Good science **CONTROLS** experiments so that the outcome answers the question.

- What type of data – time in minutes, length in meters, number of leaves. You need to decide this BEFORE you start. WHY?
- Possible outcomes? - What do you expect? What else could happen. The best you can do is try to predict what will happen if something unexpected happens you need to go back to the drawing board.

Lab 1: The Scientific Method



Exercise 1

- Read part I
- Form a Team and conduct part II

Your Goals for this lab...

With your group design a way to scientifically test what is in the box.

Ask me for any tools that you may need.

Follow the steps of the scientific method to discover what is in the box.

You MAY NOT open the box.

After the lab we will discuss your results as a class.