

NOTES: Chapter 1 - Exploring Life

- The phenomenon we call life defies a simple, one-sentence definition
- We recognize life by what living things DO

Some Properties of LIFE:

- | | |
|-----------------------|---------|
| • _____ | • _____ |
| • _____ | • _____ |
| • _____ | • _____ |
| • _____ (homeostasis) | |

Concepts / Themes in the Study of Life

► **Concept 1.1:** a set of **THEMES**/ big ideas pervade all of biology – make connections across different areas of biology!

- **THEME:** new properties emerge at each level in the **biological hierarchy**

From the _____ to _____...From _____ to _____.

Life is organized (ORDER) on many structural levels (small to large):

- | | |
|-------------------------------|------------------------|
| • _____ | • _____ |
| • <u>Biological Molecules</u> | • _____ |
| • _____ | • <u>Organ Systems</u> |
| • _____ | • _____ |

Levels beyond the individual organism:

- | | |
|---------|---------|
| • _____ | • _____ |
| • _____ | • _____ |
| • _____ | |

- **THEME:** organisms _____ with other organisms and the physical environment

-ex: cycling of chemical nutrients within an ecosystem

- **THEME:** life requires _____ and transformation

-all organisms must _____,

-flow of energy through an ecosystem (sunlight → plants → animals...)

THEME: STRUCTURE AND FUNCTION are correlated at all levels of biological organization.

“ _____!”

- Biological systems are much more than the sum of their parts

→ A system is a combination of components that form a more complex organization

THEME: the cell is an organism's basic unit of structure and function

- The cell is the lowest level of organization that can perform *all* activities required for life

The Cell's Heritable Information:

- Cells contain chromosomes made partly of DNA, the substance of genes which program the cells' production of proteins and transmit information from parents to offspring

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

- The molecular structure of DNA accounts for its information-rich nature

THEME: Feedback Mechanisms Regulate Biological Systems

- A kind of supply-and-demand economy applies to some of the dynamics of biological systems
- In feedback regulation the output, or product, of a process regulates that very process

In negative feedback:

- An accumulation of an end product _____ that produces that product

In positive feedback:

- The end product _____

THEME: Evolution is the overarching theme of biology!

► Concept 1.2: EVOLUTION accounts for life's unity and diversity

- The history of life is a saga of a changing Earth billions of years old
- The evolutionary view of life came into sharp focus in 1859 when Charles Darwin published *On the Origin of Species by Natural Selection*
- *The Origin of Species* articulated two main points

- _____
- _____

- The products of natural selection are often exquisite adaptations of organisms to the special circumstances of their way of life and their environment

Diversity and unity are the dual faces of life on earth:

- **TAXONOMY** = branch of biology concerned with _____.
 - This helps categorize the diversity to make it manageable.
- Unity of life is evident in:
 - _____;
 - Similar _____;
 - Similarities in _____.

► Classifying Life: Biologists explore life across its great diversity of species

- Diversity is a hallmark of life

****Unity in the Diversity of Life:**

- As diverse as life is there is also evidence of remarkable unity
- **Concept 1.3:** Biologists use various forms of inquiry to explore life

- At the heart of science is _____
 - A search for information and explanation, often focusing on specific questions
- Biology blends two main processes of scientific inquiry
 - _____
 - _____

Discovery Science:

- Describes natural structures and processes as accurately as possible through careful observation and analysis of data

Types of DATA:

- Data
 - _____
 - Can be _____ or _____

Hypothesis-Based Science (INQUIRY):

- In science, inquiry that asks specific questions usually involves the proposing and testing of hypothetical explanations, or **hypotheses**
- In science, a hypothesis
 - is a tentative answer to a well-framed question, an explanation on trial
 - _____

Hypotheses in Scientific Inquiry:

- A scientific hypothesis must have two important qualities:
 - It must be _____
 - It must be _____

A Case Study in Scientific Inquiry: Investigating Mimicry in Snake Populations (see textbook for figures)

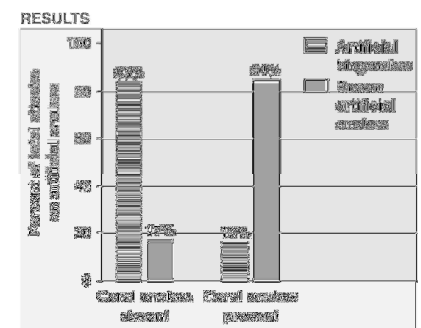
- In one type of mimicry a harmless species resembles a harmful species
- In this case study
 - Mimicry in king snakes is examined
 - The hypothesis predicts that predators in non-coral snake areas will attack king snakes more frequently than will predators that live where coral snakes are present

- To test this mimicry hypothesis researchers made hundreds of artificial snakes, an experimental group resembling king snakes and a control group of plain brown snakes

- After a given period of time the researchers collected data that fit a key prediction

Limitations of Science

- Science cannot address supernatural phenomena
 - Because hypotheses must be testable and falsifiable and experimental results must be repeatable



Theories in Science:

- A scientific theory

- Is _____

- Generates new hypotheses

- Is _____

► Concept 1.4: Science benefits from a cooperative approach and diverse viewpoints

- Science is a social activity!

- Scientists work together & share their results with the scientific community

- Building on the work of others

- _____

- Biologists approach questions at different levels

- _____ !

"We cannot say to ourselves, we need this or that sort of technology, therefore we should be doing this or that sort of science...Science is useful, indispensable sometimes, but whenever it moves forward it does so by producing a surprise; you cannot specify the surprise you'd like."

-Lewis Thomas, scientist/writer

"We know very little, and yet it is astonishing that we know so much, and still more astonishing that so little knowledge can give us so much power."

-Bertrand Russell (1872-1970), Philosopher, mathematician