General Biology
Basic Biology

Credit: 2/1

Dr. Paidi, M.Si, Fac of Math & Sci, UNY
Biology as a Science

- Object:
- Problem:
- Body of Knowledge:
- Methodology:
- (Phenomena)
- Fact (Facts)
- Concept (Construct)
- Proposition(s) (Principle(s))
- Law (Postulate)
- Theory
Biological Object and Problem

as to BSCS

BSCS Biological Science Curriculum Study

- Green Version
- Blue Version
- Yellow Version
Structure of Biology of BSCS

Themes of Problems

Living Organization Level

- Molecular
- Cellular
- Tissue
- Organ
- Individual
- Population
- Community
- Biome

Objects

- Plant
- Animal
- Protista

Science as Inquiry
History of Concept of Biology
Evolution
Diversity and Unity
Genetic Continuity
Organism and Environment
Behavior
Structure and Function
Regulation
Structure of Biology of BSCS (Revised)

Themes of Problems

Evolution: Pattern & Product of Change
Interaction and Interdependence
Maintenance of a Dynamic Equilibrium
Growth, Development, & Differentiation
Genetic Continuity
Energy, Matter, and Organization
Science Technology and Society

Objects
Monera
Protist
Fungi
Plantae
Animalia

by P. Hw. '08
Structure of Biology (modified BSCS)

Themes of Problems

- Evolution: Pattern & Product of Change
- Genetic Continuity
- Maintenance of a Dynamic Equilibrium
- Organism and Environment
- Structure and Function
- Diversity and Unity
- Science as Inquiry
- History of Concept of Biology

Living Organization Level

- Molecular
- Cellular
- Tissue
- Organ
- Individual
- Population
- Community
- Biome

Objects

- Monera
- Protist
- Fungi
- Plantae
- Animalia

by P. Hw. '08
## Themes of Biological Problems

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Biology as a Science

- Object:
- Problem:
- Body of Knowledge:
- Methodology:

Title of research/investigation/study:
Sensing/Observing
Predicting/infering
Classifying
Measuring
Communicating
Drawing chart, etc
Developing table of data
Describing variables relationship
Analyzing result of observation
Collecting & organizing data
defining variables operationally
Identifying variables
Planning investigation
Developing hypothesis
Predicting/infering
Summarizing
Sensing/Observing
Developing hypothesis
Identifying variables
Classifying
Measuring
Communicating
Planning investigation
Developing hypothesis
Predicting/infering
Summarizing
Sensing/Observing

Picture 1. Scientific skill (Rezba et al., 1995: 1)
Time Allocation: 2 x 50’

Learning Objective(s):

1. To identify varieties in one group of organisms
2. To identify uniformity in varieties of organisms
3. To explain principles of diversity and unity in biology
4. To explain taxonomical and non-taxonomical diversity
Diversity & Unity

Figure 3-4 Currently all organisms may be classified in the five kingdoms shown in this diagram. However, future changes may create more kingdoms of prokaryotes (see text).
Diversity & Unity

- **Differences**
  - Gene – level ---- Within species
  - Species-level ---- Among species
  - Ecosystem-level ---- Among system

- **Similarities**
  - Morphologically
  - Anatomically
  - Bio molecularly
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A Linnean hierarchical classification

binomial nomenclature

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<th>Monera</th>
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<th>Fungi</th>
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<td>Quercus</td>
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<td>Rhizopus stolonifer</td>
<td>Quercus alba</td>
<td>Homo sapiens</td>
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</table>
Figure 3-4  Currently all organisms may be classified in the five kingdoms shown in this diagram. However, future changes may create more kingdoms of prokaryotes (see text).
A. To Classify objects only
A. To Classify objects only

- Open curve
  - type of curve
    - Closed curve
Principles of classification

- Using Observable Characteristics (observable, measurable)
- Using Stable Characteristics
- Using Not-Responsive Characteristics to environmental factors

Morphological, anatomical, etc… biochemical
Clasification

B. To Determine of phylogeny

Classification of organism:

Taxonomy of organism

Phylogeny tree of organism
Principles of classification
Methods of classification: traditional, phentic, and cladistic.
Organism and its Environment

Organism:

- Individual
- Population
- Community
- Biome
Organism and its Environment

Environment:

Biosphere

Habitat

Niche
Association of Organism and Interaction Organism and its Environment

- Competition
  - Altruism-innate-instinctive
- Predation (Predator - Preyor)
- Symbiotic Relationship (mutual, parasitic, commensal)
- Non-Symbiotic Relationship (amensalism)
- Ecosystem
Components & Structure of Ecosystem

I. Biotic (Living Thing)
   a. Producer
   b. Consumer (herbivore, carnivore)
   c. Detritivore
   d. Decomposer

II. Non-Biotic (Non Living Thing)
   a. Climatic
   b. Edaphic
Functions of Ecosystem

1. Density (community)
2. Distribution (community)
3. Dominance (community)
4. Energy flow (ecosystem)
5. Biogeochemical cycle (ecosystem)
Ecosystem

Energy Flow

Processes
- Photosynthesis
- Digestion, assimilation, and growth
- Excretion and death
- Respiration

Heat unavailable for further energy transfers
Energy Flow

Producer
Example: Plant Leafs

100

10% transferred energy

Consumer I
(Herbivore)
Example: grasshopper

10

10% transferred energy

Consumer II
(Carnivore / omnivore)
Example: Frog

1

10% transferred energy

Consumer III
(Carnivore or omnivore)
Example: Snake

0.1

90% energy lost

0.09

90% energy lost

Decomposer and Detritivore

The Sun

90% energy lost to the environment

Energy lost

Transferred energy
The Biogeochemical cycle

Free Nitrogen (N2)

Nitrogen in protein of plant

Nitrogen in protein of animal

Death animal

Death plant

Death Bacteria

Bacteria transforming earth nitrogen to free N2

Bacteria bounding free N2 udara to earth nitrogen

Earth nitrogen (Nitrate, Amonia)
Stability and Balance

Biomass (grams/m²)

Energy flow (calories/m²/day)

- Carnivores
- Herbivores
- Producers

Biomass (grams/m²)
REPRODUCTION & GENETICS

- Production again and again in similar condition
- Transfer some things (from parental to filial)
- The things are physical things not an attitude ones
**Blending Theory**

**History toward Blending Theory**

- Theophrastus (Ancient Greek) proposed that male flowers caused female flowers to ripen.
- Hippocrates (Ancient Greek) speculated that "seeds" were produced by various body parts and transmitted to offspring at the time of conception.
- Aristotle (Ancient Greek) thought that male and female semen mixed at conception.
- Aeschylus, in 458 BC, proposed the male as the parent, with the female as a "nurse for the young life sown within her.
- During the 1700s, Dutch microscopist Anton van Leeuwenhoek (1632-1723) discovered "animalcules" in the sperm of humans and other animals.
- Spermist (1800s) Some scientists speculated they saw a "little man" (homunculus) inside each sperm.
- Ovists (1800s), believed that the future human was in the egg, and that sperm merely stimulated the growth of the egg. Ovists thought women carried eggs containing boy and girl children, and that the gender of the offspring was determined well before conception.
- Blending theories of inheritance supplanted the spermists and ovists during the end of 19th century. The mixture of sperm and egg resulted in progeny that were a "blend" of two parents' characteristics. --- Mendelian
The Egg and Sperm
Blending Theory-Interbreeding

- Flower position: Axial, Terminal
- Stem height: Tall, Dwarf
- Seed shape: Spherical, Dented
- Seed color: Yellow, Green
- Flower color: Purple, White
Di hybrid
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9:3:3:1

- Round, yellow
- Wrinkled, yellow
- Round, green
- Wrinkled, green
Evolution
J.B Lamarck

Lamarck's Giraffe

Original short-necked ancestor

Keeps stretching neck to reach leaves higher up on tree

Driven by inner "need"

and stretching until neck becomes progressively longer
Darwinism vs Lamarckism
Darwin's Theory:
"The Origin of Species by Means Natural Selection"

**Mechanism**

- Differential reproduction
- Mutation

**Variation**

**Selection pressure**

**Survival of the fittest**
Idea:
Facts: Evidences or clues

- Fossil evidence
- Morphology comparative
- Anatomy comparative
- Embryology comparative
- Biochemistry comparative
Anatomy Comp

Human  Cat  Whale  Bat
Embryology Comp
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<thead>
<tr>
<th>Organism</th>
<th>Number of differences in amino acid sequence compared to human haemoglobin</th>
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Pro-Contr
Missing Link
Evolution vs Religion

Evolution vs Special Creation
Paidi Hw.

Kantor : FMIPA dan Lemlit, UNY
Telp : (0274)586186 psw. 219
Rumah : Beran Lor, Tridadi, Sleman
Telp : (0274)864604
HP : 08156882306 (Mentari)
081804349157 (Pro-XL)
E-mail : paidiuny@yahoo.com