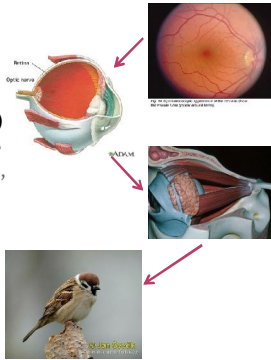


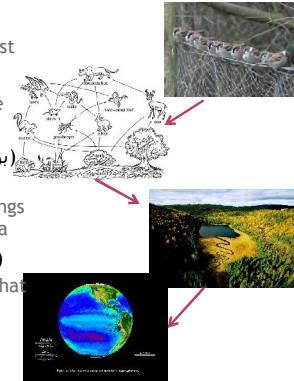
ORGANIZATION OF LIFE

- Tissue (بافت)
 - Nervous
- Organ (اندام)
 - Eye (multiple tissues)
- Organ system (دستگاه)
 - Visual system (multiple organs: eye, tear ducts, eyelids, brain, etc.)
- Multicelled organism (پرسلولی)
 - Sparrow



ORGANIZATION OF LIFE

- Population (جمعیت)
 - All sparrows in a forest
- Community (جامعه)
 - All living things in the same forest
- Ecosystem (بوم سازگان)
 - All living & nonliving (soil, water, etc.) things in a geographical area
- Biosphere (زیست گره)
 - Everything on Earth that supports life



INTERACTION OF LIFE

- تولیدکنندگان (Producers): تولید غذا برای اکوسیستم
 - Plants
 - Photosynthesis
- مصرف کنندگان (Consumers): خوردن / هضم سایرین
 - Eat other animals
- تجزیه کنندگان (Decomposers): تجزیه تولیدکنندگان و مصرف کنندگان مُرده
 - Recycle chemical nutrients
 - Fungi

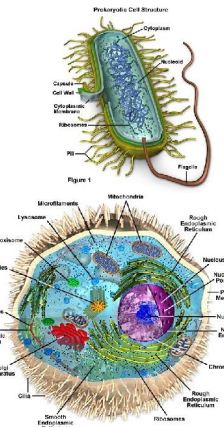
INTERACTION OF LIFE

- Cycle in ecosystem



UNIT OF LIFE

- Cell (یاخته)
 - Basic functional unit of life
- Prokaryotic
 - Small, very simple
 - Bacteria
- Eukaryotic
 - Complex
 - Organelles with membranes
 - Plants, animals, fungi



CHARACTERISTICS OF LIFE

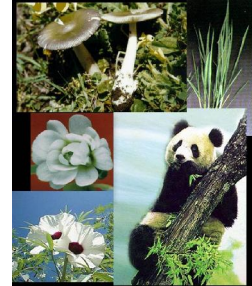
- Shared by all living things regardless of the form or complexity of life
- Order (نظم)
 - Organization
- Regulation (تنظیم)
 - Maintain internal environment
- Growth & Development (رشد و نمو)
 - Change with age during lifetime
- Energy Processing (بیشتر یا تبدیل انرژی)
 - Metabolism
 - Take in energy, transform to maintain life

CHARACTERISTICS OF LIFE

- ◉ **Response to Environment (پاسخ به محیط)**
 - Environmental stimuli affect organism
 - Sweating, chills
- ◉ **Reproduction (تولید مثل)**
 - Method to pass on genetic information
 - Sexual, asexual
- ◉ **Adaptation (سازش)**
 - Traits that aid survival are passed to next generation

CHARACTERISTICS OF LIFE

- ◉ In summary, living organisms must....
 - Have organization
 - Regulate themselves
 - Grow
 - Metabolize
 - Respond
 - Reproduce
 - Adapt



CLASSIFICATION (طبقه بندی)

- ◉ **Taxonomy (رده بندی)**— ID and organize into logical groups
- ◉ **Nomenclature (نامگذاری)**— name organisms
 - Binomial nomenclature (*Genus, species*)
 - Homo sapiens* (انسان)
 - Canis lupus* (گرگ)
 - Felis concolor* (گربه وحشی)
 - Crocus sativus* (زعفران)

HIERARCHY OF CLASSIFICATION

Group Level

- ◉ Domain (دامنه)
- ◉ Kingdom (قلمرو)
- ◉ Phylum (شاخه)
- ◉ Class (رده)
- ◉ Order (راسته)
- ◉ Family (تیره، خانواده)
- ◉ Genus (جنس، سرده)
- ◉ Species (گونه)

Example

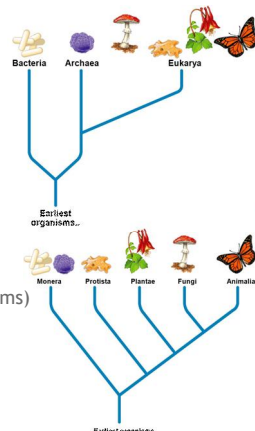
Eukarya (یوکاریوت)
 Animalia (جانوران)
 Arthropoda (بندپایان)
 Insecta (حشرات)
 Lepidoptera (پولک بالان)
 Danaidae ()
Danaus ()
plexippus ()

Monarch Butterfly



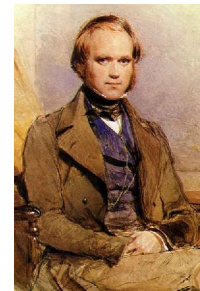
DOMAINS

- ◉ **Bacteria (باکتری ها)**
 - Multiple kingdoms
 - Prokaryotes
- ◉ **Archaea (آرکانه ها)**
 - Multiple kingdoms
 - Prokaryotes
- ◉ **Eukarya (یوکاریوتها)**
 - Eukaryotes
 - Protists (multiple kingdoms)
 - Kingdom Fungi
 - Kingdom Plantae
 - Kingdom Animalia



NATURAL SELECTION

- ◉ **Charles Darwin**
 - On the Origin of Species by Means of Natural Selection*, 1859
 - “Descent with modification”— evolution of ancestors into current species
 - Proposed to occur through **natural selection**



NATURAL SELECTION

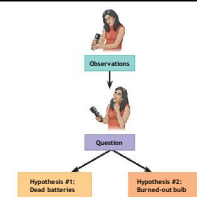
- ◉ Observations (مشاهدات)
 - #1—Individuals in a population vary in heritable traits
 - #2—Some individuals survive better than others due to these traits
 - #3—Over time and generations, more individuals will have these beneficial traits
- ◉ “Survival of the fittest” (بقای برترین ها)
 - Individuals with traits that aid in survival and/or reproduction will be more likely to pass on those traits to the next generation.
- ◉ Mutations (جهش ها)
 - Changes in DNA can lead to variations in traits

SCIENTIFIC METHOD

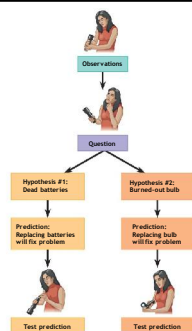
- ◉ Gather information about the world
- ◉ Do it objectively
- ◉ Explain the natural world using rules or patterns in the natural world
- ◉ Explanations that are testable
- ◉ Can use information for prediction
- ◉ No conclusion drawn in science is final!
 - However, can say many things with high probability

SCIENTIFIC METHOD

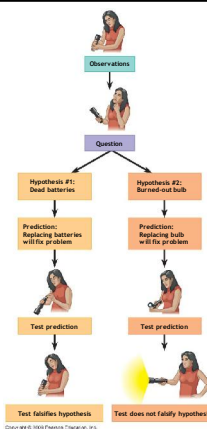
- ◉ Observation (مشاهده)
- ◉ Hypothesis (فرضیه)
- ◉ Test (آزمون)
- ◉ Analyze & Interpret (تجزیه و تحلیل و تفسیر)
- ◉ Repeat (تکرار)
- ◉ Theory (نظریه)



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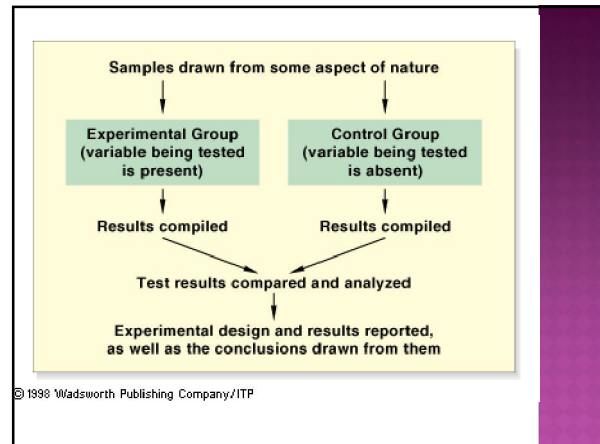
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EXPERIMENTAL DESIGN

- ◉ Control Group (گروه کنترل)
 - Standard of Comparison
 - Identical to testing group other than the variable being tested
- ◉ Sampling Error (خطای نمونه گیری)
 - Certain amount of error in any study
 - Try to minimize by taking large sample sizes



BIOLOGICAL THERAPY EXPERIMENTS

- ◉ Can we use viruses that attack bacteria (bacteriophages) to fight infections?



EXPERIMENT 1

- ◉ Hypothesis - Bacteriophages can protect mice against infectious bacteria
- ◉ Prediction - Mice injected with bacteriophages will not die as a result of bacterial injection

EXPERIMENT 1—TEST

- ◉ Experimental group (گروه آزمایشی)
 - Inject with bacteria and bacteriophage
- ◉ Control group (گروه کنترل)
 - Inject with bacteria and saline

EXPERIMENT 1—RESULTS & CONCLUSION

- ◉ Experimental group ()
 - All mice lived
- ◉ Control group ()
 - All mice died
- ◉ Conclusion - Bacteriophage injections protect mice against bacterial infections

EXPERIMENT 2

- ◉ Prediction - Bacteriophage injections will be more effective treatment than single dose of the antibiotic streptomycin
- ◉ Test - Mice injected with bacteria, then with saline, streptomycin, or bacteriophage

EXPERIMENT 2—RESULTS

- ◉ With 2nd injection:
 - Bacteriophage - 11 of 12 mice lived
 - 60 mg/gm streptomycin - 5 of 12 lived
 - 100 mg/gm streptomycin - 3 of 12 lived
 - Saline - all mice died
- ◉ Conclusion - Bacteriophage treatment can be as good or better than antibiotic

LIMITATIONS

- ◉ Limited to our knowledge and understanding of the natural world
- ◉ Cannot answer philosophical, moral, or ethical questions
- ◉ Limited by man's fallibility