Bio 10TR – Lecture Notes 5 Dr. Schmidt

Chapter 11-12

Natural Selection

Natural Selection & Variability

 1. Selection pressure

 preservation of variability

 polymorphisms - 2 or more phenotypes existing in a population

 multiple selection pressures

 interaction of genotype, phenotype, and environment

Types of Selection

 1. Stabilizing selection

 "narrowing of the bell-curve"

 elimination of individuals at the extremes

 always in operation in populations

 2. Disruptive selection

 "splitting the bell-curve"

 may lead to the formation of new species

 3. Direction selection

 "shifting the bell-curve"

 ex: development of resistant strains of insects and micro organisms.

 4. Frequency-dependent selection

 influenced by the relative proportions of different phenotypes in a population

 fitness of individual is relative to percentage in population.

 ex: predation on color morphs in a population

 5. Sexual selection

 sexual dimorphisms - differences between males and females

 investment of males vs. females in reproduction

 ex: peacock coloration, bower birds nest, antlers, etc.

Adaptation

 To both the Physical and Biological Environment

 coevolution - close interaction of 2 species, ex: milkweed & monarchs

 mimics ex: bees & wasps, viceroy butterfly

Patterns of Evolution

 1. Convergent evolution

 different organisms adapt to same environmental conditions

 2. Divergent evolution

 can lead to local adaptation (ecotypes) and, eventually, formation of new species

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Chapter 13-14

Classification of Organisms

Species - organisms that actually, or potentially interbreed in nature and are reproductively isolated from other groups of organisms. In lower organisms species may be used more to distinguish between taxonomic groups below the genus level. (8 million species on Earth)

Hierarchical Classification

1. Categories - levels of ranking

(Domain/Kingdom, Phylum, Class, Order, Family, Genus, Species)

-Classification at Kingdom level based primarily on mode of nutrition and cellular organization

2. Taxa (taxon) - groups at each level of ranking

(Animalia, Chordata, Mammalia, Primate, Hominidae, *Homo sapiens*)

(Plantae, Anthophyta, Monocotyledones, Commelinales, Poaceae, *Zea mays*)

Nomenclature

1. Developed by C. Linnaeus (1700s)

 example: *Zea Mays* (Linnaeus)

2. Common ancestry

Domain/Kingdom

Bacteria - prokaryotes (most abundant organisms on earth), bacteria

Able to form spores and remain dormant for long periods

“Protista” – single-celled eukaryotes, paramecium, etc.

Fungi - mushrooms, hyphae, spores, sporangia (decomposers)

Plantae - all of the plants (carbon fixers)

Animalia - invertebrate and vertebrate animals (consumers)

Phylum/Division

 Class

 Order

 Family

 Genus

 Species

3. Binomial nomenclature

bionomial name consists of genus and species names, *Homo sapiens*

4. Molecular biology techniques and classification - hybridization experiments

Characteristics of classification

1. Homologous structures (homology)- structures that have a common origin but not necessarily a common function. (Wing of a bird and wing of a bat)

2. Analogous structures (analogy)- structures that have a similar function and/or appearance but different evolutionary origins. (Insect wings and bird wings)

(cactus spine and rose thorn)

Additional Examples

Analogs – often the result of convergent evolution

Flying frogs – flying fish – flying squirrels

Tree bark – scaly skin of a reptile

Fin of a shark (fish, extension) – penguin flipper (bird wing) – dolphin flipper (mammal leg)

Bird song – cricket chirping – lightening bug flash

Euphorbs – cacti, old and new world adaptation to desert

Homologs

Snake hip bones

The Five Major Domains/Kingdoms

1. Bacteria – bacteria, prokaryotes - most abundant organisms on Earth (2700 species)

 Along with fungi primary ecological role is to decompose dead organic matter

2. “Protista” - single celled eukaryotes and some simple multicellular eukaryotes

 All higher organisms evolved from an ancestral prokaryote.

 Evolved into the Fungi, Plants, and Animals

 Includes:

 Protozoans – ancestors of the animals

 Algae – aquatic ancestors of the plants

3. Fungi

Along with bacteria primary ecological role is to decompose dead organic matter

Fungi are divided by their structural features and mode of reproduction

Both fungi (and bacteria) synthesize antibiotics

 Symbiosis

lichens - associations of fungi and algae or cyanobacteria

mycorrhizae - associations of fungi and plant roots

4. Plants

 Ecological role is to produce raw materials for consumers

 Evolved from the green algae

 Transition of plants from water to land

alternation of generations

cuticle - waxy coating that retards water evaporation

stomata - openings in leaves and stem to allow exchange of gasses

vascular tissue - conductive tissues for water and nutrients

multicellular reproductive organs

 specialization of protective layers to prevent drying out

 seed formation - reduction of gamete size (especially pollen)

 development of seed coat for protection from environment

 Gymnosperms - has seeds put does not produce flowers

 Angiosperms - bears flowers and fruits with seeds

5. Animals

 Radial vs. bilateral symmetry - important evolutionary development

 Development of a true coelom - body cavity

 Arthropods - centipedes, spiders, crustaceans, insects, etc.

 insects are the largest group of animals

 respiratory system - air enters through spiracles

 exoskeleton - external skeleton

 metamorphosis - distinct changes in body form (caterpillar, pupae, butterfly)

 Jaws developed from the anterior gill arches in the fish

 Amniotic egg in reptiles allowed vertebrates to become fully terrestrial

 Evolution of feathers, flight, and endothermy in birds

 Mammals developed body hair, mammary glands, and birth of live young

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Chapters 19-21

Ecosystems

Ecology: The scientific study of interactions that determine the distribution and abundance of organisms

Ecosystem Structure

 1. Biotic(living) and Abiotic (non-living) factors, both environmental and physical factors

 climate, environment

 predation

 competition

 2. Food Webs

 Diagrams of energy flow

 Food chains linked together

Energy Flow

 1. Trophic Levels

 Producers - plants and algae

 Consumers

 Primary - herbivores

 Secondary - carnivores

 Detritivores - scavengers and decomposers

 2. Energy Transfers

 Efficiency "10%" rule of thumb

 Ecosystem Structures

Cycles

 1. Water, Carbon, Nitrogen

 2. Bio-accumulation of compounds

California Ecosystems

 1. Uniqueness of California

 Geology - plate tectonics, soil types

 Topography - habitats maybe defined by geology as well as biology

 Climate

 variation - temperature, rainfall, elevation

 microclimates

 2. California Habitats

 Because of all this variation CA has 24 different major habitat types

 High Biodiversity - many diverse species within each habitat

 Highest number of endemic species

 Also highest number of endangered/threatened species

 introduced species

 habitat destruction