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