Biology Top 101

Organic Compounds

* All living things are made of organic compounds.
* Contain the element Carbon
* Carbohydrates, Proteins, Lipids, Nucleic Acids

Carbohydrates

* Monomer- monosaccharide
* Function- energy source and structure
* Tests: glucose-Benedicts, starch- Iodine
* Ex. Cellulose, glycogen, starch

Lipids

* Made of fatty acids and glycerol
* Function- energy storage and insulation
* Tests: brown paper test
* Examples: fats and steroids

Nucleic Acids

* Monomer- nucleotide
* Function- carry genetic information
* Ex. DNA and RNA

Proteins

* Monomer- amino acids
* Function- building and repairing cells, communication, transport, and regulation
* Tests- Biurets
* Examples: enzymes, hemoglobin

Enzymes

* Catalysts in living things
* Specific to a particular substrate
* Reusable
* Affected by temperature and pH



Cells

Prokaryotes

* Simple, no membrane bound organelles
* Bacteria only
* One circular chromosome
* Includes: chromosome, ribosomes, and plasma membrane

Eukaryotes

* Membrane bound organelles
* Plants and Animals
* True nucleus containing chromosomes

Nucleus

* “Control Center”
* Contains chromosomes

Mitochondria (Singular: Mitochondrion)

* “Powerhouse” of the cell
* Produces energy in the form of ATP
* Site of Aerobic respiration

Chloroplast

* Site of photosynthesis
* Plant cells ONLY
* Contains the pigment chlorophyll

Vacuole

* Storage of excess materials
* Plant cells usually contain one large vacuole

Ribosomes

* Proteins are synthesized
* Found in both prokaryotes and eukaryotes

Plasma Membrane ( aka: Cell Membrane)

* Surrounds the cell
* Regulates what enters/leaves the cell
* Helps maintain homeostasis
* Made of phospholipids with embedded proteins

Cell Wall

* Plant + Fungi cells ONLY
* Surrounds cell and provides support and protection.

\*Plants cell walls Made of cellulose

Plant: Cell wall, Chloroplast, Large central vacuole



Animal



Cell Organization

Cell ->Tissue ->Organ -> Organ System -> Individual organism

* Cell Specialization: cells develop to perform different functions
* Regulated by genes
* Cell to Cell CommunicationChemical Signals (hormones) can be sent from one cell to another
* Receptor proteins on the plasma membrane receive the signal

Diffusion

* Form of passive transport (NO ENERGY NEEDED) across a membrane
* Solutes move from high concentration to low concentration

Osmosis

* Diffusion of water (also passive transport)

Active Transport

* Particles moving against the concentration gradient which REQUIRES ENERGY (ATP)
* Low concentration to high concentration

ATP

* Energy storing molecule
* Can be used for quick energy by the cell
* Energy is stored in the phosphate bonds

Photosynthesis

* Water and Carbon Dioxide used to produce Glucose and Oxygen
* H2O+CO2🡪C6H12O6+O2
* Occurs in the chloroplast



Aerobic Respiration

* Used to release energy (ATP) for cellular use
* C6H12O6+O2🡪H2O+CO2
* Occurs in the mitochondria

Anaerobic Respiration (aka Fermentation)

* Does not require Oxygen
* also used to release energy, but not as efficient as aerobic respiration (less ATP)
* Products include CO2 and lactic acid or alcohol
* Two Types: Alcoholic Fermentation and Lactic Acid Fermentation

Autotroph

* Obtain energy from the environment
* Photosynthesis or chemosynthesis
* “Producers”

 Heterotroph

* Obtain energy from other living things
* “Consumers”

DNA / RNA

* Carry genetic information
* Made of a chain of nucleotides
* Nucleotides contain a sugar, phosphate, and a nitrogen base

DNA

* Double stranded
* “Double Helix”
* Four base pairs: ATGC
* Sugar is Deoxyribose
* Found in nucleus

RNA

* Single stranded
* Four base pairs: AUCG
* Sugar is Ribose

In DNA,

\*Adenine always pairs with Thymine, and

\* Guanine always pairs with Cytosine

Replication

* Making of an identical strand of DNA
* “semi” conservative (one new one old)

Central Dogma

DNA 🡪 mRNA 🡪 protein 🡪 trait



Transcription

* DNA🡪mRNA
* Occurs in nucleus
* Complementary mRNA strand is produced from a segment of DNA

Translation

* Connects amino acids in the correct order to make a protein
* Occurs in the cytoplasm within the ribosomes

Codon: Sequence of three mRNA nucleotides that code for an amino acid



Mutations

* Change in DNA code
* May cause a change in protein produced
* NOT always harmful

Mitosis

* Cell division
* Produces two identical diploid daughter cells
* Occurs in body cells to grow and repair
* PMAT

Cancer

* Error in cell growth with causes uncontrolled cell growth
* Has environment and genetic variables

Meiosis

* Cell division
* Produces four different haploid daughter cells (gametes)
* Occurs in sex cells to form gametes

Crossing Over

* Homologous chromosomes exchange parts of their DNA
* Creates variation in gametes

Nondisjunction

* Homologous chromosomes fail to separate during meiosis
* Can lead to Down Syndrome

Asexual

* One parent
* Identical offspring
* Variation only thru mutations
* Examples: budding, fragmentation, fission

Sexual

* Two parents
* Offspring different from parents
* More variation
* Fertilization (fusion of gametes)

Inheritance

* Traits are specific characteristics inherited from parents
* Genes are the factors that determine traits
* The different forms of a gene are called alleles
* Dominant alleles are expressed, if present, and recessive are hidden

\*Genotype actual alleles an individual has for a trait

Homozygous

* Both alleles are the same Ex. BB or bb

Heterozygous

* Both alleles are different Ex. Bb

Phenotype: The actual characteristic displayed by the individual (ex. brown eyes, Hemophiliac)

Incomplete Dominance

* Heterozygote shows a blending of the dominant and recessive phenotypes

Codominance

* Heterozygote expresses BOTH dominant and recessive traits
* Ex. Roan animals

Polygenic Traits

* Traits are influenced by more than one gene Ex. skin color

Multiple Alleles

* More than two alleles for a trait (an individual still only inherits two)
* Ex. Blood Type (IA,IB, i)

 type A = IAIA or IAi

 type B = IBIB or IBi

 type AB= IAIB

 type O = ii

Sex Linked Traits

* Sex Chromosomes
	+ Female = XX
	+ Male = XY
* Sex linked traits are carried on the X chromosome
* Ex. Hemophilia, red-green colorblindness

Test Cross

* used to determine the phenotype of an unknown dominant individual
* uses a homozygous recessive individual as the “test”

Pedigree

* similar to a family tree
* Shows pattern of inheritance of a specific trait through a family
* Square-male, circle –female, colored in affected

Karyotype

* Picture of someone's chromosomes
* Can detect chromosomal disorders
* Ex. Down Syndrome, Klinefelter’s Syndrome, and Turners Syndrome

Human Genome Project

* Sequencing of human DNA
* Being used to develop gene therapies

Gel Electrophoresis

* Technique used to separate molecules (DNA or proteins) based on their size
* Sometimes called a DNA fingerprint
* Used to analyze and compare DNA



Recombinant DNA

* Cell with DNA from another source
* Bacteria used to produce human insulin
* Human gene inserted into bacterial plasmid

Transgenic Organism

* An organism with a gene from another source
* used to improve food supply, research, and healthcare

Clone -A genetically identical copy

* An organism made from one cell of another organism

Origin of Life

* Abiotic earth LACKED Oxygen
* Early organims anaerobic prokaryotes

Endosymbiotic Theory

* Eukaryotic cells evolved from prokaryotes
* Early prokaryotes engulfed other prokaryotes and developed symbiotic relationships
* Evidence includes mitochondria and chloroplast have prokaryotic type DNA

Abiogenesis

* Living from non-living or spontaneous generation
* Disproved by Redi and Pasteur’s experiments

Biogenesis: Living from Living

Natural Selection

* Theory of Evolution
* Fit organisms survive, reproduce, and pass on traits
* Requirements: Variation and Competition

Adaptations

* Trait that increases survival
* For Example,
	+ Beaks that make it easier to eat insects
	+ Bright flowers to attract pollinators
	+ Vascular tissue in plants to adapt to life on land

Evidence for Evolution

* Fossil Record
* Biochemical Similarities
* Shared anatomical structures

Speciation

* Evolution of a new species
* must be isolation between populations

Antibiotic and Pesticide Resistance

* Populations will eventually become resistant to pesticides and antibiotics with overuse
* Short lifespans and quick reproduction allows for this

Coevolution

* Two organisms evolve in response to each other Ex. Flowering plants and their pollinators

Binomial Nomenclature

* Two word naming system
* Scientific name
* Uses *Genus* and *Species* names
* *Ex.* Dogs: *Canis familiaris*

Dichotomous Keys

* Used to identify organisms
* Paired set of questions with two choices

Levels of Organization

* Kingdom -> Phylum->class-> order-> family -> genius -> species

Phylogenic tree



Protists

* Unicellular Eukaryotes
* Can be autotrophic or heterotrophic
* Reproduce mostly asexually

Fungi

* Multicellular eukaryotes

 (yeast are the only unicellular fungi)

* Heterotrophs
* Reproduce asexually and sexually

Plants

* Multicelluar eukaryotes
* Autotrophs
* Reproduce sexually and asexually

Animals

* Multicellular eukaryotes
* Heterotrophs
* Reproduce sexually and asexually

Non Vascular Plants

* Also called Bryophytes
* No true roots or vascular tissue causing them to be small in size
* Must live in moist environments
* Reproduce with spores

Gymnosperms

* Non-flowering vascular plants
* Reproduce with cones that contain seeds
* Ex. Conifers (pine trees)

Angiosperms

* Flowering vascular plants
* Flower is main reproductive organ
* Seeds are enclosed within a fruit
* Ex. Deciduous plants

Insects

* Transport through open circulatory system
* Exchange gases through spiracles and tracheal tubes
* Most reproduce sexually with external fertilization
* Develop through metamorphosis

Annelids(segmented worms)

* Transport through closed circulatory system
* Exchange gases through moist skin
* Reproduce asexually and sexually with internal fertilization

Amphibians

* Transport through a closed circulatory system involving a three chambered heart
* Gas exchange in young with gills, adults lungs and moist skin
* Reproduce sexually with external fertilization
* Develop through metamorphosis

Mammals

* Transport though closed circulatory system involving a four chambered heart
* Gas exchange through lungs
* Reproduce sexually with internal fertilization
* Young develop in a uterus and exchange nutrients and oxygen through the placenta (placental mammals)

Viruses

* Not considered living things
* Pathogens that can mutate to resist vaccines
* Ex. HIV, Influenza, Smallpox

Genetic Disorders and the Environment

* Many diseases have both genetic and environmental factors
* Ex. Cancer, diabetes, PKU

Immune Response

B-cells

* Fight antigens in body fluids
* B-cells make antibodies
* Make memory cells after exposure to antigen

T-cells

* Fight pathogens inside living cells
* May help B-cells to make antibodies
* Make memory cells after exposure to pathogen

Passive Immunity

* Antibodies are introduced into the body
* Short term
* Such as mother transfers antibodies to infant through breast feeding

Active Immunity

* Antibodies are acquired when an immune response is activated in the body
* Long term
* Ex. Vaccines are weak/dead antigens that are introduced to the body

Parasites

* Lives on or within a host
* Benefits while causing harm to the host
* Ex. Plasmodium causes malaria (genetic influence- carriers of sickle cell are resistant to malaria)

Ecosystems

* Collection of abiotic (nonlivng) and biotic (living) factors in an area
* Together they influence growth, survival, and productivity of an organism

Symbiotic Relationships

* Relationship between two organisms in which one benefits
* Types:
	+ Mutualism (+,+)
	+ Parasitism (+,-)
	+ Commensalism (+, o)

Predation

* Predator eats prey
* Evolve in response to one another

Carrying Capacity

* Maximum number of individuals that an ecosystem can support
* Limiting factors: Food availability, Competition, Disease, Predation, Natural Disasters

Human Impacts

* Acid Rain
* Deforestation
* Habitat Destruction
* Invasive Species
* Ozone depletion from the release of CFCs

Global Warming

* Increase in the average temperature of the earth
* Caused by the release of too much CO2 into the atmosphere which amplifies the greenhouse effect
* Burning of fossil fuels, volcanic eruptions

Bioaccumulation

* An increase in environmental toxins at higher tropic levels
* Ex. DDT and birds of prey

Innate Behavior

* Behaviors an animal is born with
* Includes suckling, migration, hibernation
* Ex. weaving of spider webs

Learned Behavior

* Behavior an animal acquires during its lifetime
* Includes: Habituation, Conditioning, Trial and error

Social Behavior

* Communication between individuals of the same species
* Can be courtship, territorial or chemical (pheromones)