


Unit A
Biological Diversity

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1.1 Examining Diversity

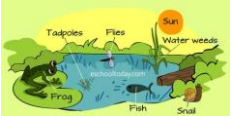
- **Biological Diversity:** The number and variety of organisms in an area.



2

Ecosystem

- **Ecology:** branch of *biology*, deals with the interactions/relationships of organisms and their environment.
 - **Ecologist:** an expert in or student of ecology.
- **Ecosystem:** living and non-living things interacting with one another.
 - Function as a *system*

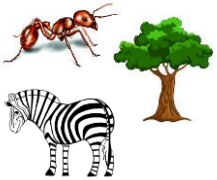


- **Biotic-** Living
- **Abiotic-** Non-living

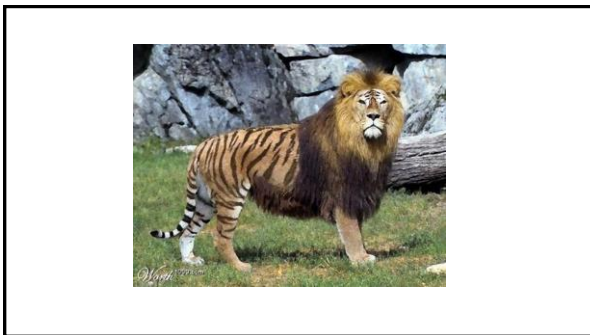
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Species

- **Species-** Organism capable of breeding and producing fertile offspring
- *What does fertile mean?*
- *What are offspring?*
- Examples of species:
 - Ant
 - Tree (Spruce Tree)
 - Zebra



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Populations


- **Population**- Group of species living in specific area at the same time
- Examples
 - Bison Population
 - Elephant Population
 - Zebra Population



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Community


- **Community**- All different species that live and interact in the same area



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Check and Reflect

- Pg. 15 #'s 1, 2, 5.



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1.2 Interdependence

- **Interdependence**: two or more people/organisms rely on each other for survival
 - Need one another
- **Relationships**:
 - Interactions are important for survival
 - Varying kinds of relationships



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Interactions among Living Things



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Symbiotic Relationships

- **Symbiosis**: association between different species
 - Sym= together
 - Bio- life
- **Long term** interactions between two species
 - Relationship may benefit one or both organisms
- There are 3 types:




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1. Commensalism

- One species benefits
- Other neither benefits or is harmed:

+ / 0





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2. Mutualism

Both species in the relationship benefit:

+ / +





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3. Parasitism

- One species benefits
- Other is harmed - becomes infertile (cannot have babies) or dies






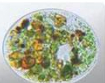
+ / -



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Body Invaders- Parasites


- [Body Invaders](#)
- [Cordyceps](#)

 ROUNDWORM	 HOOKWORM	 FLUKE
 TAPEWORM	 NEMATODE	 PROTOZOA

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Competition


- **Competition:** interaction between two species for resources.
 - Resources- food, water, and territory, mate.
- **Competitive exclusion-** two organisms cannot coexist if they have the same niche.
 - Coexist = different niche



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Competition


- **Intraspecific Competition:** the same species compete for resources
- **Interspecific Competition:** different species compete for resources



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Niche

- **Niche:** The role/function of an organism in an ecosystem.
 - Job/work
- **Ecological Niche:** place an organism fits within its ecosystem.
 - Includes *where* the organism lives and what *role* it plays within its habitat.



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Broad Niche


- **Generalist-** species have very broad ecological niches.
 - Broad- ample distance from side to side; wide.
- Ex. **Omnivores-** eat a varied diet of plants, insects, and other animals.
 - Species able to utilize a wide variety of food resources, and adapt to a wide range of climatic conditions
 - Aren't as impacted by change.



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Narrow Niche

- **Narrow:** Limited or restricted scope (space).
 - Can only survive on single food source.
 - Ex. Panda lives only in China where bamboo shoots grow.
 - Koala - eucalyptus leaves found in Australia.
- **Specialists:** specific adaptations that help them survive under extreme conditions.



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Your Turn

- Describe your own **niche** in the form of a **concept map**

Map out connections

Answer the following questions:

- Where do you live?
- Do you work- What's your job in the community?
- What do you eat?
- Is your niche broad or narrow?
- Are you in competition with others? Who?




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Check and Reflect

- Pg. 19 #'s 1, 3.



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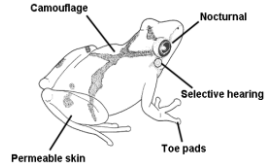
1.3 Variation Within Species

- Why is it that not all members of a species are exactly alike?
 - Look around this class, you are not exactly like your neighbor!
- **Variation:** Differences in characteristics of organisms caused by genetic and environmental factors
 - **Differences**
- **Variations** are visible (ex. color) and invisible (ex. biochemical) differences
 - Passed on from one generation to the next.

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Adaptations

- **Variations that allow species to survive**
- **Process of change**
 - Better suited for environment.
- Structural or Behavioral

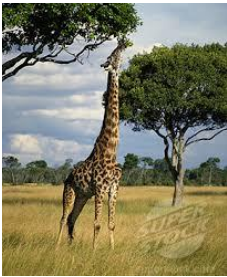


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Adaptations

- **Adaptations**- how organisms respond to their environment
- A change by which an organism or species becomes better suited to their environment.
 - Variation= Change
 - Adaptation= Beneficial Change
- Only species best suited to their environment *survive*

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- Living things **cannot** choose how they change
- **Over time**- successful characteristics become **more common**
- Changes in behavior and physical characteristics make species **better suited** for their environment.

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Structural Adaptations

- Physical features of an organism like the bill on a bird or the fur on a bear



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Behavioural Adaptations

- Behavioral response to stimulus (what does a cat do when threatened)



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The Source of Adaptations


- Environment
 - Not all variations are beneficial
 - Mutations



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Natural Selection


- **Charles Darwin:** Scientist/biologist-
 - Coined *evolution*
- **Natural Selection:** process where organisms adapt to better suite their environment.
- Adapted organisms survive
- Produce fertile offspring with similar traits
- [Galapagos Finches](#)



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Biological Diversity Importance


- The number and variety of organisms in an area.
- **Importance:**
 - Controls population size
 - Increases ecosystems probability to withstand natural disasters (environmental changes).
 - Organisms rely on one another- food, resources, shelter, competition, symbiosis.
 - Ex. [Mountain Pine Beetle](#)



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Check and Reflect

- Pg. 24 #'s 1-4



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Review

Review

- Read- pg. 9-24
- Questions- pg. 25 #'s 1-8

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2.1 Closer Look at Variation

- Non-heritable: are acquired (learned)
 - Not passed from generation to generation
 - Ex. Playing the piano
- Heritable: passed from generation to generation
 - (genes)

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Variation

- **Discrete Variation:** differences in characteristics that have a defined form
 - Yes/No
 - Ex. Blue or green eyes
 - Ex. Can or cannot roll tongue
- **Continuous Variation:** characteristics that have a range of forms
 - Ex. Height
 - Ex. Hair length

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Check and Reflect

Pg. 29 #'s 1-5

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2.2 Asexual and Sexual Reproduction

- **Reproduction:** is the life process by which new organisms are produced.
 - Required for survival
- Fundamental feature of all known life
 - Each individual organism exists as the result of **reproduction**.

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Asexual Reproduction

PARTHENOGENESIS 	BINARY FISSION
BUDDING 	FRAGMENTATION

- **Asexual reproduction:** is the process by which a *single organism* makes an *identical copy* of itself.
- Involves only one parent cell
 - **Advantage:** organisms can reproduce *quickly* and in *large numbers*.
 - **Disadvantage:** *vulnerable* to the same diseases and environmental stresses.
 - whole population could be wiped out


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Two new cells (daughter cells)

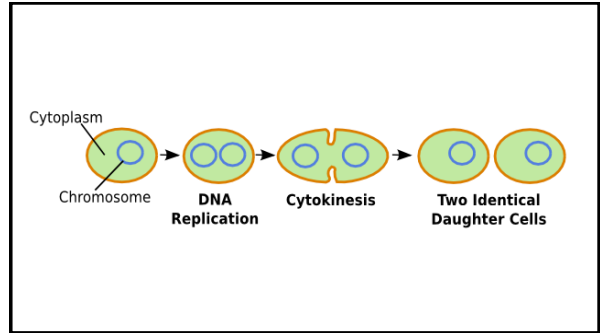
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Binary Fission

- Type of *asexual reproduction* common among prokaryotes (single celled organisms)
 - cell divides giving rise to two cells
- Binary Fission:** One cell replicates and divides into two identical cells, two cells divide into four, and so on.
- Prokaryotes**= single celled organisms (1 cell)



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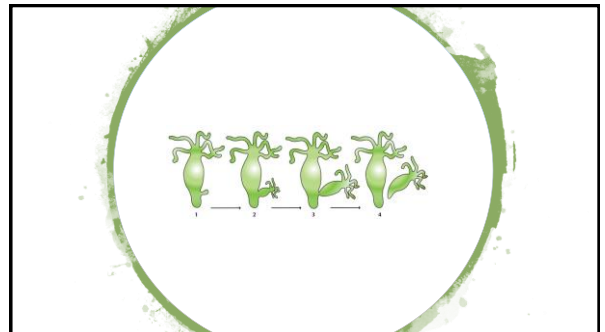


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Budding

- Budding:** involves growing a bud that is attached to the *mother cell*.
- The bud contains exact copy of the mother cell's genetic material.
 - Can remain attached or detach
 - Depending on the amount of food and other nutrients available in its environment.
 - In **hydra**, the bud detaches and becomes an individual organism.
 - Jellyfish*
 - In animals like coral, the bud remains attached. In both cases, the bud is identical to the parent.
- Eukaryotes**= multicellular (many cells)

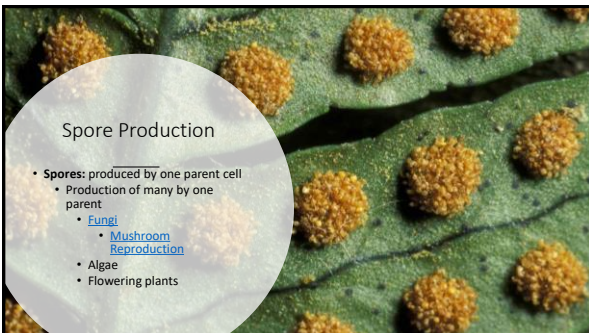
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Spore Production

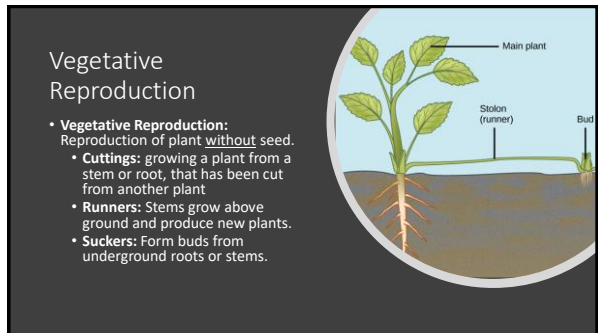
- Spores:** produced by one parent cell
 - Production of many by one parent
 - Fungi**
 - Mushroom Reproduction**
 - Algae
 - Flowering plants



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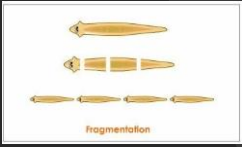
Vegetative Reproduction

- Vegetative Reproduction:** Reproduction of plant without seed.
 - Cuttings:** growing a plant from a stem or root, that has been cut from another plant
 - Runners:** Stems grow above ground and produce new plants.
 - Suckers:** Form buds from underground roots or stems.



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- **Fragmentation:** part of an animal or plant can regrow into an identical copy of the parent
 - Ex. Starfish, worms
- **Pathogenesis:** reproduction from an ovum (egg) without fertilization
 - Female gives birth (rarely male)
 - Virgin birth
 - Insects, bees, and ants



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Sexual Reproduction


- **Sexual Reproduction:** parents supply genetic material
 - Offspring are *variations* (combinations) of parents
 - New combinations of genetic material



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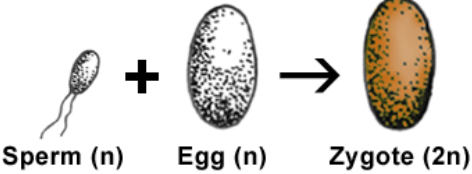
Stages

- Combining gametes- sex cells
- Egg + sperm = offspring
 - Gamete (23 chromosomes)
 - + Gamete (23) = zygote (46 chromosomes)
- There are three stages of sexual reproduction:
 - Mating
 - Fertilization
 - Development



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© E.M. Collins 2001




Sperm (n) + Egg (n) → Zygote (2n)

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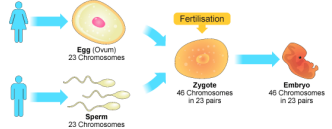
Fertilization

 Sex cells= **Gametes**

 Egg + Sperm = **Zygote**

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- Fusion of two gametes is called **fertilization**.
- This process combines the genetic information
 - **Zygote** is formed
 - Variation = diversity
- Zygote develops
 - Becomes multicellular **embryo**.



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Development

- Embryo develops within mother or outside in an [egg](#)
- Displays (carriers) characteristics of **both** mother and father
 - Will **not** be identical to either parent

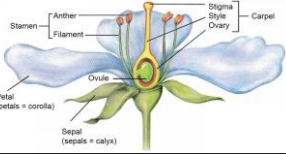


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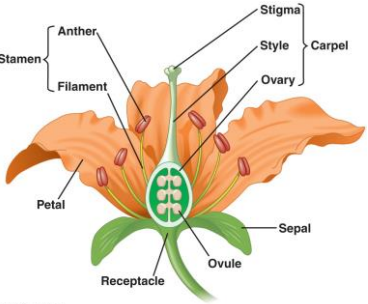
Plant Reproduction



- **Pollination:** When pollen (male gamete) transferred to stigma (female reproductive structure).
- [Bees](#)



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Plant Reproduction

- Male Structures: *Stamen*
- Female Structures: *Pistil*
 - **Gametes:** sex cells
- **Fertilization:** egg and sperm cells combine
 - Pollen+Stigma
- **Zygote:** cell formation after fertilization
 - Fertilized egg
 - Develops into embryo

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Asexual Reproduction

Advantages	Disadvantages

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Sexual Reproduction

Advantages	Disadvantages

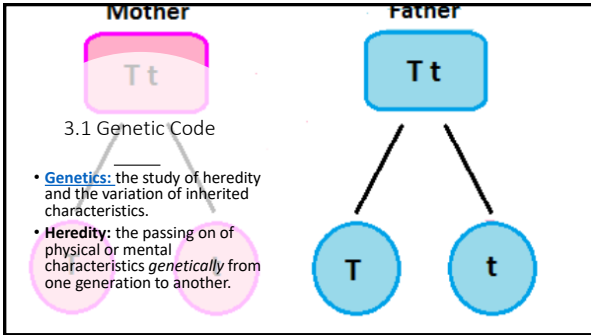
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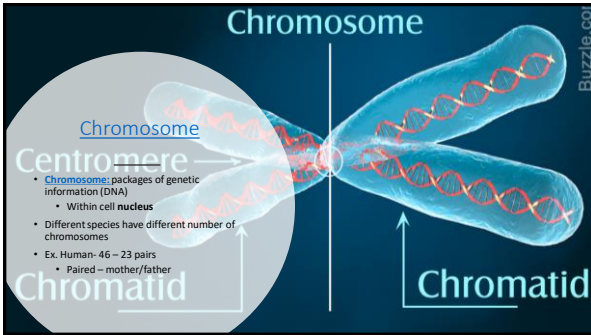


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DNA

- **DNA:** deoxyribonucleic acid
 - Double Helix
 - Twisted Ladder
- DNA is made of proteins: organic molecules
 - Building blocks
 - Specific jobs
 - Body tissue, enzymes, antibodies, DNA
- **Information** (genetic traits) carried by genes
 - Genes make up chromosomes (strands of DNA)
 - <https://www.youtube.com/watch?v=hywRdDVR76A>

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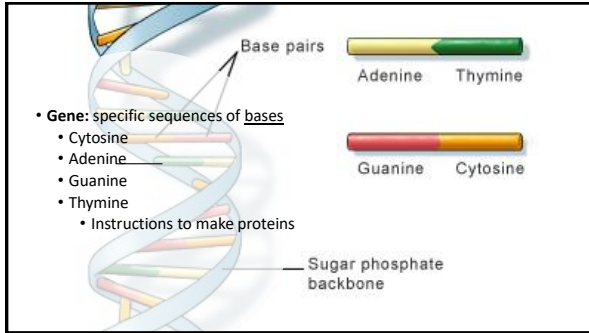


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Gene:

- **Gene:** section of chromosome- codes for trait
 - Ex. Skin colour, height.
- Genes instruct body to make proteins
- Each gene is a combination of bases
 - Unique combination makes gene
- Human Genome Project
 - Mapping Genes
 - Chromosome 7- cystic fibrosis

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Deoxyribonucleic acid (DNA)

- Responsible for traits and characteristics
 - Hereditary
 - Passed on to next generation
- Repeating units- Sections of DNA= **nucleotides**
 - Basic structural units

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Alleles

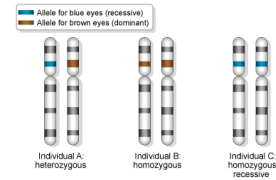
- **Allele:** variation of gene
 - Different alleles
 - Ex. Eye colour- green, brown, blue
- One allele from Mom and one from Dad
 - Dominance allele vs. Recessive allele
 - [Ex. Pea Plant](#)



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Alleles

- **Homozygous:** Same alleles – RR/rr
- **Heterozygous:** Different alleles – Rr



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Check and Reflect

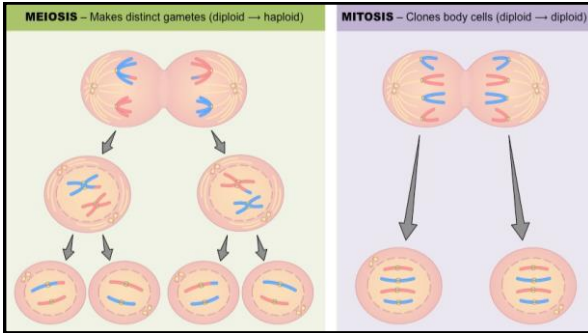
- Pg. 45 #'s 1-4

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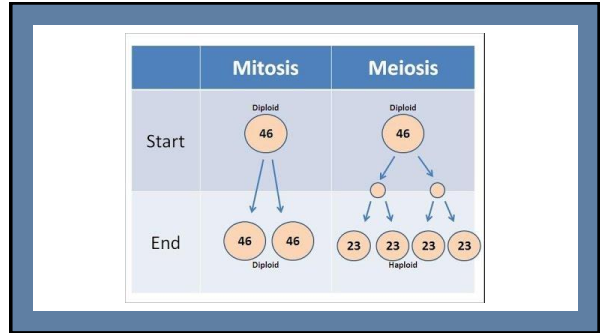
3.2 Cell Division

- **Mitosis** – cell division
 - Results in two daughter cells
 - Same number and kind of chromosomes as the parent nucleus
 - Skin cells
- **Meiosis**- cell division that results in four daughter cells
 - Each with half the number of chromosomes of the parent cell
 - Production of gametes or plant spores

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Who Has What Number?

- Give it a try
- Pg. 48 – Table

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3.3 Patters of Inheritance

- Traits: genetic characteristics
 - **Dominance**: traits expressed/seen when recessive trait is present.
 - Brown= BB – Dominant
 - **Recessive**: alleles (genes) are masked by **dominant** alleles
 - Blonde= bb – Recessive
 - Brown= Bb

<https://www.youtube.com/watch?v=8m6hHRlKwXY>

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Genotype vs. Phenotype

- **Genotype**: the genetic constitution of an individual organism.
 - Genetic variation – RR/Rr
 - Genes
- **Phenotype**: the set of observable characteristics of an individual resulting from the interaction of its genotype with the environment.
 - What you can see

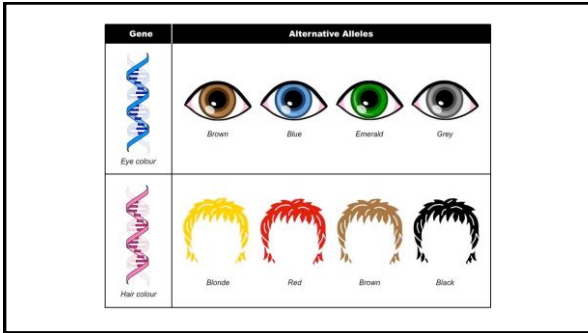
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Phenotype= Blue Eyes **Phenotype**=Brown Eyes

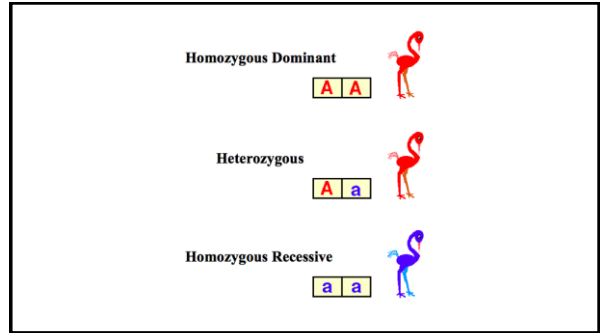
Genotype=bb **Genotype**= Bb or BB

Recessive=b **Dominant**=B

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Dominant vs. Recessive

- Dominant Trait: dominant allele is passed on from parent and is expressed as a phenotype.
 - Masks/covers the appearance or expression of a recessive trait
 - RR
 - Rr
- Recessive Trait: allele passed on from parents and must be homozygous to be expressed as phenotype.
 - rr

A Punnett square with 'T' and 't' on the top and left sides. The four cells contain: top-left 'TT' (orange), top-right 'Tt' (orange with green), bottom-left 'Tt' (orange with green), and bottom-right 'tt' (green).

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Incomplete Dominance

- Alleles/Genes can express **incomplete dominance**
- No masking
- Both alleles have influence
- Ex. Carnations- white, red, or pink

A Punnett square with 'R' and 'r' on the top and left sides. The four cells contain: top-left 'RR' (red flower), top-right 'Rr' (pink flower), bottom-left 'Rr' (pink flower), and bottom-right 'rr' (white flower).

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Mutations and Variation

- All **variation** is due to **mutations**
- Changes in genetic code result in different genes
 - DNA mutations can occur from **errors in copying, damage** from radiation, or mutagens
- **Mutagens:** an agent, such as radiation or a chemical substance, that causes genetic mutation.

A diagram of a DNA double helix with a red glow indicating a mutation site on one of the strands.

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The Effect of Mutations

- **Genes** (amino acids) code for **proteins**
- A change in code can alter sequence of amino acids that form a protein
- Change in the shape of the protein will change its action

The diagram shows a gene being transcribed into mRNA, which is then translated into a sequence of amino acids. This sequence folds into a specific 3D protein structure.

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Mutations and Selective Advantage

- Produce change in an individual that may be beneficial
- These mutations increase chance of survival
 - Passed on to the next generation



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Case Study: Pesticide Resistance

- **Why did DDT lose its effectiveness?**

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Case Study: “Superbugs”

- In 1928, Sir Alexander Fleming discovered that penicillin could be used to kill bacteria
- Penicillin was first used as a medicine in 1941
- By 1945, there were already reports of penicillin-resistant strains of bacteria
- There are now bacterial strains that are resistant to all known antibiotics

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Check and Reflect

- Pg. 54 #'s 1-4

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4.1 Reduction of Diversity

- Impact of human action
- Good/bad intensions
 - In England - highways kill toads
 - Toad tunnels created



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Threatened

- **Threatened:** species likely to become endangered within foreseeable future



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Endangered


- **Endangered:** seriously at risk of extinction.



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Extinction

- **Extinction:** state or process of a species, family, or larger group being or becoming extinct.



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Extirpation

- **Extirpation:** extinction of species from specific geographic area





Figure 5.10. Shifting distribution of the grizzly bear during pre-glacial, historic, and present times.

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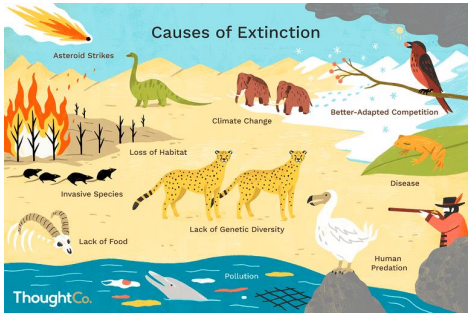
Natural Causes

- Catastrophic events
 - Volcanic eruptions
 - Floods
 - Fires
- Disease
- Overpopulation
 - Food
 - Resources



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Causes of Extinction



ThoughtCo.

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Human Causes

- Habitat Destruction
 - Pollution
 - Pesticides
 - Fertilizers
 - Clear cutting
- **Invasive species:** new species introduced by humans
 - Disrupts ecosystem
- Hunting



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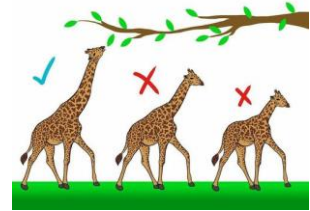
Check and Reflect

- Pg. 65 #'s 1-3

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4.2 Selecting Traits

- [Natural Selection](#)



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Genetics

- [Artificial Selection](#): Breeding for specific/desired characteristics
 - Intentional reproduction of individuals that have **desirable traits**



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Biotechnology

- **Genetic Engineering**: technology that alters DNA
 - Direct **manipulation** of an organism's **genes**
- **Genetic Engineering**: moving pieces of DNA from one cell to another
 - Desirable traits
 - Biotechnologies – “tampering with nature”

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Check and Reflect

- Pg. 71 #'s 1-6

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4.3 Reduce Impact

- Conserve Biological Diversity
- Resource use policies
- Protected Areas
- **Restoration:** returning something to a former owner, place, or condition.

2011

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Garbage

- Humans have biggest impact on ecosystems
- We use technology to alter the ecosystems we live in.
- Technology has affected the amount and type of waste we produce

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Waste

- Now use complex materials- ex. plastic
 - Cannot be broken down
- **Dumps-** Large pits used for garbage disposal
 - Smelly
 - Unattractive
 - Catch fire
 - Pollute air

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Solutions

- **Recycling-** Convert into reusable material
 - Paper, glass, bottles, cans, plastics;
 - Must be separated, sorted, crushed, compacted & reprocessed.

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Solutions

- **Sanitary Landfills-** Designed not to leak.
 1. Hole is dug
 2. Clay liner and pipes put into place
 1. Prevent leakage.

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Solutions

- **Incinerating**- Burning waste
- Results-
 - Does not filter out small particles
 - Particles could cause health problems
 - Ongoing research seeking exact effects.



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Unit A: Review

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