Diversity of Life

1. List at least 5 characteristics of life that are true for all living things.
Living Things are composed of cells, have different levels of organization, use energy, respond to their environment, grow, reproduce, adapt to their environment, and have DNA.
For further elaboration go to -- http://infohost.nmt.edu/~klathrop/7characterisitcs_of_life.htm

2. What is the major difference between **prokaryotic** and **eukaryotic** organisms?
Bacteria are Prokaryotes. Animals and Plants are Eukaryotes.
Prokaryotes are single-celled, have no nucleus, therefore their DNA is not held in a nucleus. Their cells are generally smaller.
Eukaryotes have more complex cells, with a nucleus and many organelles. Their cells are generally larger.
For further elaboration go to -- http://www.diffen.com/difference/Eukaryotic_Cell_vs_Prokaryotic_Cell
and -- http://www.slideshare.net/JessicaSandel/prokaryotes-vs-eukaryotes

3. What is the major difference between **autotrophic** and **heterotrophic** organisms?
Organisms are divided into autotrophs and heterotrophs according to their energy pathways. Autotrophs are those organisms that are able to make energy-containing organic molecules from inorganic raw material by using basic energy sources such as sunlight. Plants are the prime example of autotrophs, using photosynthesis. All other organisms must make use of food that comes from other organisms in the form of fats, carbohydrates and proteins. These organisms which feed on others are called heterotrophs. -- from: http://hyperphysics.phy-astr.gsu.edu/hbase/biology/autotroph.html

4. Describe the major differences between **sexual** reproduction and **asexual** reproduction.
Sexual reproduction involves two parents, each passing on half of their genetic information to the offspring.
The mix of genetic information produces an offspring that is different from the parents>
With asexual reproduction, an organism passes on its entire set of genetic information to the offspring.
Excluding genetic mutations, the offspring is identical to the parent.
For further elaboration, go to --http://www.ops.org/MIDDLE/BRYAN/LinkClick.aspx?fileticket=8YZ9oCYuBl8%3D&tabid=327&mid=2399

5. For each kingdom of life below tell whether it is:

	Prokaryotic Or Eukaryotic	Autotrophic, Heterotrophic or Both	Single-cellular, Multicellular or Both	Reproduction Method
Archaea & Eubacteria	Prokaryotic	Both	Single	Asexual
Protista	Eukaryotic	Both	Single	Sexual
Fungi	Eukaryotic	Heterotrophic	Both	Sexual
Plantae	Eukaryotic	Autotrophic	Multicellular	Both
Animalia	Eukaryotic	Heterotrophic	Multicellular	Both

6. *Norns belong to the **genus Norno** and are generally located in specific regions of the world.*
*Use the dichotomous key to identify the norns below. Write their **complete scientific name** (genus + species) on the lines below the Norns.*

1. Has pointed ears .... go to 3
Has rounded ears ....go to 2

2. Has no tail .... kentuckyus
Has tail .... dakotus

3. Ears point upward .... go to 5
Ears point downward ....go to 4

4. Engages in waving behavior .... dallus
Has hairy tufts on ears ....californius

5. Engages in waving behavior .... wala wala
Does not engage in waving behavior ....go to 6

6. Has hair on head .... beverlus
Has no hair on head (may have ear tufts) ....go to 7

7. Has a tail .... yorkio
Has no tail, aggressive .... rajus

A. *Norno dallus*

B. *Norno rajus*

C. *Norno dakotus*

Cell Structure and Function

- Describe the structure and function of cell membranes
- Describe and distinguish active and passive transport, including the roles of proteins, energy and the concentration gradient
- Predict the effects of osmosis on cells in different concentrations of solutions
- Identify the parts of a cell and their functions: nucleus, mitochondria, chloroplast, cell membrane, cell wall, ribosome
- Describe the major ideas of mitosis: purpose, final products, effect on DNA (not phases)

Vocabulary to know and be able to apply: *phospholipid bilayer, active transport, passive transport, membrane proteins, cell membrane, cell wall, mitochondria, chloroplast, mitosis, chromosome, nucleus, osmosis, diffusion, hydrophilic, hydrophobic, solute, solvent, solution*

1. Complete the table for molecular transport in cells:

Type of Molecular movement	Does it always involve a membrane?	Move from high to low concentration, or low to high?	Does it require energy?	Does it require membrane proteins?
Diffusion	no	high → low	no	no
Osmosis	yes	high → low	no	no
Active transport	yes	low → high	yes	yes
Passive transport	yes	high → low	no	yes

2. Label the major parts of cell membrane:
   * phospholipid bilayer

   hydrophilic head
   transport protein
   hydrophobic tail

   J.Soucie, © BIODIDAC
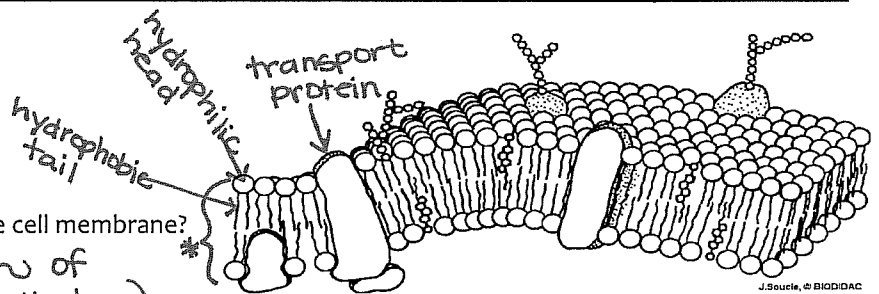
3. What are the **two** major functions of the cell membrane?
   Physical separation of inside the cell (intracellular) and outside the cell (extracellular). Regulates what enters & leaves the cell.

4. In the diagram below, consider the dots to be molecules of a *solute* in a water solution. The space between the dots is *water*. The cell membrane is semi-permeable.

   A   B   C
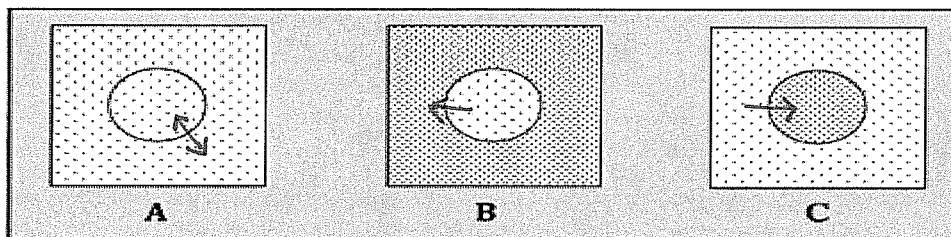
For each cell system, tell whether the <u>outside</u> solution is isotonic, hypertonic, or hypotonic.
   A Isotonic   How do you know you're correct? Same amount of solute inside & outside
   B Hypertonic How do you know you're correct? more solute in outside solution
   C Hypotonic   How do you know you're correct? Less solute in outside Solution

For each system, draw arrows showing whether <u>water</u> (white) will move into the cell, out of the cell or neither.

5. If a jellyfish is placed in distilled water, where there is a lower concentration of salt on the outside of the cells than inside, what will happen to the jellyfish cells? The jellyfish's cells are hypertonic (more solute) in comparison to the distilled water. Through osmosis, the water will enter to balance the solute concentration by entering the jellyfish's cells. The cells will burst from too much water.

6. Describe the important function of each cell organelle listed below:

   a. Nucleus _Membrane organelle that houses the chromosomal DNA._

   b. Mitochondria _Organelle in eukaryotic cells. Carries on cellular respiration. Releases energy from food molecules & storing it in ATP._

   c. Chloroplast _Found only in plants & photosynthetic protists. Contains chlorophyll, which absorbs light energy used to drive photosynthesis._

   d. Ribosome _Consists of two subunits & functions as the site of protein synthesis in the cytoplasm._

   e. Cell wall _Constructed of cellulose, in plants, algae & some prokaryotes. Gives plant cells structure & gives them shape._

7. Use the diagram below to identify the cell parts.
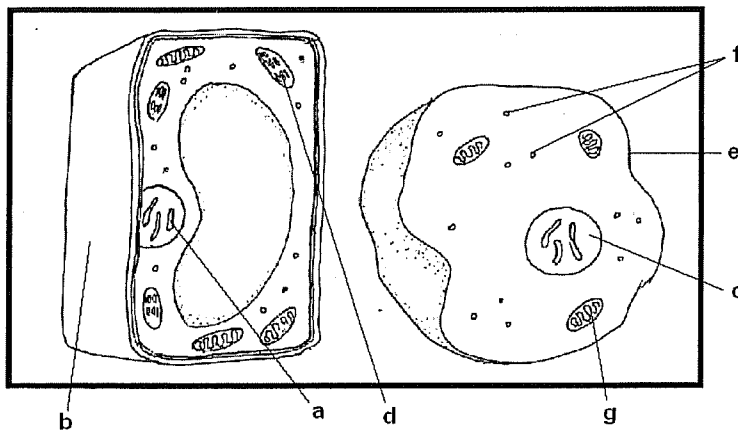
a. _Chromosome_
b. _Cell wall_
c. _nucleus_
d. _Chloroplast_
e. _Cell membrane_
f. _ribosome_
g. _mitochondria_

8. The diagram below shows substances moving out of a cell. Explain what form of transport is used and how you know.
Active transport. I know this because energy (ATP) is being used & the Hydrogen is moving from low concentration to high concentration.
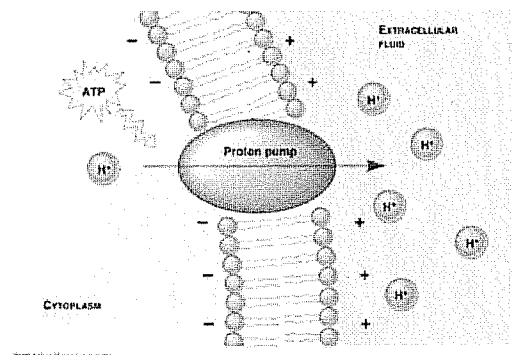
9. Describe the results of **mitosis**, cell division. Be sure to include in your description:
   - the number of cells 2
   - the number of chromosomes compared to the original cell exact same number of chromosomes (unduplicated)
   - how the DNA information in the new cells compares with each other and the original cell
   The DNA information in the new cells is exactly the same as the original.

8. If a flea-beetle has 32 chromosomes in a body cell, how many chromosomes will be in the cells resulting from mitosis, cell division? 32 How do you know? Mitosis maintains chromosome number.

9. How will the information in each of the DNA of the cells that result from **mitosis** compare?
   The DNA information in each cell will be exactly the same after mitosis.

Molecules of Life

- Describe and/or identify a protein, carbohydrate, and lipid by its molecular structure (both polymers and monomers)
- Explain the process of forming polymers from monomers, and the process of forming monomers from polymers
- Explain the functions of proteins, carbohydrates, and lipids for biological organisms
- Explain the role of enzymes in the human body
- Describe the different levels of protein structure, how they are determined, and unique characteristics about each
- List or identify sources of each biomacromolecule

Vocabulary to know and be able to apply:
Atom, Molecule, Carbohydrate, Lipid, Protein, Monosaccharide Polysaccharide, Glucose, Glycerol, Fatty Acid, Double Bond, Saturated, fat), Unsaturated (fat), Amino Acid, Peptide Bond, R group, Primary Structure, Secondary Structure, Tertiary Structure, Quaternary structure, Enzyme, Dehydration Synthesis, Hydrolysis, Monomer, Polymer

1. Explain the role of **enzymes** in the human body.
Enzymes are biological molecules (proteins) that catalyze (i.e., increase the rates of) chemical reactions. In enzymatic reactions, the molecules at the beginning of the process, called substrates, are converted into different molecules, called products. This may be taking a molecule and breaking it apart, or taking molecules and putting them together. Enzymes are your body's workers. They are responsible for constructing, synthesizing, carrying, dispensing, delivering, and eliminating the many ingredients and chemicals our body uses in its daily business of living.
This link provides a good simple animation showing how an enzyme works:
http://highered.mcgraw-hill.com/sites/0072495855/student_viewo/chapter2/animation__how_enzymes_work.html

2. What is a **monomer**? What is a **polymer**? Next to each description, give an example.
Polymers are made up of many small, repeating molecular units known as monomers.

Take a carbohydrate such as glucose ($C_6H_{12}O_6$). This is one molecule... a monomer.
Bind a bunch of glucose molecules together (like 300-600 of them), you get a polymer named starch.
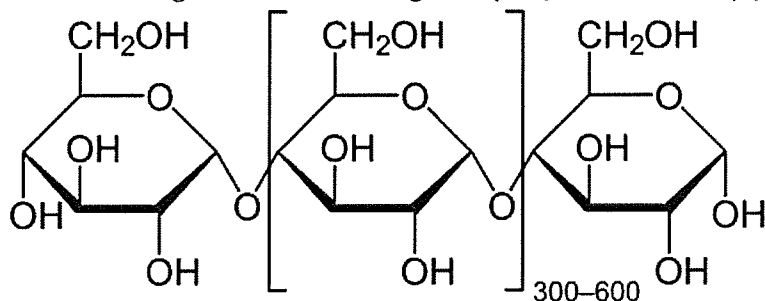
Another example: Proteins are a collection of amino acids bonded together.
The protein is the polymer, the amino acids are the monomers.

3. Describe the processes of **dehydration synthesis** and **hydrolysis**.
    Explain how they are **similar** and how they are **different**.
The monomers of organic compounds join together by a chemical reaction know as dehydration synthesis to make polymers. The reverse reaction of breaking up polymers is accomplished by another chemical reaction known as hydrolysis.
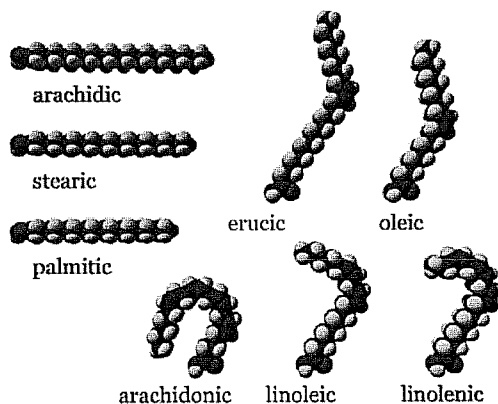This link shows animation's illustrating the role of water in these processes:
http://nhscience.lonestar.edu/biol/dehydrat/dehydrat.html

4. Complete the following table for the different molecules of life:

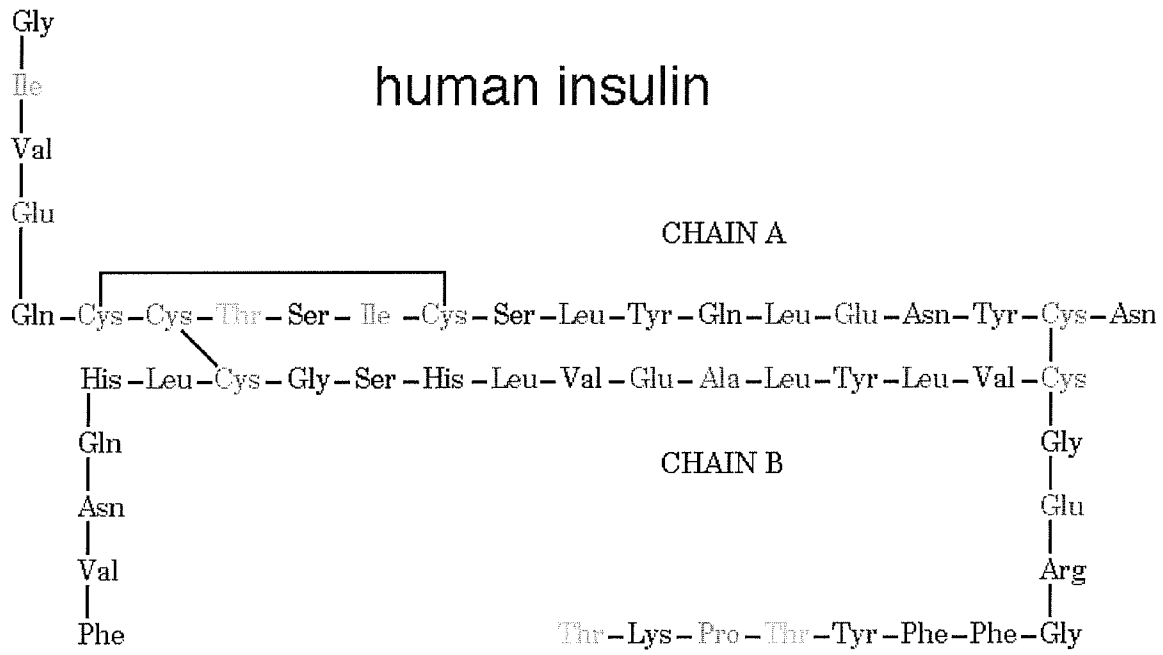|	Examples of Macro-molecule (i.e., where you can find it or example name)	Monomers (i.e., what smaller molecules make this up?)	Molecular Formula & Monomer Structure (i.e., what is a rule that helps us distinguish this molecule from others?)	Functions of this Macromolecule in the body
Carbohydrates	Starch	Glucose	$(C_6H_{12}O_6)_{300}$	Starch is produced by all green plants as an energy store. It is the most common carbohydrate in the human diet and is contained in large amounts in such staple foods as potatoes, wheat, corn and, rice
Lipids	Triglyceride	Three fatty acids bonded to one glycerol backbone	See below.	Triglycerides contribute to the structure of a cell membrane by the formation of a lipid bilayer. (i.e. phospholipid bilayer)
Proteins	Example: Insulin	51 different amino acids bonded together.	See Below: Two peptide changes bind together to make the 51 amino acid long molecule named insulin.	Regulate Blood Sugar

Triglyceride with a glycerol backbone and three fatty acid tails.
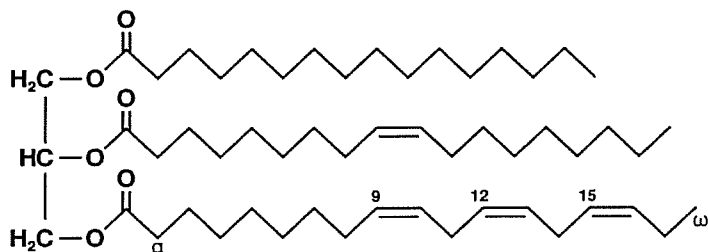
Just like proteins are made up of a collection of 21 different amino acids, there are many different fatty acids. Here are some examples:

arachidic

stearic

palmitic

erucic

oleic

arachidonic   linoleic   linolenic

human insulin

```
Gly
 |
Ile
 |
Val
 |                                          CHAIN A
Glu
 |         ┌────────────────────────────┐
Gln —Cys—Cys—Thr—Ser—Ile—Cys—Ser—Leu—Tyr—Gln—Leu—Glu—Asn—Tyr—Cys—Asn
          His—Leu—Cys—Gly—Ser—His—Leu—Val—Glu—Ala—Leu—Tyr—Leu—Val—Cys
           |                                                          |
          Gln                          CHAIN B                       Gly
           |                                                          |
          Asn                                                        Glu
           |                                                          |
          Val                                                        Arg
           |                                                          |
          Phe              Thr—Lys—Pro—Thr—Tyr—Phe—Phe—Gly
```

Genetics and Inheritance

Vocabulary to know and be able to apply:

Homozygous, heterozygous, Punnett –square, allele, dominant , recessive, meiosis, homologous -chromosomes, haploid, diploid, gamete, sperm, egg, fertilization, DNA, nucleotide, base pairing, mRNA, ribosome, gene, proteins, amino acid, transcription, translation, codon, nucleus, cytoplasm

1. What is the role of chromosomes in cells? _Made of DNA; help code for traits_

2. How many chromosomes in a human body cell? _46_

3. What is the purpose of **meiosis** in organisms? _to split the # of chromosomes in half (haploid) for egg and sperm cells.(gametes). Increase genetic variation._

4. What is the purpose of **fertilization** in organisms? _To combine the haploid egg and sperm cells to make a diploid cell._

5. For the results of meiosis in humans. Give:

   a. The number of cells that result _4 cells – 4 sperm or 4 eggs_

   b. The name of the cells that result _gametes_

   c. The number of chromosomes in the resulting cells _23_

   d. How the genetic information compares between the resulting cells _genetically different from original cell –(crossing over)_

6. How many chromosomes in a human zygote (the first cell of the offspring, after fertilization)? _46_

7. Where does the zygote (offspring) get its chromosomes? _23 from egg 23 from sperm_

8. Where do the chromosomes in a homologous pair come from? _1 from mom 1 from dad_

9. What happens to the number of chromosomes per cell during meiosis? _split in half_

10. What is the difference between **haploid** and **diploid** cells? _haploid– 1 set of chromosomes (23) Diploid – 2 sets of chromosomes (46) total._ total

---

~ aware f the ypo's...

11. In cattle, Horn~~less~~ed (H) is dominant over horn~~ed~~less (h). A homozygous horn~~less~~ed bull is mated with a homozygous horn~~ed~~less cow. Draw a Punnett square in the space for this cross and answer the questions below.

H = horned
h = hornless

HH × hh

	h	h
H	Hh	Hh
H	Hh	Hh

   a. What is the percent probability that a cow from this cross will have horns? _100%_

   b. What is the percent probability that a cow from this cross will be hornless? _0%_

21. What are the possible effects of mutations?

   – No effect
   – Change in trait

22. What effect does a mutation in a gene have on the protein coded for?

   The mutation could code for different amino acids which would change the shape of the protein.

23. Where must a mutation occur if it is going to be passed on to the next generation?

   In the sperm or egg cell.

24. Where does transcription from DNA to RNA occur in the cell?

   In the nucleus.

25. What is the role of mRNA in the transcription phase of making proteins?

   Copy of DNA gene that can leave the nucleus. It goes out to the ribosome to be translated into a protein.

26. Transcribe the DNA sequence of bases below in to an **mRNA sequence of bases.**

   TACTGTAAAGGCTATATGCCGAAT
   AUG ACA UUU CCG AUA UAC GGC UUA

27. Where does **translation** from RNA to protein occur in the cell?

   In the ribosome (in the cytoplasm)

28. Use the mRNA sequence of bases in your answer above to write the chain of amino acids that makes this protein below.

   MET, THR, PHE, PRO, IIE, TYR, GLY, LEU

	2nd base in codon					
	U	**C**	**A**	**G**		
U	Phe	Ser	Tyr	Cys	U	
	Phe	Ser	Tyr	Cys	C	
	Leu	Ser	STOP	STOP	A	
	Leu	Ser	STOP	Trp	G	
C	Leu	Pro	His	Arg	U	
	Leu	Pro	His	Arg	C	
	Leu	Pro	Gln	Arg	A	
	Leu	Pro	Gln	Arg	G	
A	Ile	Thr	Asn	Ser	U	
	Ile	Thr	Asn	Ser	C	
	Ile	Thr	Lys	Arg	A	
	Met	Thr	Lys	Arg	G	
G	Val	Ala	Asp	Gly	U	
	Val	Ala	Asp	Gly	C	
	Val	Ala	Glu	Gly	A	
	Val	Ala	Glu	Gly	G	

(1st base in codon / 3rd base in codon)

29. What is the main feature of a protein that gives it its function?

   Shape.

   ✻ Works like a lock and key.

12. Now draw a Punnett square for a cross between two heterozygous horned cows.

Hh × Hh

	H	h
H	HH	Hh
h	Hh	(hh)

hh ⟶ hornless

a. What is the percent probability that a cow from this cross will have horns? __75%__

b. What is the percent probability that a cow from this cross will be hornless? __25%__

13. In purple people eaters, one-horn is dominant and no horns is recessive. Show the cross of a purple people eater that is heterozygous for horns with a purple people eater that does not have horns. Summarize the genotypes & phenotypes of the possible offspring.

H - one horn
h - no horns

Hh × hh

	h	h
H	Hh	Hh
h	hh	hh

genotypes - 2 Hh
             2 hh

phenotypes - 2 that have 1 horn
             2 that have no horns
             (50% likelihood)

14. What is the basic shape of a DNA molecule, and the parts that make it up?
Double helix -made up of phosphate, deoxyribose sugar, and 4 nucleic acids (A, T, G, C).

15. For the sequence of DNA bases below, write the complementary **DNA bases** below each one.

TACTGTAAAGGCTATATGCCGAAT
ATGACATTT CCG ATATAC GGC TTA

16. Describe the two main steps of DNA replication.
- unzip double helix (helicase enzyme)
- add complimentary DNA nucleotides (DNA polymerase)

17. How does the genetic information coded in the DNA of a muscle cell in your arm compare to the genetic information in the DNA of a cell in your brain?
Same DNA codes in both cells. HOWEVER, different genes are expressed in the muscle cell versus the brain cell.

18. What happens to allow your brain cells to take a different shape and function compared to your arm cells?
The different genes are expressed and help the brain cell to have its unique shape that helps it to do its function.

19. What is the relationship between **DNA, genes** and **proteins**? How does this relate to **genotype** and **phenotype**?
Genes are segments of DNA that code for a protein. The genes are the genotype and the protein expresses the phenotype, or physical trait.

20. Describe three types of mutations.
Frameshift (addition, deletion)
Point (substitution)

11. Mice can have white or black fur. Researches released 10 white mice and 10 black mice into the white sand in White Sands National Park. Eagles and hawks lived nearby and used this area as their hunting ground. By the end of 3 years the population of mice had increased and there were twice as many white mice as there were black mice. And by the end of 10 years there were 6 times as many white mice as there were black mice.

a. What was the environmental pressure on the mice? *Eagles and Hawks*

12. **Biological Evolution** is the consequence of the interaction of population growth (the ability to overproduce), genetic variation, competition for finite resources, and the selection of better traits by the environment.

Read each scenario in the table below. Decide whether it is a case of **overproduction, competition,** or variations. Some situations may involve one or more causes. For example, a situation may involve overproduction and competition. Write your decision and explain your reasoning.

Scenario	Overproduction, genetic variation, or competition?	Explain your reasoning (why?)
A mother sea turtle crawls onto shore and lays over one hundred eggs. The eggs hatch and more than half don't survive.	*Over production*	*more than will survive*
Some species of geckoes are different shades of green. These differences help the species survive in different types of habitats in the regions where they live.	*Variation*	*there are different shades in the offspring*
A species of lions is living in the African plains. Over the past year, there has been very little rain, which has caused the water holes to dry up. Consequently, the antelope and other mammals of the region are dying due to lack of water. The lions are experiencing a great shortage of food. Only the best hunters are surviving.	*Competition*	*Lions compete for resources*
Humans can range in height from Minnie Me to Shaq. These differences are due to the different genes that have been passed down from parents to offspring.	*Variation*	*Organisms are different*
A species of road runners nest in the hollowed out bases of cactus plants. In one area of the desert, land developers have bought the land and have removed most of the old cacti. Only the road runners who are the best nest builders are able to survive.	*Competition*	*Competing for Space*

13. Explain the role of **mutations** in the evolution of species.
mutations in the DNA produce different traits. Different traits may give advantages for survival

14. **When** does a mutation have to occur in order for it to become part of a population?
The mutation must occur before reproduction

15. **Where** does a mutation have to occur in order for it to become part of a population?
The mutation must occur in the gamete (egg, sperm)

Evolution

Vocabulary to know and be able to apply: *species, population, mutations, genes, common ancestor, embryo, adaptation, competition, overproduction, natural selection, trait, related*
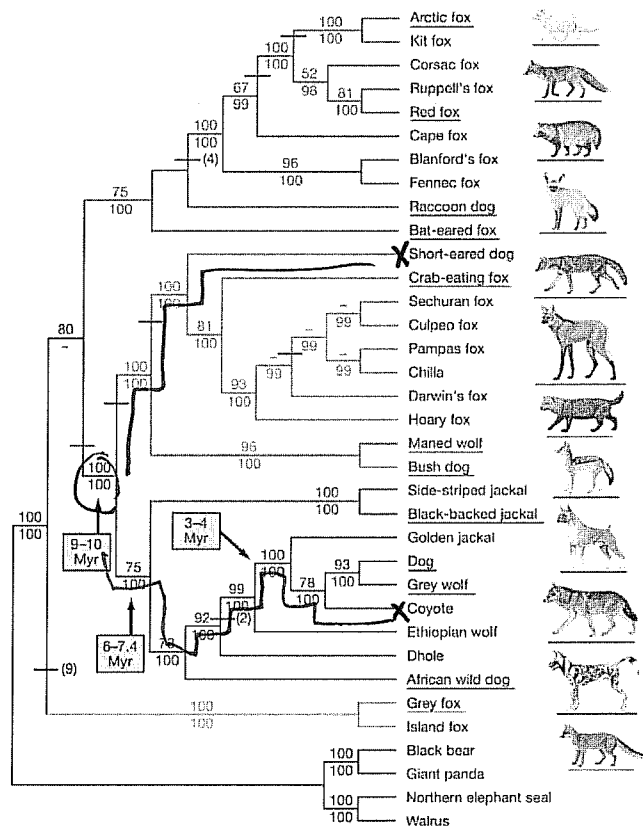
1. According to the diagram below, which group of organisms is most closely related to humans and how do you know?

Chimps,
They diverge and have a
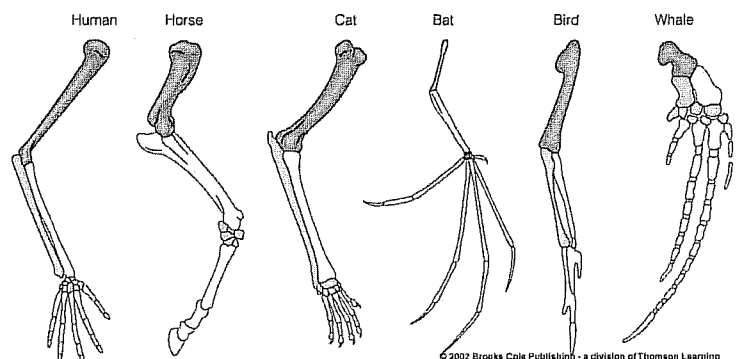common ancestor with humans
most recent.

Orangutan   Gorilla   Chimp   Human
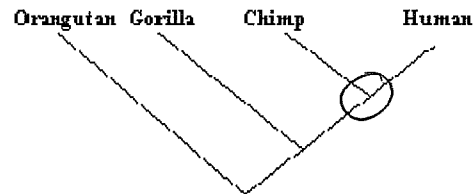
2. According to this diagram, the short-eared dog and the coyote last shared a common ancestor how many years ago?

9-10 million years ago

3. Based on the bone anatomy diagrams below, which of the following animals is most closely related to the cat and how do you know?
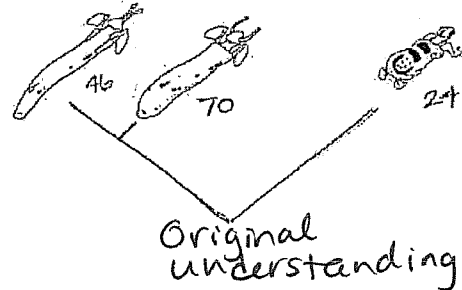
Human.
More similar bone
Structures

Human   Horse   Cat   Bat   Bird   Whale

© 2002 Brooks Cole Publishing - a division of Thomson Learning

Observe the following three DNA sequences found from the fossils of specimens 24, 46, and 70.

Specimen 24   AATCGCGGTA

Specimen 46   AATGCGGGTA

Specimen 70   AACGTTTCTA

New

Original understanding

4. Explain the original understanding of relatedness as indicated by the phylogenetic tree.

#46 + #70 were most alike by the way they looked

5. In light of the new molecular evidence, explain how scientists may now explain the relatedness between all 3 species.

The new DNA evidence suggests # 46 + #24 are most similar and closely related

6. Briefly explain the story of the **peppered moth** and describe how this phenomenon supports the principle of evolution by natural selection. There were two variations of moth, light and dark as London became more polluted with smoke the area buildings and trees became darcer. The Dark moths blended in and had an advantage. The white moths were easily seen and eaten. After a few years there were more dark moths.

7. List and briefly describe two cases in which the **fossil record** supports the principle of evolution by natural selection.

Horse evolution - fossils show they have the same parts but got bigger
Whale evolution

8. Explain what is meant by **homologous structures** and describe how they serve as support for the principle of evolution by natural selection.

Homologous structures are the same anatomical part but used for a different purposes in different organisms. As organisms adapt, the existing structures may be used for new purposes.

9. Briefly explain how the **molecular record** supports the principle of evolution by natural selection.

Closely related organisms will have more similar DNA. Small changes in DNA can yield changes in body structure.

10. Rainbow trout live in the rivers of Minnesota. The mother fish deposit hundreds of eggs into the water at one time. The rainbow trout that survive are well adapted to the cold temperature of the river. However, a few of the offspring can survive in water up to 20 degrees colder. During one especially cold winter, most of the plants the trout feed on in the river dies from the cold. If this trend in cold temperature were to continue, what trait(s) would you observe in the trout population after 20 generations? Why?

Trout would get smaller because less food is available
Trout would eat different plants.
Trout would survive colder water. This adaptation would be more prevalent.

Energy and Matter

Vocabulary to know and be able to apply: Atom, Molecule, Carbohydrate, Protein, enzyme, photosynthesis, cell respiration, glucose, carbon dioxide, oxygen, sunlight, energy, chlorophyll,

1. Identify the **inputs** and **outputs** of matter and energy into photosynthesis. You can use words or chemical formulas.

Inputs:
CO_2 (matter)
H_2O (matter)
sunlight (energy)

Outputs:
O_2 (matter)
$C_6H_{12}O_6$ – glucose (matter)

2. Explain the role of photosynthesis in the life of plants.

Photosynthesis creates glucose from sunlight so the plant has energy.

* Light enters chloroplast to make ATP, which powers Carbon fixation (CO_2 into Glucose)

3. Explain the role of photosynthesis in the life of animals.

Animals are all heterotrophs, so we depend on plants for producing glucose for us. Glucose gives us energy.

4. Describe the **inputs** and **outputs** of matter and energy in cellular respiration.

Inputs:
O_2 (matter)
$C_6H_{12}O_6$ (Glucose) (matter)

Outputs:
CO_2 (matter)
H_2O (matter)
ATP (matter, BUT is our cell's energy storage molecule)

5. Describe the role of cellular respiration in all living things.

Cell respiration allows all living things to harness ATP from food (glucose).

6. Describe the role of **enzymes** in the digestive system.

Enzymes help break down large molecules into small molecules so our body/cells can absorb the nutrients (small molecules) from food.

8. Describe the role of enzymes in cellular respiration.

Enzymes control the rate of respiration. They speed up ~~slow down~~ the breakdown of molecules and the building of new molecules.
For example, ATP synthase builds ATP.
↓
enzyme

Ecology   This contains some additional questions.

Vocabulary to know and be able to apply:
aquatic, bacteria, biodiversity, biomass, carbon cycle, carbon dioxide, concentration, decomposer, diversity, ecosystem, energy chain, estuary, food web, glucose, habitat, hydrosphere, invasive, niche, nitrogen cycle, prey, pesticide, pollinator, population density, reliability, species, succession, sustainability, toxin

1. Describe the cycle of carbon through ecosystems. (include: atmosphere, soil, CO2, Glucose, photosynthesis, (producer) cellular respiration, decomposition, producer, primary consumer, secondary consumer, decomposer)

CO_2 (Carbon dioxide) is a gas in the atmosphere. CO_2 is absorbed by plants during photosynthesis. Glucose is created. The glucose can be used in cellular respiration by the plant and released as CO_2. Consumers can eat the producer and the carbon in the glucose is passed on. The consumers uses the glucose for cellular respiration and CO_2 is released as gas. After an organism dies decomposition occurs and decomposers break the tissue down and carbon is released to the soil and air.

2. Describe the cycle of nitrogen through ecosystems. (include: N2, bacteria, soil, producer, consumer, decomposer, amino acids, protein, DNA)

N_2 (nitrogen gas) is found in the atmosphere. Bacteria in the soil capture the N_2 and change it into a form ~~usable by producers~~ such as ammonia or nitrates. Nitrates are then absorbed by plants roots and they use it to build proteins, amino acids and DNA. When consumers eat the plants the nitrogen is passed to them. When organisms die the proteins and nucleic acids break down to in the soil and can be reabsorbed by plants. Other bacteria change nitrates back to N gas.

3. What is the difference between energy **transfers** and **transformations**? Describe energy transfers and/or transformations in an ecosystem.

Energy transfer - ~~same~~ one type of energy changing location. example - chemical energy stored in glucose is eaten and becomes chemical energy in another organism. Heat made by cells moves to another cell.
Energy transformation - energy changes type. In Photosynthesis light energy is changed to chemical energy in glucose.

4. Describe population density and the biotic and abiotic factors that affect population density.

Population density is the number of organisms in a given area. Biotic factors that affect population density are the amount of food, number of predators, living material for building materials or shelter.
Abiotic factors include amount of water, space and weather/climate.

5. Calculate population density given an area and the number of a given organism within the area. Isle Royale had an area of 520 km² in size. There were 2,000 deer and 21 wolves. What was the population density of the deer? What was the population density of the wolves?

Deer - $\frac{2,000 \text{ deer}}{520 \text{ km}^2}$ = 3.8 deer/km²

Wolves = $\frac{21 \text{ wolves}}{520 \text{ km}^2}$ 0.04 wolves/km²

6. Describe biotic and abiotic factors that limit growth of plant and/or animal populations in a natural ecosystem ("limiting factors").

Biotic limiting factors - food, predators, nest/building material, competition from others
Abiotic limiting factors - space, climate (temperature, precipitation), water

7. What is carrying capacity? The maximum number of organisms than an ecosystem can support without harming the ecosystem.

Deer Population on WallaWalla Island
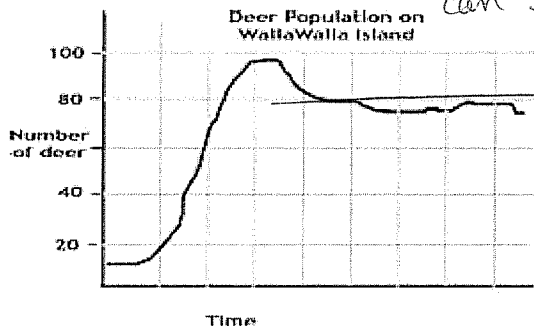
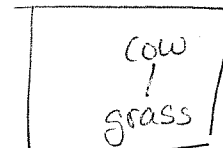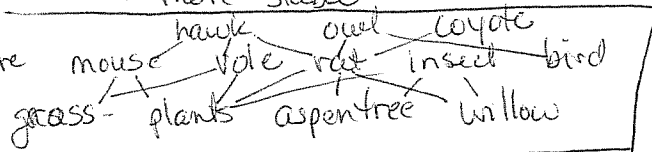What is the carrying capacity of the deer population on WallaWalla Island? Explain your answer. 80 deer - is the graph shows a steady, sustainable population.

8. Explain how biodiversity contributes to the **stability** of an ecosystem. Provide 2 examples examined in class to support your answer. Draw food web or relationship web diagrams to support your answer. List interrelationships in your food web and describe how they would decrease or increase the population of each organism. complex food web = large biodiversity = = more stable   simple food web = low biodiversity = less stable

If one organism is removed there are others than can replace it

hawk owl coyote
mouse vole rat insect bird
grass plants aspen tree willow

cow
↓
grass

if one is removed there is a large effect on the other

9. Define and describe examples of ecological succession.
Primary succession is when an ecosystem and the soil are destroyed and regrowth begins with pioneer organisms, such as lichen, followed by grass then trees and larger organisms. This occurs after lava flows or infilling of ponds. Secondary succession occurs after vegetation has been removed (fire or flood) and regrowth occurs with smaller plants such as grasses then larger plants.

10. Biomes include deserts, rainforests, polar areas, temperate forests and grasslands. Describe the rainfall, temperature range and typical vegetation in each biome.
Desert - low rainfall, high temperature, cacti and plants with waxy leaves
Rainforest - high rainfall, high temperature, large trees, much vegetation.
Polar/artic/tundra - low temp, low rainfall, very small, compact vegetation
temperate forest - moderate rainfall and temperature, trees and plants
Grassland - low rainfall, moderate temperature, grasses and shrubs.

11. Define and give examples of an organism's "niche." Explain how two organisms can live in the same habitat successfully.
Niche - the role and and location of an organism in the food web.
2 organisms can live in the same habitat if they eat different food, or are active at different times.

12. Pesticides are applied to the plant in the following food web. These pesticides are not excreted by the organisms. Which organisms would accumulate the most pesticide in its body? Explain your reasoning.
The owl would accumulate the most because it has all the pesticides accumulated in the other organisms passed up the food chain.
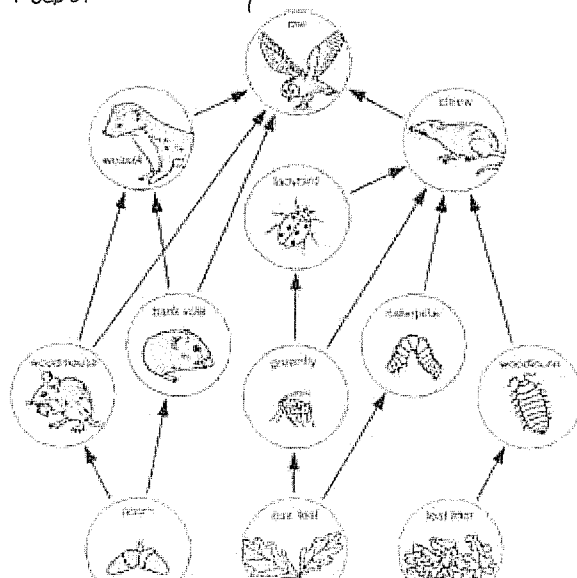
A company that produces Brand X flea shampoo claims to have the most effective shampoo for killing fleas. Which of these sets of data supports the Brand X claim?

A

	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
Number of Dogs With Fleas	25	2	25	12	25	5

C

	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
Number of Dogs With Fleas	25	4	25	1	25	10

B

	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
Number of Dogs With Fleas	25	10	25	4	25	12

D

	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
Number of Dogs With Fleas	25	5	25	1	25	4

Michael wanted to find out if frogs chirped more in the morning or evening. Which of the following type of investigation would be appropriate to answer MIchael's question. (INQB-3)

A. Controlled Experiment
B. Field Study
C. Simulation
D. Model

Jennifer wanted to know if E.coli grows better on chicken or apples. Which of the following type of investigation would be appropriate to answer Jennifer's question. (INQB-3)

A. Controlled Experiment
B. Field Study
C. Simulation
D. Model

A biology class in Washington conducted a survey of the plant species found on their school grounds. They found several plants they didn't recognize. What resources would be most helpful to the class in identifying the plants and determining if they were introduced exotic species? (INQH-2)

A. Wikipedia
B. Fossil Records
C. Biology Textbooks
D. Washington plant guide

A student researching a new discovery about the activity of mitochondria could find the most current and reliable information in a (INQH-2)

A. Newspaper
B. Biology Textbook
C. Scientific journal
D. Popular news magazine

In the Pasture Story the farmer wanted to maximize milk production by buying more cows. Which could be an unintended consequence of putting more cows on the pasture? (APPE-1)

A. The farmer will sell more milk
B. Each cows milk production will decline
C. The cows will start to make chocolate milk
D. The pasture will grow flowers due to increased fertilizer

/10