

SBI3U Exam Review

Please Note: This review is to **JUST GET YOU STARTED**. You must study all of your notes and previous review questions to be completely prepared for the examination

CELLS

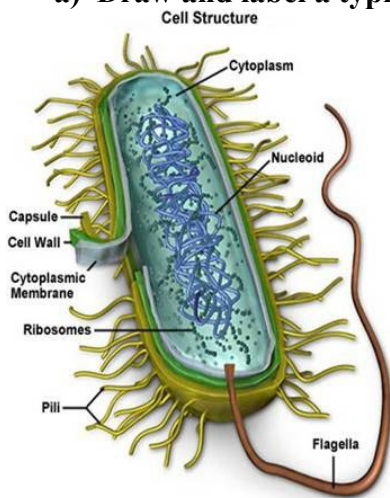
1. a) Name the four main types of biological macromolecules. Carbohydrates, proteins, lipids, nucleic acids
- b) List and provide examples for the monomers and polymers of each type of macromolecule.

	monomers	polymers
carbohydrates	glucose, galactose, fructose	Starch, glycogen, cellulose
proteins	Amino acids	polypeptides
lipids	3 Fatty acids + glycerol	Triglycerides, steroids, phospholipids
nucleic acids	Nucleotides, ATP	RNA, DNA

2. Complete the table below.

Cell Organelle	Major r unction
cytoplasm	A gel like substance between the nucleus and the cell membrane.
Endoplasmic reticulum	Extension of the nucleus that contains ribosomes. Aids in protein folding, packaging and transport.
Vacuole	Accumulates waste material and excess water.
Mitochondrion	Double membraned organelle that makes ATP (energy).
Lysosomes	Contains digestive enzymes that break down materials.
Nucleus	The organelle that contains the heredity material in eukaryotes.
Golgi Apparatus	Packages proteins for transport (using vesicles) to other areas of the cell or outside of the cell.
Ribosome	The Site of protein synthesis.

3. a) Draw and label a typical bacterium.



b) State AT LEAST five differences between prokaryotic and eukaryotic cells.

Prokaryotes	Eukaryotes
Very small	larger
No nucleus (DNA in nucleoid region)	Nucleus contains DNA
Evolved first.	Evolved after prokaryotes.
No membrane-bound organelles	Membrane bound organelles
Some aerobic/many anaerobic	Mostly aerobic
Smaller ribosomes	Larger ribosomes
Mostly asexual reproduction	Mostly sexual reproduction

4. Fill in the blanks below.

- a) The ability of water to stick to other water molecules is called *cohesion*.
- b) The ability of water to stick to other surfaces is called *adhesion*.
- c) Provide the reason for the properties in a and b. *hydrogen bonding*.

BIOLOGICAL DIVERSITY

1. List the 6 kingdoms as we currently know them.

Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia

2. List two similarities and two differences between Kingdom Eubacteria and Kingdom Archaeobacteria.

Similarities:

- *no nucleus or membrane bound organelles*
- *both possess cell walls and ribosomes*

Differences:

- *Archaeobacteria are older and live in very harsh conditions*
- *Eubacteria probably evolved more recently and live in “everyday” conditions.*

3. Why are viruses not considered living organisms by most biologists?

- *Only possess protein and nucleic acid (not carbohydrates and lipids)*
- *Cannot replicate without a host cell.*
- *Cannot perform metabolic reactions.*

4. What is the endosymbiotic theory?

The idea that the chloroplast and the mitochondria were, at one time, types of archaeobacteria that were engulfed by other bacteria by phagocytosis. Eventually, symbiotic relationships developed between the bacteria to the point in which neither bacteria could live without the other.

Evidence:

- *Chloroplast and mitochondria are double-membraned*
- *Chloroplast and mitochondria have their own DNA very similar to the DNA of some archaeobacteria.*
- *Chloroplast and mitochondria possess small ribosomes like archaeobacteria.*

5. a) How do antibiotics work (and on what type of organisms)?

Antibiotics work on bacteria only. They do not all work in the same way; some interfere with cell membrane synthesis, protein synthesis, cell wall synthesis, etc....

b) What is antibiotic resistance and how does it occur?

The ability of some bacteria to not be affected by a certain type of antibiotics. It occurs by natural selection. All susceptible bacteria will die off if exposed to antibiotics. Leaving those bacteria that are not as susceptible to reproduce (passing on their genes).

Bacteria can undergo sexual reproduction by conjugation and pass their antibiotic resistant genes (usually in plasmids) to any bacteria.

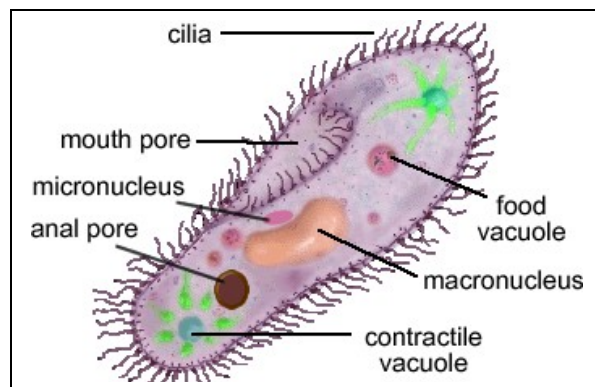
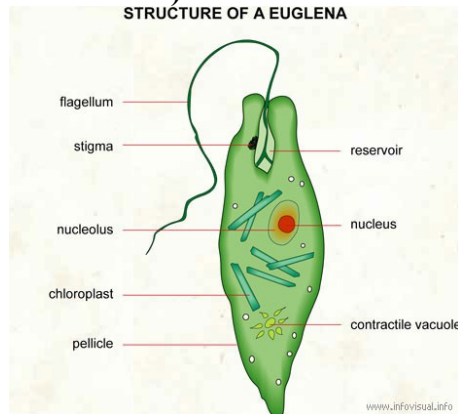
5. a) Describe the three major types of protists.

Animal-Like Protists (protozoans): Heterotrophs that absorb their food either directly through their cell membranes or as a whole by phagocytosis. _

Plant-like Protists: Contain chlorophyll and carry out photosynthesis (autotrophs).

Fungus-Like Protists (Slime Moulds): Heterotrophs that are decomposers and live in cool and damp habitats.

b) Draw and label a diagram of a euglena and paramecium.



c) Describe how some protists undergo both sexual and asexual reproduction.

Sexual Reproduction – meiosis or conjugation

Asexual Reproduction – binary fission

6. a) Describe the major structures of many fungi.

- Bodies are composed of **hyphae** – a branching network of tubes filled with cytoplasm. The hyphae form a loose, branching network under the soil and are called **mycelium**.
- Cell walls are composed of chitin.

b) Describe reproduction in most fungi.

Asexual Reproduction:

- Fragmentation – hyphae pieces are broken off and grown into new mycelia.
- Spore formation – diploid spores are produced by mitosis.

Sexual Reproduction – Spore Formation (haploid cells undergo meiosis)

7. a) List and describe the four major categories of plants

- (1) Bryophytes – lack true roots, stems, leaves, no specialized tissues, spore producers (mosses, liverworts, hornworts)
- (2) Ferns, Horsetails, club mosses – vascular and spore producers.
- (3) Gymnosperms – vascular, seed producers (cones) ex. Conifers
- (4) Angiosperms – Vascular, seed producing flowering plants

b) What is the difference between the nonvascular and vascular plants (and what do we mean by “vascular”)?

Nonvascular – Do not contain specialized cells for transporting fluids throughout the plant (each cell is responsible for obtaining its own water, minerals and nutrients from the outside environment).

Vascular – Contain specialized tissue (xylem and phloem in the seed producers) to carry water and minerals and sugars to different areas of the plant. This leads to tissue specialization.

c) What is the difference between seedless and non-seedless plants?

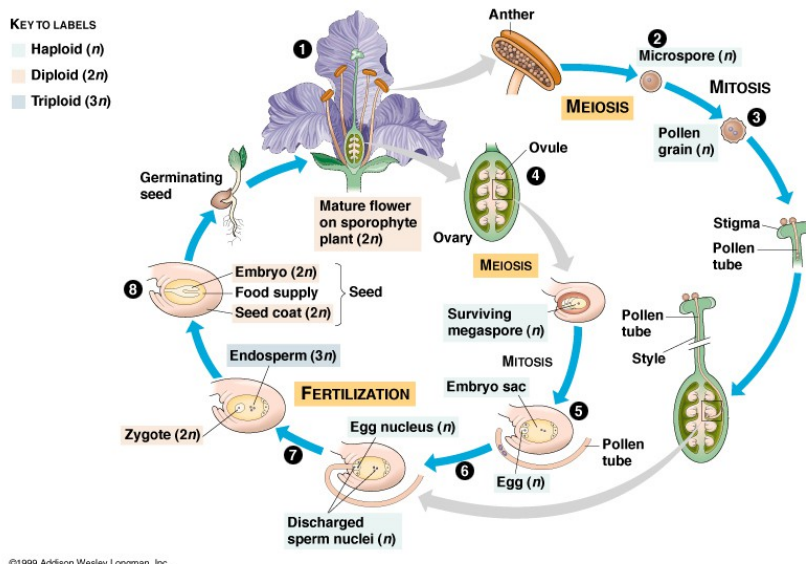
Seedless plants – Produce spores for reproduction. Thus must live close to water to transport the spores.

Plants with Seeds – Are able to live away from damp environments because they do not need water for transport of pollen. Seed-producing plants undergo pollination and can live in dry environments.

d) Why are Angiosperms so prevalent today?

Angiosperms are able to live in many environmental conditions. Their reproductive structures are flowers. Thus, they do not require water for pollen transfer, and the seeds are contained within a fruit for protection.

e) Describe the haploid generation of plants and diploid generation.



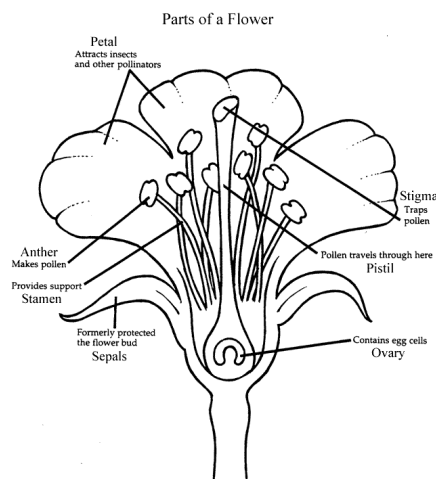
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f) Explain how plants can undergo both asexual and sexual reproduction.

Self pollination – Pollen from the same plant fertilizes an egg cell.

Cross Pollination – Pollen is transferred from one plant to another of the same species.

g) Draw and label a flowering plant.



8. Describe the general characteristics of organisms belonging to the Animal Kingdom.

- *Heterotrophic*
- *Multicellular*
- *Eukaryotic*
- *No cell walls*
- *Diploid generation – dominant*
- *Motility*
- *Nervous tissue and muscle tissue*
- *Most have 2 or 3 germ layers*

9. Describe how the following developments led to increased complexity in the animal kingdom (and in what phyla):

(1) no tissue → tissue

Sponges do not have cells that are organized in a coordinated fashion. Thus, have no tissues. All other animals have closely functioning cells that allow for specialization of tissues.

(2) two germ layers → three germ layers

Cnidarians have two germ layers (endoderm & exoderm). All others, (except sponges) have a third layer (mesoderm – middle). Allows for greater specialization.

(3) radial symmetry → bilateral symmetry

radial symmetry – bodies are organized around a central vertical axis (one orientation)

bilateral symmetry – bodies can be cut into two equal, mirror images of one another. This leads to cephalisation and development of specialized nervous tissue in the anterior end.

(4) one gastrovascular cavity opening → two gastrovascular cavity openings

With one opening, processes that occur are limited as what is entering the body enters at the same spot as what is leaving the body. With two openings, animals have a digestive tract that performs specialized digestive function as food moves from one end to the other.

(5) acoelomate → pseudocoelomate → coelomate

Acoelomate (no body cavity) – Body must be thin and flat because nutrients and O₂ must diffuse into all body cells.

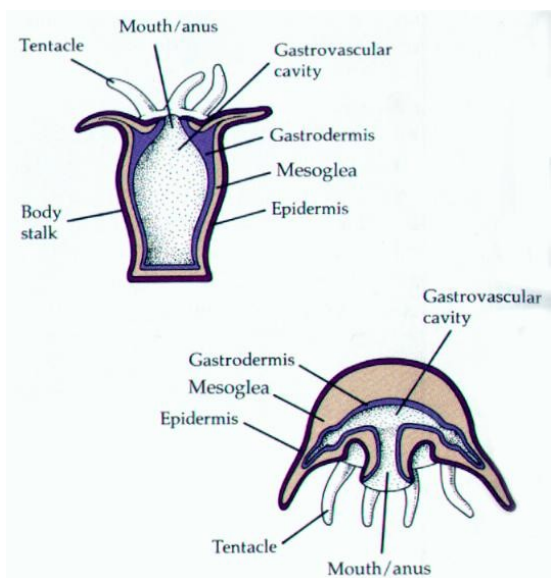
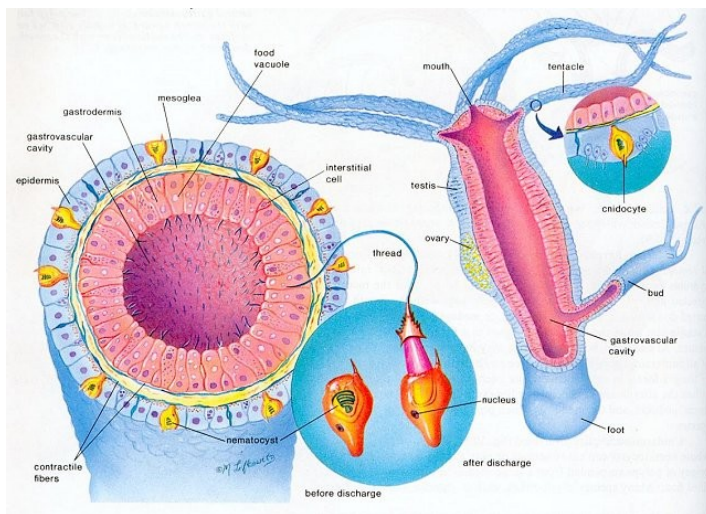
Pseudocoelomate – Body is not lined with mesoderm completely (in between mesoderm and endoderm)

Coelomate – Has a mesoderm lined fluid-filled body cavity that provides space for development and suspension of organs and organ systems.

(6) no segmentation → segmentation

The division of the body into repetitive sections allows for more effective mobility because segments can move independently. This allows for more complex movement.

10. Draw and label a hydra and a cnidarian.



11. Describe the general characteristics of chordates.

- Nerve cord
- Bilateral symmetry
- Ventral heart
- Gill slits, notochord, tail as embryos (most)

GENETICS

1. Describe a DNA molecule.

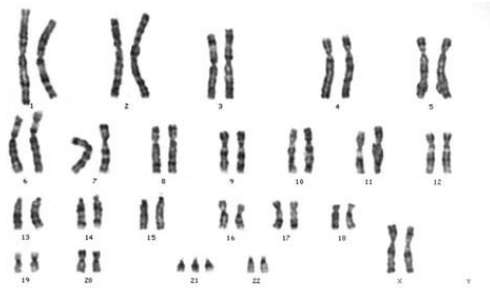
- Monomer – nucleotide, consisting of a sugar, phosphate, and a nitrogenous base.
- Two strands – sugar phosphate backbones. Strands are joined by hydrogen bonds between the nitrogenous bases.
- Four nitrogenous bases: adenine (A), guanine (G), thymine (T), and cytosine (C).
- A and T always H-Bond, C and G always H- bond.

2. Explain the difference between the following terms:

- a) mitosis & meiosis
- b) cytokinesis & mitosis
- c) nondisjunction & crossing over
- d) homologous chromosomes & sister chromatids
- e) crossing over & independent assortment
- f) spermatogenesis & oogenesis
- g) allele & gene locus
- h) diploid & haploid
- i) autosomal recessive & X-linked heredity

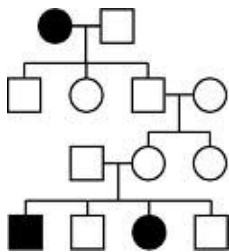
These are terms you can look up for yourself!! Sorry, you're on your own with these!

3.



- a) What is the name of the picture in the left?
Karyotype
- b) Is this a male or a female? female
- c) Are there any chromosomal abnormalities?
Explain. Yes, Trisomy 21- 3 chromosomes on the 21st pair.

4.



- a) What type of inheritance does this pedigree represent? **Explain.**
Autosomal recessive – Found in both males and females, skips a generation.

5. In dogs, dark coat (D) colour is dominant over albino and short hair (H) is dominant over long. If these traits are caused by two independently assorting genes, what parental genotypes would produce a litter of puppies having equal number of dark – short hair and dark – long hair?

Three Parental Possibilities: (1) DDHH x Ddhh
(2) DdHH x DDh
(3) DDHH x DDhh

6. A haemophiliac man with group AB blood has children with a woman who has normal blood clotting and group A blood. The woman's father was a group O haemophiliac. Use a Punnett square to show a cross between the

man and the woman. Determine genotype and phenotype frequencies of the offspring.

Man: $X^h Y I^A I^B$

Woman: $X^h X I^A i$

Genotype Frequencies: all 6.25% (1/16)

- | | |
|---------------------|-------------------|
| • $X^h X^h I^A I^A$ | • $X^h Y I^A I^A$ |
| • $X^h X^h I^A i$ | • $X^h Y I^A i$ |
| • $X^h X I^A I^A$ | • $X Y I^A I^A$ |
| • $X^h X I^A i$ | • $X Y I^A i$ |
| • $X^h X^h I^A I^B$ | • $X^h Y I^A I^B$ |
| • $X^h X^h I^B i$ | • $X^h Y I^B i$ |
| • $X^h X I^A I^B$ | • $X Y I^A I^B$ |
| • $X^h X I^B i$ | • $X Y I^B i$ |

Phenotype Frequencies:

- Female hemophiliac, Type A Blood: 12.5% (1/8)
- Female carrier, Type A Blood: 12.5% (1/8)
- Female hemophiliac, Type AB Blood: 6.25% (1/16)
- Female hemophiliac, Type B Blood: 6.25% (1/16)
- Female carrier, Type AB Blood: 6.25% (1/16)
- Female carrier, Type b Blood: 6.25% (1/16)
- Male hemophiliac, Type A Blood: 12.5% (1/8)
- Normal Male, Type A Blood: 12.5% (1/8)
- Male hemophiliac, Type AB Blood: 6.25% (1/16)
- Male hemophiliac, Type B Blood: 6.25% (1/16)
- Normal Male, Type AB Blood: 6.25% (1/16)
- Normal Male, Type B Blood: 6.25% (1/16)

7. A plant with red petals is crossed with a plant of the same species with yellow petals.

a) Describe the results of the cross if petal colour followed incomplete dominance inheritance.

$R = \text{red}, r = \text{yellow}$

$RR \times rr$

All offspring are Rr and have orange petals.

b) Describe the results of the cross if petal colour followed co – dominance inheritance.

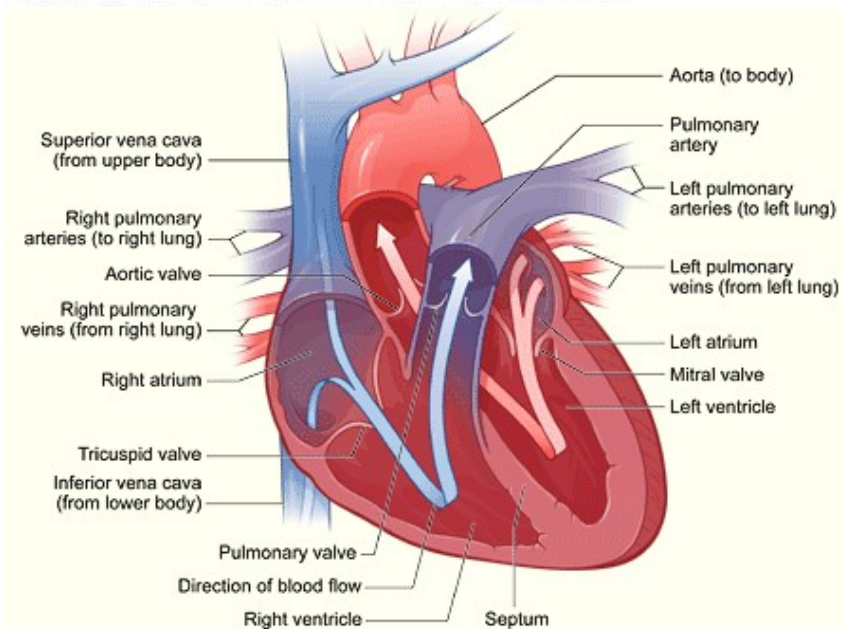
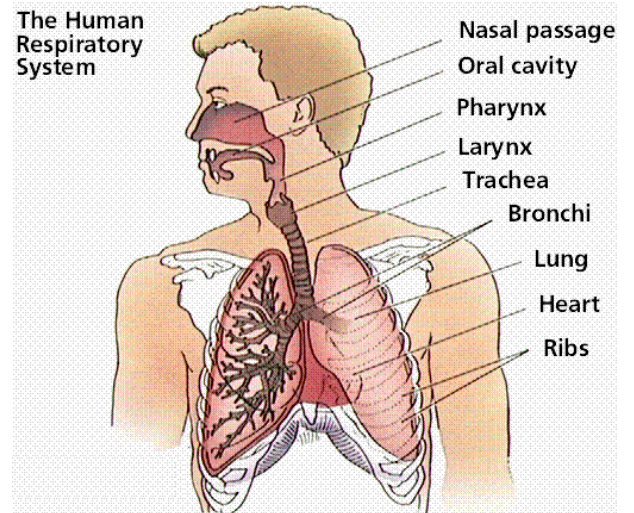
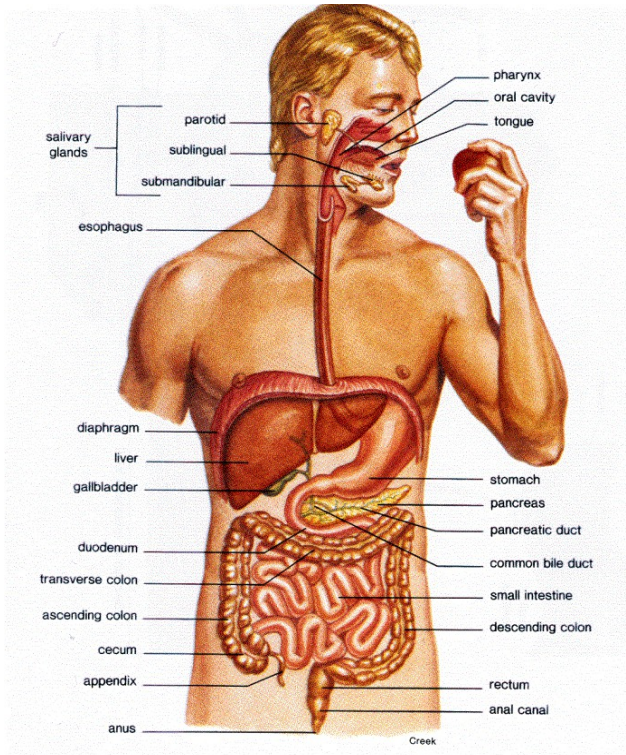
$P^R = \text{red}, P^y = \text{yellow}$

$P^R P^R \times P^y P^y$

All offspring are $P^R P^y$ and have petals that are both red and yellow.

INTERNAL SYSTEMS

1. Draw and label diagrams of the digestive, respiratory, and circulatory system in humans.



2.
 - a) Describe when carbohydrates first begin to be broken down in the digestive system and what enzyme(s) accomplish this breakdown.
Mouth, amylase
 - b) Describe when proteins first begin to be broken down in the digestive system and what enzyme(s) accomplish this breakdown.
Stomach, pepsin (then small intestine, trypsin and other proteases)
 - c) Describe when lipids first begin to be broken down in the digestive system and what enzyme(s) accomplish this breakdown.
Small intestine, lipases and bile (although bile is an emulsifier, not an enzyme)
3. What is the function of the following structures in the digestive system?
 - a) pancreas
 - b) gall bladder
 - c) liver
 - d) colon
 - e) stomach
 - f) small intestine

You can do these yourself...straightforward!

4. What is peristalsis?

Involuntary, wave-like contractions of smooth muscle throughout the digestive tract that push a bolus of food along the digestive tract, regardless of gravity.

5. **Cellular respiration within somatic cells results in CO₂ production. Describe the path of a CO₂ molecule, and processes involved, from a body cell to the atmosphere.**

body cell → RBC (via diffusion) → vena cava → Right atrium → tricuspid valve → right ventricle → pulmonary semilunar valve → pulmonary artery → lungs → alveoli (via diffusion) → bronchiole → bronchus → trachea → larynx → pharynx → nasal cavity/mouth

6. **Why do veins need valves and arteries do not?**

Most veins are below the heart and must work against gravity to get to the heart. The blood in veins is also not under as high a pressure as arteriole blood. Thus, without valves, the blood may not flow in one direction.

7. **In this chapter, we learned about structures in the systems that have increased surface area. Describe these structures and explain why increased surface area is beneficial for each system.**

Digestive system – villi & microvilli in small intestine (increases SA for nutrient absorption)

Respiratory System – Alveoli (grape like clusters at the end of bronchioles). Increased SA for faster O₂/CO₂ diffusion (gas exchange)

Circulatory System – capillaries have small diameters (thus, larger SA for RBC's) for faster gas exchange with alveoli and body cells.

EVOLUTION

1. Provide examples of each type of structure/term:

- Homologous structures
- Vestigial structure
- Analogous structures
- Convergent evolution
- Divergent evolution
- Artificial selection
- speciation

Various answers...you can do this on your own!!

2. **a) What evidence did Darwin have to explain his theory of natural selection?**

- Biogeographical knowledge*
- Some fossils (although many gaps)*
- Comparative anatomy*

- b) What evidence do we have today that Darwin did not have that supports his theory of natural selection?**

- A mechanism of inheritance (Mendel's Laws)*
- Biochemistry, DNA, & genotyping knowledge*
- Many more fossils*

3. **Describe how bacteria develop a resistance to antibiotics using the theory of natural selection.**

- There may be some bacteria in a colony have a slight resistance to an antibiotic.*
- If the antibiotic does not completely kill all of the bacteria (the slightly resistant ones) because there was not enough antibiotic for a long enough period, the slightly resistant bacteria will survive and pass on their genes to offspring (or other bacteria via conjugation).*
- Many of the new bacteria will have the slight resistance. After many generations, a mutation may occur in which a bacterium becomes completely resistant to the antibiotic, will survive and pass on its resistant genes.*

4. Explain how environmental changes in Britain led to changes in the selection pressures for wing colour in the peppered moth.

Before industrial revolution: peppered moth (light in colour) was more prevalent than the melanic form (dark in colour) because it had a selective advantage of camouflage against predators (lichen covered trees were light coloured).

After Industrial Revolution: Coal killed off lichens, trees became darker. The melanic form of moths now had the selective advantage against predators because they were better camouflaged when resting on the trees. Thus, urban areas saw an increase in this variant of moth and a decrease in the peppered variant.

5. List the five assumptions made if a population is in genetic equilibrium.

- (1) No net mutations
- (2) No immigration or emigration
- (3) large population
- (4) random mating
- (5) No natural selection

6. List and explain the different types of selection. Provide an example for each.

- *disruptive*
- *directional*
- *stabilizing*
- *sexual*

You can fill in your own explanation and examples!