Science Semester II Study Guide

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Chapter 11

1. **Gene** A unit of heredity which is transferred from a parent to offspring. A distinct sequence of nucleotides forming part of a chromosome, the order of which determines the order of monomers in a polypeptide which a cell may synthesize.
2. **Allele** One of two or more alternative forms of a gene that arise by mutation and are found at the same place on a chromosome.
3. **Hybrid** The offspring of crosses between parents with different traits
4. **Genome** The complete set of genes or genetic material present in a cell or organism
5. **Dominant allele** One allele of a gene is expressed even if another allele is present. The dominant allele masks the expression of the other allele.
6. **Recessive allele** This form of allele will be expressed only if the other pair is the same type. If the other pair is dominant, then the recessive will not be expressed.
7. **Heterozygous** Organisms that have two *different* alleles for the same trait.
8. **Homozygous** Organisms that have two *identical* alleles for a particular trait.
9. **Principle of Dominance** If two or more forms (alleles) of the gene for a single trait exist, some forms of the gene may be dominant and others may be recessive.
10. **Inheritance pattern of dominant allele**
11. **Inheritance pattern of recessive allele**
12. **Law of Segregation** Each adult has two copies of each gene. These genes are segregated from each other when gametes are formed.
13. **Law of Independent Assortment** The alleles for different genes usually segregate independently of one another
14. **Genotype** The genetic make-up of an organism - shows the combination of alleles (ex: PP or Pp or pp)
15. **Phenotype** The characteristics or traits that show up - the appearance of an organism(ex: purple flower or white flower)
16. **Incomplete dominance** When one allele is NOT completely dominant over another (they blend - pink carnations)
17. **Codominance** Both alleles are expressed in the phenotype (black and white chicken)
18. **Multiple alleles** Genes that are controlled by more than two alleles
19. **Alleles for the blood groups (genotypes and phenotypes)** Three alleles for this gene
    - I^A, I^B and i
    - Alleles I^A and I^B are codominant
    - i is recessive
20. **Diploid number vs Haploid number** Haploid is Total number of chromosomes found in a gamete (23 for humans). Humans are diploid organisms, carrying two complete sets of chromosomes: one set of 23 chromosomes from their father and one set of 23 chromosomes from their mother.

21. **Somatic cell vs sex cell**
22. **Importance of meiosis**
23. **Homologous chromosomes** Homologous chromosomes are chromosome pairs (one from each parent) that are similar in length, gene position, and location. The position of the genes on each homologous chromosome is the same. However, the genes may contain different alleles.
24. **Tetrad**
    - Each chromosome pairs with its corresponding homologous chromosome to form a tetrad. This process is called Synapsis.
    - There are 4 chromatids in a tetrad.
25. **Importance of crossing over**
    - Homologous chromosomes form a tetrad
    - Chromatids cross over one another
    - The crossed sections of the chromatids are exchanged.
    - Crossing-over produces new combinations of alleles.

    Understand from pictures
26. **Gamete formation in males** In male animals, meiosis results in four equalsized gametes called sperm. *Understand from pictures*
27. **Gamete formation in females** Only one egg results from meiosis. The other three cells, called polar bodies, are usually not involved in reproduction. They give up their cytoplasm to nourish the 1 good egg. *Understand from pictures*
28. **Should be able to**
    - *set up and interpret a monohybrid cross and a dihybrid cross*
    - *predict probability of offspring from Punnett square*

Chapter 12

1. **Structure of DNA (a drawing will help you remember)**
2. **Parts of a nucleotide** Monomer of nucleic acids made up of:
    - Deoxyribose – 5-carbon Sugar
    - Phosphate Group
    - Nitrogenous Base
3. **Base pairing rule**
4. **Purines** Double ring bases. Adenine, Guanine.
5. **Pyrimidines** Single ring bases. Cytosine, Thymine.
6. **Structure of RNA**
7. **Difference between RNA and DNA**
8. **Types of RNA and functions - mRNA, rRNA, tRNA**
9. **Codon**
10. **Stop codon** Stop transcription here. UAA, UAG, UGA
11. **Start codons** Start transcription here. AUG or methionine.
12. **Anticodon**
13. **DNA replication (where it takes place, what it is, enzymes involved)**

14. **Transcription (where it takes place, what it is, structures and enzymes involved)**
15. **Translation (what this is, structures involved, where it takes place)**
16. **Should be able to**
    - *make a complementary DNA strand when given bases of one strand*
    - *be able to figure out the DNA, mRNA, tRNA sequences and polypeptide chain when either is given*
    - *read the Genetic Code*
    - *Recognize a mutation as substitution, nonsense, silent, frameshift, insertion, deletion*

Chapter 13

1. **Selective breeding**
2. **Hybridization**
3. **Inbreeding**
4. **Restriction enzymes (Where are they found? How they work? Blunt End vs Sticky End)**
5. **Gel electrophoresis - purpose and process**
6. **DNA Fingerprinting and how it works**
7. **Plasmid**
8. **Recombinant DNA - process; examples; enzymes involved**
9. **Transgenic organisms**
10. **Cloning - (what this is, not the process)**

Chapter 14

1. **Karyotype and its purpose**
2. **Autosomes vs Sex chromosomes**
3. **Biological sex determination in humans**
4. **Rh factor in human blood**
5. **Blood type inheritance - which alleles are involved; which are dominant and recessive; antigens and antibodies**
6. **X-linked inheritance pattern?**
7. **Why is X-linked recessive inheritance more common in males?**
8. **Non disjunction**
9. **Should be able to**
    - *Interpret and create pedigree chart - autosomal dominant, recessive, x-linked recessive*
    - *Interpret a karyotype*

Chapter 15

1. **Lamarck's hypothesis of evolution** All organisms have a tendency to be perfect. They are continuously changing and acquiring new features to live successfully in their environments. Example: Bird ancestors desired to fly so they tried until wings developed
2. **Struggle for existence?** Members of each species compete regularly for food, living space, and other life necessities.
3. **Competition**
4. **The definition of fitness according to Darwin**
5. **Survival of the fittest** Those best suited for environment, survive and reproduce.
6. **Four main steps of Natural selection with their definition**
   (a) Overproduction: Have more kids than can survive
   (b) Variation: Individuals differ
   (c) Selection: Different survival probability
   (d) Traits of surviving individuals become more common.
7. **The definition of and types of sexual selection**
8. **Descent with modification**
9. **Homologous structures** Bodily structures similar in structure due to sharing a common ancestor, but different in function. (e.g hands of mammals). Evidence of common ancestory.
10. **Analogous structures** Bodily structures similar in function, but not in structure. *NOT EVIDENCE OF COMMON ANCESTRY but of evolution.*
11. **Vestigial organs** Structures that are present but diminished in size or function. Give evolutionary history. Long time ago, must have been useful.
12. **The five main points of Darwin's theory**
    (a) Individual differ, and some of this variation is heritable
    (b) Offspring produce more offspring than can survive; those that don't survive do not reproduce
    (c) Due to limited resources, organisms compete
    (d) Natural Selection: Individuals best suited to their environment survive and reproduce thus passing their heritable traits to the offspring. Others die or leave fewer offspring. Species change over time.
    (e) Common ancestory for all species.
13. **DNA evidence of evolution**

Chapter 16: 16-3 The Process of Speciation

1. **Reproductive isolation** When the members of two populations cannot interbreed and produce fertile offspring.
2. **Behavioral isolation** Two populations can interbreed but have different mating rituals or strategies.
3. **Geographic isolation** Two populations separated by geographic barriers such as rivers or mountains.
4. **Temporal isolation** Two or more species with overlapping range, reproduce at different times. Mating seasons are different.

Chapter 17

1. **Fossils and how they form**
2. **Relative dating**
3. **Index fossil** Used to define and identify geologic periods. Must have a short vertical range, wide geographic distribution and rapid evolutionary trends.
4. **Half life** How long does it take for a radioactive substance to reduce to half its original value.
5. **Earth's early atmosphere** Hydrogen Cyanide, CO_2, CO, N, H_2S, H_2O vapor but no O_2.
6. **Why life didn't form as soon as the Earth was formed**
7. **When and under what conditions life started on Earth**
8. **Endosymbiotic theory**
9. **Photosynthetic organisms**
10. **Chemosynthetic organisms**
11. **The two major mass extinctions**
12. **Adaptive radiation/divergent evolution**
13. **Convergent evolution**
14. **Coevolution**
15. **Punctuated equilibrium**
16. **Should be able to**
    - *Determine which organism is more evolved when looking at a cladogram*
    - *Determine common ancestors from a cladogram*
    - *Determine what traits organisms share when looking at a cladogram*
    - *Calculate half life*

Plate Tectonics

1. **Continental crust**
    - Thicker
    - Mostly Granite (igneous rock)
    - Less dense than oceanic crust
2. **Oceanic crust**
    - Thiner
    - Mostly Basalt (igneous rock)
    - More dense than continental crust
3. **Convection currents**
    - Form of heat transfer. Currents within fluids
    - Hot. Molecules move apart. Fluid less dense. Rises.
    - Cold. Molecules move together. Fluid more dense. Sinks
    - Movement is vertical.
4. **Continental drift theory** Wegener's hypothesis was that all the continents were once joined together in a single landmass - Pangaea and have since drifted apart.
5. **Age of Earth**

Chapter 19

1. **Shapes of bacteria**
    - Bacili: Rod shaped
    - Cocci: Spherical
    - Spirilli: Spiral or Corkscrew shaped prokaryotes
2. **Gram positive bacteria** Thick cell walls with lots of peptidoglycan. Stain dark violet stain
3. **Gram negative bacteria** Thinner cell walls. No peptidoglycan. Have an outer lipid layer (makes it harder to kill). Stain pink
4. **Structure of virus** Nucleic Acid, Protein and sometimes lipid cover.

Chapter 35-1 Homeostasis

1. **Homeostasis** Process by which organisms keep internal conditions mostly constant even if external environment changes.
2. **Negative feedback loop** Something changes from set value. Body makes response to do opposite (negative thing). Makes variable get back to set value. (*Give examples*)
3. **Levels of organization in human body**
    - Cells
    - Tissues
    - Organs
    - Organ Systems

Chapter 37

1. **Structure of heart**
2. **Importance of valves**
3. **Circulation of blood through the heart**
4. **Pulmonary circulation**
5. **Systemic circulation**
6. **Pacemaker**
7. **Arteries**
8. **Veins** Blood vessels that carry carbon dioxide rich blood back to the heart.
9. **Capillaries** Very narrow (one cell thick). Bring oxygen and nutrients to tissues and take waste and carbon dioxide from them.
10. **Systolic pressure** Pressure on the arteries when the ventricles contract. Time of highest pressure in the arteries
11. **Diastolic pressure** When ventricles relax. Lowest pressure.
12. **Red blood cells structure and function**
13. **Blood clotting steps**
14. **Structure of respiratory system**
15. **Path of air flow from nasal cavity to alveoli**
16. **Gas exchange between alveoli and capillaries**
17. **Diaphragm**

18. **Process of Inhalation**
    - The diaphragm contracts and moves down
    - The rib muscles contract and cause the ribs to move outward
    - The volume of the chest cavity increases
    - Air pressure in the lungs decreases (Boyle's Law)
    - The difference in air pressure between the lungs and outside air causes air to rush into the lungs.
19. **Process of Exhalation** Passive event.
    - The diaphragm relaxes
    - The size of the chest cavity decreases
    - Pressure in the chest cavity is greater than atmospheric pressure.
    - Air is pushed out of the lungs.
20. **How breathing is controlled** Controlled by medulla oblongota (in brain). Looks at CO_2. If high, then makes diaphragm contract. Get air in. More CO_2, more impulse to breathe in.
21. **Tobacco and the respiratory system** Three dangerous things:
    - Nicotine: Increases BP and heart rate. Stimulant.
    - Carbon Monoxide: Sticks to hemoglobin. So oxygen cannot stick. So cells starved for oxygen.
    - Nicotine and Carbon Monoxide: Paralyze Cilia
    - Tar: Cause cancer (carcinogenic)

Chapter 38: (No 38-1)

1. **Process of digestion from mouth to large intestine including accessory structures**
2. **Mechanical digestion** Chewing to break down large pieces. Teeth cut and tear into food.
3. **Chemical digestion** Use enzymes to break down food.
4. **Amylase** Enzyme in saliva that breaks the chemical bonds in starches and releases sugars
5. **Lysozyme** Enzyme in saliva that fights infections by digesting bacterial cell walls. in starches and releases sugars
6. **Pepsin** Enzyme that digests protein. Pepsin works best under acidic conditions. Released in stomach.
7. **Structures of excretory system**
8. **Filtration**
9. **Reabsorption**
10. **Urine composition** Urea, excess salt and water.
11. **Water balance**

Chapter 39

1. **Hormones** Coordinate slower but longer-acting responses including reproduction, development, energy metabolism, growth, and behavior. Secreted by endocrine system.
2. **Exocrine glands vs Endocrine glands**
    - Exocrine glands release secretions through ducts directly to the organs that use them. Eg: glands that release sweat, tears, digestive juices – effect is localized.
    - Endocrine glands release their secretions directly into the bloodstream – can affect cells throughout the body
3. **Regulation of Thyroxine**
4. **Regulation of water**

5. **Regulation of calcium**
6. **Regulation of blood glucose**
7. **Structure of sperm**
8. **Structures of the male reproductive system**
9. **Structures of the female reproductive system**
10. **Menstrual cycle phases (including hormones)**
    - follicular phase, ovulation, luteal phase, menstruation
    - Horomones: FSH, Estrogen, LH, Progesterone
11. **Fertilization (what this is and where it takes place)** The process of a sperm joining an egg. Sperm swims up the fallopian tues from vagina. If egg is in the fallopian tube, fertilization likely.
12. **Zygote**
13. **Function of placenta** Connects the mother and developing embryo. Embryo gets its oxygen and nutrients and excretes its waste products. Acts as a barrier to some harmful or disease-causing agents. But HIV, measles can cross. Also drugs and alcohol can penetrate placenta.
14. **Hormones involved in child birth and milk production**
    - : Signal baby is ready. Synchronize uterine contractions. Dilate the cervix. Prepare mother for nursing.
    - Prolactin stimulates production of milk. (Horomone secreted by pituatary glands).
    - Oxytocin: Affects involuntary muscles in uterine walls. They contract rhythmically - called labor.
15. **Identical twins vs fraternal twins**
    - Fraternal: If two eggs are released during the same cycle and fertilized by two different sperm
    - Identical: A single zygote may split apart to produce two embryos

Chapter 40: (No 40-1 and 40-4)

1. **Non-specific defenses** Defenses are designed to keep most foreign things out of the body.
2. **First line of defense**
    - Intact skin: Epidermis shield against invaders. Secrete chemicals that kill invaders. pH maintained between 3 and 5. Acidic to prevent microbe colonization.
    - Mucus and Cilia: Mucus is viscous fluid and traps bacteria and foreign particles. Hair like cilia sweeps this goop into throat for coughing and swallowing. Keep goop away from lungs.
    - Saliva: Contain lysozyme to break bacterial cell wall (kill bacteria)
    - Tears: Also has lysozyme
    - Stomach Acids: Strong acids break down swallowed bacteria
3. **Second line of defense**
    - Blood WBC : Attack invaders. Initiate inflammatory response to protect tissue. Phagocytes: Engulf and destroy bacteria in lysosomes.
    - Fever: High temp means pathogen growth slowed or stopped. High temp increases heart rate so WBC can get to infection place faster.
    - Interferon: When virus infection body releases interferon. Interferes with virus replication. Block synthesis of key proteins required for viral replication.
4. **Antigens** Any substance, as a virus or bacterium, that triggers immune response. Specific Defense.
5. **Antibodies** Protein that recognizes and binds to an antigen.
6. **Risks of transplant** Immune system thinks transplant in foreign and attacks it. Makes transplants tough. Cells have marker proteins on surface which lets immune system recognize them. Can cause organ rejection.

7. **Passive Immunity** Antobodies produced by other animals are injected into the bloodstream. Eg. Mom passing down immunity to baby via breast milk or placenta.

8. **Active Immunity** You produce the antibodies - Your body has been exposed to the antigen in the past either by infection or vaccination.

9. **Allergies** Immune system mistakenly recognizes harmless foreign particles as serious threats.

10. **What is histamine?** Allergens attach to mast cells. Mast cells in locations where external contact possible. Mast cells start inflammatory response. These release histamines. Histamines increase blood flow and fluid production in affected area. Sneezing, watery eyes, runny nose.

11. **Humoral immunity** Defends the body against antigens and pathogens in body fluids (blood and lymph) - involves mainly B cells. Produce antibody.

12. **Cell mediated immunity** Defends the body against abnormal cells and pathogens inside living cell - involves mainly T cells. No antibody production.

13. **Secondary immune response** When 2^{nd} time person exposed to antigen, immunological memory is triggered and immune system can start making antibodies immediately.

14. **Autoimmune disorder** When the immune system attacks the body's own cells, it produces an autoimmune disease. Thinks body's own cells are pathogens.

15. **Immunodeficiency disorder** Person has a weakened immune response. E.g. AIDs caused by HIV.