

Objectives for Cell Chemistry

READ YOUR NOTES. AFTER YOU HAVE STUDIED ALL OF YOUR NOTES FOR THIS TEST, USE THESE OBJECTIVES TO TEST YOUR KNOWLEDGE. IF YOU DO THIS YOU WILL DO BETTER ON THE TEST!!!!!!!!!!!!!! If you only study "answers" to these objectives you will not do as well as you want to do on the test.

1. Define the following terms:
anatomy (gross) physiology cytology embryology
pathology biochemistry
2. List and briefly describe each of the 11 body systems.
3. Define homeostasis. List the 3 physiological factors (conc, temp, water pressure) that are regulated with homeostasis. Be able to give an example of HOW homeostasis works using one of these factors.
4. Be able to explain and give an example of negative feedback and positive feedback systems. Include the following in your answers:
sensor control center effector
5. Define elements, atom and molecule. Describe the structure of an atom including the location and charge of protons, neutrons, and electrons. Define and give an example of the following
ion or electrolyte cation anion
6. Describe the following types of bonds:
ionic bonds covalent bonds hydrogen bonds
Know whether electrons are donated or shared, whether bonds are polar or nonpolar and give an example of each bond. Know which bonds fall apart in water and which type of bond is the strongest and weakest.
7. Distinguish between organic and inorganic compounds. Include presence of carbon, types of bonds, size, and examples.
8. Describe why water is an important inorganic compound. Describe the following functions:
polar solvent suspension specific heat
heat of vaporization lubricant
9. Define and give an example of an acid, base and salt. Identify relative acidity and alkalinity from the pH scale.
10. Be able to recognize the functional groups we covered in class.
hydroxyl group amino group carboxyl group phosphate group
Be familiar with these categories of molecules: organic acids, alcohols
11. Be able to recognize the structure of a glucose, triglyceride, amino acid and nucleotide as drawn on the page in your handout.
12. Define the term carbohydrate. Identify each of the following:
monosaccharide disaccharide polysaccharide glucose
galactose fructose sucrose maltose
lactose starch glycogen cellulose
Know where each of these can be found.
13. Define the term lipid. List and give functions of the following members of the lipid family:
triglycerides phospholipids steroids eicosanoids
14. Explain what is meant by a fatty acid, a saturated fatty acid, a monounsaturated fatty acid and an polyunsaturated fatty acid. Know which foods contain saturated, and unsaturated fats and whether they are liquid or solid at room temperature.
15. Define the term protein. Explain what is meant by the following terms:
amino acid peptide polypeptide
primary structure secondary structure tertiary structure
quaternary structure enzyme structural protein
16. Explain what is meant by denaturing a protein and show how this would affect its function.
17. Explain how the order of amino acids in a protein determines the function of the protein.
18. List at least 4 functions of proteins in the body.

19. List the 3 components of all nucleotides. Be able to give 3 examples of nucleotides.
20. Define ATP. Describe the function of ATP and how it is formed from ADP.

Objectives for Cell Structure and Transport

1. Describe the function of the membrane. Know the following terms:
intracellular extracellular intercellular interstitial
2. BE ABLE TO LABEL A PORTION OF A CELL MEMBRANE ON THE LECTURE TEST. Include the following:
phospholipids proteins cholesterol
Describe the fluid mosaic model of the membrane.
3. Describe the structure and function of the following:
cilia flagella microtubules microvilli
4. Be able to describe the process of diffusion from high to low concentration and how it is affected by molecular weight and temperature.
5. Define osmosis. Explain the importance of the semipermeable membrane. What is osmotic pressure? How does the number of solutes effect the osmotic pressure? What is the function of an aquaporin?
6. Define each of the following types of solutions and describe what happens when RBCs are placed into them:
isotonic hypertonic hypotonic
Be able to define the following terms:
crenation hemolysis
7. State the isotonic concentrations of glucose and saline. Know that isotonic is 0.3 Osm or 300 mOsm. Be able to give concentrations of hypertonic and hypotonic solutions. Be able to explain why a 2% CaCl₂ solution is more hypertonic than a 2% NaCl solution.
8. The plasma membrane is said to have selective permeability. Define the term selective permeability. Explain what selective permeability means functionally to a cell.
9. Describe how each of the following gets inside the cell:
water steroid hormones sodium
glucose protein
10. Define and give example of facilitated diffusion.
11. Distinguish between active and passive transport. Name and define the major characteristics of active transport (energy, carrier, specificity, and used to concentrate a chemical).
12. Describe the following ways for large particles to enter & leave a cell:
endocytosis phagocytosis pinocytosis exocytosis
13. Describe the function of the following organelles:
cytoplasm nucleus nucleolus
nucleoplasm nuclear envelope chromatin material
ribosomes endoplasmic reticulum (rough and smooth)
golgi complex mitochondria lysosomes
vacuoles centrioles cytoskeleton
inclusions

Objectives for Chapter Protein Synthesis, Mitosis & Metabolism

1. Distinguish between DNA and RNA (3 differences).
2. Name the five nitrogen bases and the two sugars involved in the structure of nucleic acids. Be able to correctly pair the nitrogen bases.
3. Describe how RNA is transcribed from a DNA molecule. List the three major types of RNA and give the general function of each. Know the enzyme that is used for this process.
4. Describe the process of translation. State clearly the role of ribosomes, mRNA, tRNA, and amino acids. Define base triplet, codon and anti-codon.
5. List the organelles of the cell that are involved with packaging proteins after they are made. Describe the posttranslational modifications that are made to proteins.
6. Explain clearly how DNA, confined to the nucleus, can control the structure and function of the entire cell, and ultimately the entire organism.
7. Describe the process of the semiconservative replication of DNA. Know the enzyme that regulates this process.
8. Know what happens in each part of interphase of the cell cycle (G_1 , S, & G_2)
9. Name and describe each stage of mitosis. (interphase, prophase, metaphase, anaphase and telophase). Define cytokinesis, chromatin, chromatid, chromosome with 1 chromatid, chromosome with 2 chromatids, spindle fibers and centromere.
10. Define the following terms:

somatic cell	reproductive cells	mitosis
meiosis	gamete	diploid (2n)
haploid (n)	homologous chromosome	
11. Explain how meiosis differs from mitosis. Name and describe each stage of meiosis. (interphase, prophase I, II, metaphase I, II, anaphase I, II and telophase I, II). What is a tetrad and why does it form? What is crossing over and why does it happen?
12. Be able to describe the following types of reactions:

oxidation-reduction	phosphorylation
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13. Describe the function of NAD^+ , NADH, FAD, $FADH_2$, ATP and ADP in the cell.
14. Describe the process of glycolysis and state where in the cell it occurs. State the end product of glycolysis and state the number of ATP molecules and NADH produced.
15. Describe what happens to pyruvate when oxygen is present. State the end products obtained from metabolizing pyruvate when oxygen is present.
16. Describe the function of the citric acid cycle and know its alternate names. State the source and fate of acetyl CoA. List the products of the citric acid cycle (primarily NADH). What happens next to NADH?
17. Describe the function of the electron transport chain. Understand how the oxygen we breathe is used in this metabolic pathway. Know where in the cell the electron transport chain is.
18. Be able to explain how the chemiosmotic mechanism works. Where does the energy come from to pump H^+ into the intermembrane space? How is ATP made? How many ATP are made from each NADH that comes to the ETC?
19. State the total number of ATP generated when glucose is metabolized aerobically. Compare this number to when glucose is metabolized anaerobically.
20. What is lactic acid? When is it made and what is its fate?
21. Define glycogenesis. Name two types of cells that store significant amounts of glycogen. Define glycogenolysis. What is the only organ that can release glucose back into the blood stream?
22. Describe the process of lipolysis and beta-oxidation. Know where in the cell this process occurs. State the end products

of fatty acid metabolism and how many ATP are generated by completely catabolizing a 16 carbon fatty acid.

23. Explain how proteins are catabolized. What is the fate of the amino group? What is the primary function of the protein we eat every day?
24. Define gluconeogenesis and how amino acids can be used in this process.
25. List the conversions that the liver can do (ex. excess glucose is stored as glycogen).

Tissues and Skin

1. Define the terms: tissue and intercellular (or interstitial or extracellular) fluid. List the four basic types of tissues.
2. Describe the 7 general characteristics of epithelial tissue. Define basement membrane and list where it is found.
3. Describe the 3 shapes of epithelial cells. For the 7 tissues (2 types of stratified squamous) that were covered in class know their characteristics, function and location in the body. Be familiar with the following:
microvilli cilia keratin
4. Be able to describe embryonic connective tissue. Describe the 3 general characteristics of connective tissue and state its general function. Where is the matrix and what is found there? List the 4 types of connective tissue. How is the matrix different for each of these connective tissues?
5. List and describe the 3 types of fibers found in connective tissue. List and give the function of the following cells
fibroblasts macrophages plasma cells mast cells
6. List and describe the 6 types of connective tissue proper. For each know: the type of fibers that are present, function, and location in the body.
7. List and describe the 3 types of cartilage, giving their functions and examples of where each may be found. List the type of cell found in cartilage. Define the terms: lacuna(e) and perichondrium.
8. Describe the function of each of the following cell junctions and an example of where it is found.
tight junctions desmosomes gap junctions
9. Define the term gland. Differentiate between endocrine and exocrine glands.
10. Give an example of the following glands and know how they release their secretions:
goblet cell merocrine glands holocrine glands
apocrine glands.
11. Describe the following types of membranes:
mucous membranes serous membranes
For each, give their tissue structure, function and location in the body. Know the location of the following:
parietal layer visceral layer serous fluid
pleural membrane pericardial membrane peritoneal membrane
lamina propria of mucous membrane
12. Be able to describe how tissues grow differentiating between hyperplasia and hypertrophy. Also differentiate between fetal and adult stem cells, including how many types of tissue it can become.
13. List and describe 4 functions of skin.
14. Differentiate between the epidermis and the dermis. Know which tissues make up each layer.
15. List the five layers of epidermis and describe each. Define keratohyalin and give its function.
16. Describe the two layers of the dermis. Locate the nerve and blood supply for the skin.
17. Describe friction ridges and their purpose.
18. Describe what makes skin dark, pink and yellow.
19. Explain the role of skin in body temperature control. (surface area, blood vessels and sweat).
20. Describe the structure and location of a hair follicle. Identify the shaft, root, papilla and arrector pili muscle of a hair. Locate the growing part of hair.
21. Describe the structure of a nail. Locate the growing point of nails.
22. Differentiate between sebaceous glands, sudoriferous glands (apocrine & merocrine), and ceruminous glands. Know the differences in secretions, locations and functions of these glands.

Bones and Articulations

1. State what is meant by the term "skeletal system" and list 5 functions of the skeletal system.
2. Describe the structure of bone and its blood supply. There will be pictures to label on the lecture test. Be familiar with the following:

osteogenic cells	osteoblasts	osteocytes
osteoclasts	organic matrix	inorganic matrix
diaphysis	epiphysis	epiphyseal plate
epiphyseal cartilage	periosteum	endosteum
medullary cavity	red/yellow marrow	articular cartilage
compact bone	spongy bone	Osteon or Haversian System
Central or Haversian Canal	Perforating or Volkmann's canals	lamella
lacuna(e)	canaliculi	trabeculae
3. Describe intramembranous ossification, using the formation of a skull bone as an example.
4. Describe endochondral ossification, using the formation of a long bone as an example. Include the following:

cartilage model	chondrocyte swell	primary ossification center
bony collar	buds of CT	primary marrow space
secondary ossification center	epiphyseal plate	
5. Explain the process of growth (length and width) during childhood. Define epiphyseal plate and line.
6. Describe resorption. Why does it happen? Describe the activities of osteoclasts. Know that spongy bone remodels more often than compact bone and that 5% of your bone is remodeling at any given time.
7. Name some nutritional and hormonal factors that affect normal bone growth and repair.
8. Define fracture and describe several general types (partial, complete, closed, open, comminuted, greenstick, spiral, transverse, impacted, Pott's, Colles', displaced, and nondisplaced).
9. Describe briefly the general process of fracture healing.
10. Define osteoporosis and Rickets. Explain the effect of immobility or exercise on bone. Be able to explain why postmenopausal women are at higher risk for osteoporosis and what women can do to reduce their risk.
11. Define what is meant by a joint or articulation. Describe the two ways of classifying joints (structure or function).
12. Describe the structure and mobility (no, slight, full movement) of the following types of joints, giving an example of each type. For the synovial joints, know whether it is a monoaxial, biaxial or triaxial joint.
 - a) fibrous (sutures, syndesmosis, gomphosis)
 - b) cartilaginous (synchondrosis, symphysis)
 - c) synostosis
 - d) synovial (ball-and-socket, hinge, saddle, pivot, gliding, and condyloid)
14. Be able to describe and identify demonstrations of the following movements:

flexion	extension	hyperextension
abduction	adduction	elevation of shoulder
depression of shoulder	protraction of jaw	retraction of jaw
circumduction	rotation	supination of forearm
pronation of forearm	dorsiflexion of foot	plantar flexion of foot
inversion of foot	eversion of foot	
15. Describe what is meant by arthritis. Differentiate between rheumatoid arthritis and osteoarthritis, including the cause of the disease, which joints each disease attacks, and the age the person usually gets the disease.

Excitable Tissue and Muscle

1. Define membrane potential. List the charge inside and outside the cell and how these charges are generated. List the distribution of ions inside and outside the cell (high vs low is ok). What causes this ion distribution? List the forces (electrical, concentration) on each of the ions at rest.
2. Describe the process of an action potential. Include in your discussion changes in membrane permeability, gates opening & closing, ion movement, positive feedback cycle and changes in the membrane potential.
3. Understand the role or meaning of:

stimulus	depolarization	hyperpolarization
ion channels	short-term repolarization	long-term repolarization
all-or-none law	threshold	subthreshold
suprathreshold	absolute refractory period	relative refractory period
4. List the three main types of muscle tissue and state how they differ from one another in nerve innervation, whether or not they are voluntary, and list a location for each.
5. Describe the structure of a skeletal muscle and its attachments and related structures. Include the terms:

tendon	superficial fascia	deep fascia	endomysium
fasciculi	perimysium	epimysium	muscle fiber
aponeurosis	tendon sheaths		
6. Describe the structure of a skeletal muscle cell. Include the terms:

sarcolemma	sarcoplasmic reticulum	T-tubules
triad	myofibrils	myofilaments
thick filaments	thin filaments	all bands & zones
myosin	actin	tropomyosin
troponin	sarcomere	dystrophin
7. Describe how the thin and thick filaments are arranged within the sarcomere. BE PREPARED TO DRAW AND LABEL A SARCOMERE ON YOUR TEST including the location of the A, I and H bands and A lines. Describe how troponin inhibits muscle contraction. Know which types of muscle are striated and which are not.
8. Define a motor unit. Explain the functional significance of a motor unit and the ratio of muscle cells to neurons in each unit. Describe how the all-or-none law is followed by motor units and the muscle organ. In a muscle, such as the biceps brachii, is there only 1 motor unit? Explain.
9. Describe a neuromuscular junction. Describe the process by which an action potential passes from a motor neuron to a skeletal muscle cell. Include:

motor end-plate	synaptic knob	synaptic cleft
neurotransmitter	acetylcholine	acetylcholinesterase
10. Describe a muscle cell at rest. List 3 facts about a sarcomere at rest (Ca, Troponin/tropomyosin complex and myosin head).
11. Describe the process of muscle contraction and relaxation. Start with depolarization of the sarcolemma. List the 2 specific events that require ATP. Define the role or the meaning of:

calcium	sodium	potassium
crossbridge formation	power stroke	ATP hydrolysis
recovery stroke	asynchronous movement	rigor mortis
12. What happens to calcium at the end of the muscle contraction? Describe how we can go through more than one cycle of muscle contraction.
13. Understand the nature of skeletal muscle responses. Be sure to distinguish those responses possible in a whole muscle as opposed to those of a single cell. Include the following terms:

simple twitch	latent period	contraction
relaxation	motor unit summation	wave (temporal) summation
incomplete tetanus	complete tetanus	isotonic contraction
isometric contraction	length-strength relationship	muscle tone
14. Discuss the various energy sources for a muscle. Include the length of time the energy source lasts.

ATP	creatine phosphate	glucose (anaerobic & aerobic)
glycogen	lactic acid	
15. Differentiate between type I and II muscle fibers. Include:

Study Guide for Nervous System

1. State the three broad functions of the nervous system.
2. Describe the basic structure of a neuron, including the location and function of the following components:

cell body	nissl bodies	neurofibrils	dendrites
axons	axon hillock	synaptic knobs	
3. Describe the structure and function of the following:

sensory or afferent neurons	multipolar neurons
motor or efferent neurons	bipolar neurons
interneurons or association neurons	unipolar neurons
4. Describe how substances (mitochondria, vesicles) are transported from the cell body to the synaptic knobs, and how neuron components are slowly moved.
5. List the types of neuroglia cells and state the function of each. 5 types were given in class - Schwann cells, oligodendrocytes, astrocytes, microglia and ependymal.
6. Describe how Schwann cells (PNS) and oligodendrocytes (CNS) make up the myelin sheath. Why is the myelin considered an electrical insulator? What are the neurolemma and nodes of Ranvier?
7. Discuss neuron damage and the probability of repairing neurons or their axons. List the components of the regeneration tube that must be present for nerve growth.
8. Review the mechanism of impulse conduction, and understand the meaning of

polarized	depolarized	all or none law
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9. Describe the process of saltatory conduction. What is the benefit of this process? List approximate transmission speeds for myelinated and unmyelinated fibers. Be able to give examples of A, B and C fibers. Explain how the rate of nerve impulse conduction is affected by the diameter of the fiber and the myelin sheaths.
10. Describe a synapse, and explain how a nerve impulse crosses a synapse. Define the term "neurotransmitter" and name the principle neurotransmitters, and how transmitters are removed from synapses. Know the direction of nerve transmission.
11. Describe the terms convergence and divergence. Explain the function of convergence and divergence.
12. Describe an excitatory postsynaptic potential and an inhibitory postsynaptic potential. Does an EPSP always generate an action potential? Compare an EPSP to an action potential.
13. Describe how EPSP and IPSP can summate. Explain temporal summation and spatial summation, including how they are different. Include the axon hillock in your answer.
14. List some factors that affect transmission at the synapse. (curare, caffeine, O₂)
15. Know the location and function of the following neurotransmitters. Know how acetylcholine and norepinephrine are broken down. Know any drugs that were mentioned in class.

acetylcholine	norepinephrine	MAO inhibitor	glutamate
serotonin	glycine	GABA	dopamine
substance P	endorphins & enkaphalins		

Brain

1. State the parts of the brain that make up the brain stem, cerebrum and cerebellum.
2. Know the 5 parts of the embryonic brain and what they become in the adult brain.
3. Know the meninges.

dura mater	falx cerebri	tentorium cerebelli
arachnoid mater	pia mater	subarachnoid space
4. Know the location of the:

lateral ventricles	septum pellucidum	3rd ventricle
4th ventricle	cerebral aqueduct	median aperture
lateral aperture	interventricular foramen	
5. State the appearance, chemical composition and normal amount of cerebrospinal fluid in an adult. Be able to list the 3 places that make CSF. Be familiar with the following:

choroid plexuses	arachnoid villi	superior sagittal sinus
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 Trace the flow of cerebrospinal fluid from where it is formed to where it is reabsorbed into the blood stream.
6. Discuss what is meant by the blood-brain barrier. List substances that can diffuse across easily, and which are inhibited.
7. Be able to LABEL the following on a DRAWING. Describe the FUNCTION of each of the following:

MEDULLA OBLONGATA

PONS

CEREBELLUM

superior cerebellar peduncle	middle cerebellar peduncle	inferior cerebellar peduncle
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 (you will not have to label the individual peduncles)

MIDBRAIN

cerebral peduncles	corpora quadrigemina	cerebral aqueduct
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THALAMUS

oval mass	intermediate mass	
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HYPOTHALAMUS

mammillary bodies

PITUITARY

PINEAL BODY

CEREBRUM

tracts

ascending & descending projection tracts	Example: internal capsule	
commissural tracts	Example: corpus callosum	
association tracts		

hemispheres

cerebral sulci & fissures	cerebral cortex	gyri,	sulci
longitudinal	central	lateral	
parieto-occipital			

extension of dura mater in fissures

falx cerebri	tentorium cerebelli	
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cerebral lobes

frontal	parietal	temporal
occipital	insula	

basal ganglia

corpus striatum,	caudate nucleus,	lentiform nucleus
putamen	globus pallidus	Parkinson's disease

functional areas of the cerebral cortex

primary motor area	motor association area	
primary somesthetic	primary visual area	
primary auditory area	primary gustatory area	
primary olfactory area	somesthetic association area	
visual association area	auditory association area	
Wernicke's area	Broca's (motor speech) area	
prefrontal cortex		

8. Know where the reticular formation is and its function.
9. Define the function of the limbic system. Know the components of the limbic system (cortex, mammillary bodies of hypothalamus, thalamus, and olfactory bulbs).
10. Describe the right/left functional differences and similarities of the brain.
11. State the name, number and basic function of each of the 12 pairs of cranial nerves, including the three divisions of the trigeminal nerve. Also be able to identify the cranial nerves on a diagram, including the three divisions of the trigeminal nerve.

Study Guide for the Comprehensive Final - AP I

These are the topics that will be covered on the comprehensive portion of the final. This part of the final will be multiple choice and will be curved. 37 questions but it will be counted as 34 points.

Regional Terminology

Homeostasis and Feedback Regulation

Protein Structure

Na-K ATP Pump

Osmolarity

ATP Production

Epithelial and Connective Tissue - Function, Location, and characteristics

Membranes

Skin - layers of epidermis, glands

Types of Bone Formation

Structural and Functional Classification of Joints

Types of Synovial Joints

Characteristics of Skeletal Muscle

Sliding Filament Theory

Energy Sources for Muscle contraction

Action Potential

Function of parts of the brain including brain stem

Spinal Neuron anatomy and meninges

Autonomic Nervous System

Cranial Nerves

Study Guide for the Comprehensive Final – Summer Classes Only

1. What is osmosis? Why is it important for the body to be isotonic? What concentration of glucose and salt are isotonic to our cells? What happens to our cells if our blood is hypertonic?
2. List the 4 categories of organic chemicals. For each list 2 examples and their functions.
3. Draw a small portion of a cell membrane. Describe how each of the 4 categories of organic chemicals get into the cell.
4. List the 4 tissue types. For each give 2 examples and 2 characteristics. (Know the tissue types of the following: stratified squamous, salivary glands, cartilage, RBC, and bone).
5. Describe a polarized cell (charges, ions, membrane potential). Describe what happens with an action potential.
6. Describe why calcium is important for the body. Include where it is stored and 2 different processes (in detail: muscle contraction and neurotransmitter release) that depend on calcium.