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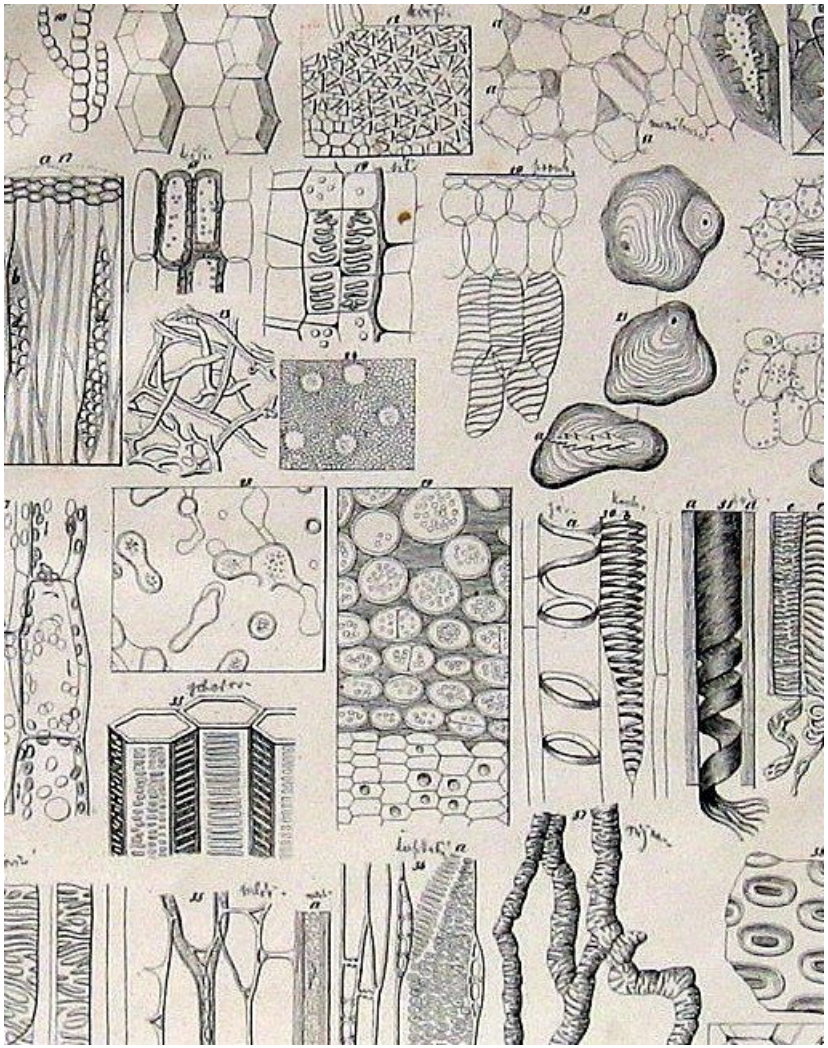


Body Composition 2007-1

TOPIC: Body composition _____ **NUMBER:** _____

OPENING QUESTION	How is water distributed through the body compartments?	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	1 TBW is 60% of body weight	How much water is in the intracellular space?	
	2 ICF 2/3 of TBW		ICF/ECF proportions needed
	3 ECF 1/3 of TBW		
	4 Interstitial ¾ of ECF		
	5 Plasma ¼ of ECF		
SECOND QUESTION	How do age and gender affect total body water?		
POINTS REQUIRED	1 Decreases with age		
	2 Higher in males		

Buffers 2007-1

TOPIC: Buffers _____ **NUMBER:** _____

OPENING QUESTION	What are the buffer systems in blood?	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	1 Especially carbonic acid / bicarbonate system	What binds to H^+ in blood?	This + one other
	2 Plasma proteins (free carboxyl and amino groups)		
	3 Hb (imidazole groups of histidine residues)		
SECOND QUESTION (if needed)	Explain how carbonic acid / bicarbonate system works.		
POINTS REQUIRED	1 Draw equations		Essential
	2 Highlight importance of carbonic anhydrase (increases speed of reaction) and where carbonic anhydrase is (intracellular)		Essential
	3 Outline control by respiratory and renal systems.		

Buffers 2005-2

3.4 Buffers in body fluids	What are the major buffers of blood? How do they work? What are the major buffers in cells. Describe the Henderson-Hasselbalch equation	**Proteins**, albumin; **Haemoglobin**; histidine residues = x6 proteins; Deoxygenated Hb better than HbO2; **Carbonic Acid**-Bicarb system, fast with carbonic anhydrase; Hb deoxygenated; Hb histidine residues; proteins anions Hproteins = H+ and Protein- ; H2PO4 = 2H+ and HPO4 -- .pH = .pK + log [A-] / [HA]. Most effective when [A-] / [HA] = 1, so pH = pK.	

Cell Transport 2011-1

Question 5.1	Please outline the different ways in which a substance can cross a cell membrane	Passive • Diffusion • Facilitated diffusion Active • Endo/exocytosis • Ion channels –ligand, voltage, mechanical gated • Active transport Primary and secondary	3/5 methods to pass
Question 5.2	Can you please explain the process of secondary active transport? PROMPT: Give a clinical example	The movement of an ion down its electrochemical gradient provides energy to transport another substance against its electrochemical gradient. Example – Na/glucose, Na/ aminoacids	Basic concept or clinical example to pass

Cell Transport 2005-2

3.3 Transport across cell membranes	Describe the mechanisms of transport across cell membranes? Give an example of active transport	**Exocytosis, endocytosis, ion channels**, Carrier proteins, primary and secondary active transport. Exo: ER to Golgi apparatus to granules/vesicles to cell membrane. Endo: phagocytosis, pinocytosis = liquid. Ion channels open, voltage gated, ligand (molecule) gated. Transport proteins for active transport (vs chemical, electrical gradient), facilitated diffusion; uniports for one substance, symports require two together (eg Na + glucose), antiports exchange one for another (eg Na for K).	4/5

Cell Transport 2003-1

TOPIC: Cell Transport_____ **NUMBER:** _____

OPENING QUESTION	List some ways in which substances are transported across cell membranes.	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	1. Exocytosis	1	3/5 to pass
	2. Movement across ion channels	2	
	3. Endocytosis	3	
	4. Active transport	4	
	5. Secondary active transport	5	
SECOND QUESTION (if needed)	Describe the sodium potassium pump.		
POINTS REQUIRED	1. Energy dependent (ATP to ADP)	1	2/2
	2. 3 Na+ ions going out in ex-change for 2 K+ going into cells via a carrier protein	2	
THIRD QUESTION (if needed)	Give an example of secondary active transport		Bonus points
POINTS REQUIRED	1. Co-transport eg: glucose with sodium, sodium with amino acids	1	
	2. Counter-transport system: eg. Sodium counter-transport with calcium and hydrogen ions	2	

Cyclic AMP 2003-1

TOPIC: Cyclic AMP _____ **NUMBER:** _____

OPENING QUESTION	Describe the synthesis and metabolism of cAMP	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	1. Formed inside the membrane	1	2/3 to pass
	2. ATP is converted to cAMP via adenyl cyclase	2	
	3. Metabolised by phospho-diesterase	3	
SECOND QUESTION (if needed)	Discuss the function of cAMP.		
POINTS REQUIRED	1. Intracellular second messenger	1	
	2. Stimulate protein synthesis	2	
	3. Activate an intracellular enzyme system in the neurone	3	
	4	4	

Glucose level 2009-2

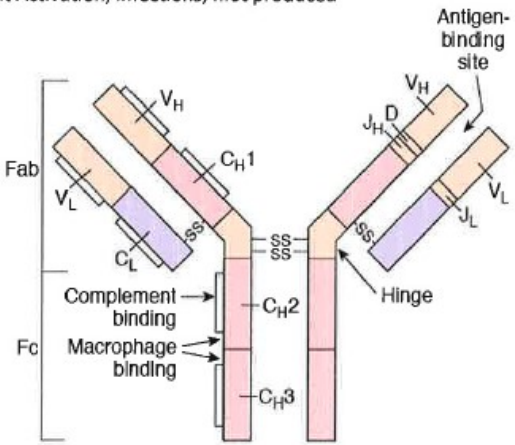
Question 4a: *Score:*	**What are the major factors determining the plasma glucose level?** PROMPTS If discussing hormones XS- how does glucose enter and leave the plasma	1) Concept: Balance between glucose entering the bloodstream and glucose leaving the bloodstream. 2. Dietary intake 3. Cellular uptake (partic muscle/fat/ hepatic) 4. Hepatic glucostat / glycogenisis, glycogenolysis, gluconeogenisis 5. Renal freely filtered but PT reabsorbed to Tmax 6) Hormonal effects on these (partic 1, 3,4)	**COMMENTS** 3 for a pass + concept Complex hormonal effects not required 
4b :	**List the hormones which effect plasma glucose levels?** **Prompt- which way does gluc move**	↓BSL - Insulin (),Ins like GF 1and 2- (NSILA) ↑ BSL Catecholamines (Nor / Epi partic) (>),Glucagon (>), GH>, Cortisol>, Thyroid Pass requires 3 hormones + correct < or >	Insulin via glucose uptake (al tissues), glycogenogenesis, Liver - gluc to fat, - IGF- similar but much < Catechol –b receptor > cAMP- glycogenolysis/ gluconeogenesis Glucagon- cAMP direct- as catech TFTs- > absorption + ↑glycogenolysiss (liver partic) + ins bkdown↑ Cortisol- permissive to Glucagon/Catechols + some glucgenesis, prot to gluc liver- < uptake GH- > gluc liver, insulin block, <tissue upotake

Glucose level 2007-1

TOPIC: Carbohydrate metabolism _____ **NUMBER:** _____

OPENING QUESTION	What factors control blood glucose levels?	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	1 Dietary intake		
	2 Rate of entry into cells		
	3 Glucostatic activity of the liver (storage of glycogen, breakdown of glycogen, gluconeogenesis)		
SECOND QUESTION	What are the potential pathways for glucose metabolism in the body?		
POINTS REQUIRED	1 Aerobic		
	2 Anaerobic		
	3 Glycogen		
	4 Pentoses		

Immunoglobulin 2012-2

Question 5 Immunoglobulins LOA: 2	1. What are the types of immunoglobulins and what is the clinical significance of each?	1. Five Types A = Secretory D = Antigen recognition by B cells E = Anaphylaxis; release of histamine from basophils & mast cells G = Complement Activation; infections M = Complement Activation; infections, first produced	1. **3 of 5 to pass**
	2. Draw a typical Immunoglobulin Molecule and label the parts. *Prompt: Indicating the Variable region on their diagram; what is the significance of this region?*		2. **Bold to pass** **Light Chain** **Heavy Chain** Fab = Antigen Binding Fc = Effector Portion Hinge V = Variable Region

	BONUS
	3. What are the features of innate and acquired immunity?
		Innate immunity
		• triggered by cellular receptors (eg TLRs = "Toll-like Receptors")
		• bind molecular sequences common on MOs (not in eukaryotic cells)
		• activate defence mechanisms (interferons, phagocytosis, production of antibacterial peptides, complement activation, proteolytic cascades)
		• important in early response to infection
		Acquired immunity
		• T lymphocytes
		  ○ Cell-bound receptors related to antibody molecules
		  ○ APCs (Antigen Presenting Cells), MHC (Major Histocompatibility Complex) & HLAs (Human Leukocyte Antigens)
		  ○ encounter cognate antigen
		  ○ T cells proliferate & produce cytokines
		  ○ orchestrate immune response, including
		• B lymphocytes
		  ○ form clones to produce Abs
		• Memory cells
		  ○ small numbers of lymphocytes persist
		  ○ second exposure to same Ag provokes prompt & magnified immune attack	

Intercellular Communication 2005-2

1.3 Principles of intercellular communication	How do cells communicate one to the other?	Cell to cell via **gap junctions**. **Chemical messengers** in ECF: **neural** (neurotransmitters at synapses), **endocrine** (hormones and growth factors), **paracrine** (products of cells diffuse to neighbours). **Autocrine** = cell secretes messenger that acts on itself. Same chemical can function in several ways. **Juxtacrine** = molecules attached to membrane that attaches to another cell.	3/5
	How do receptors respond to variations in messengers?	Receptors change with physiological variations: **messenger in excess -> decrease receptors** (down regulation, internalisation, desensitisation); **deficient messenger -> increase receptors** (up regulatoin). Exception is Angiotensin 11 in adrenal cortex.	
	How do messengers act?	*Via ion channels (Ach, nicotinic, noradrenalin.); transcription of mRNAs (steroids, thyroid hormone.); activation of phospholipase C (angiotensin 11, noradrenalin. vasopressin); production of cAMP (noradrenalin); production of cGMP; increased activity tyrosine kinase (insulin); increased activity serine or threonine kinase (TGF, MAPK).*	

Ketones 2011-1

Question 5	5.1 Please name the principal Ketone bodies.	Acetoacetate, β hydroxybutyrate, Acetone	2 out of 3 to pass
	5.2 How are the Ketone bodies produced and how are they metabolised?	Substrate – Fatty acids, AcetylCoA Site – mitochondria - Liver / Other tissues Mechanism – β oxidation of fatty acids and entry of AcetylCoA into CAC High energy yield process. AcetylCoA units condense to form AcetoacetylCoA. Liver – AcetoacetylCoA ⟶ Acetoacetate ⟶ β hydroxybutyrate and acetone which is excreted in the urine and the breath Tissues – SuccinylCoA ⟶ Acetoacetate ⟶ CO2 and H2O via CAC	Fatty acids AcetylCoA
	5.3 In which clinical situations do they accumulate in the body?	Ketosis – metabolic acidosis (Diabetes, Starvation, high fat low carbohydrate diet)	Diabetes Starvation
	What are the physiological and clinical consequences of excess ketones?		(Bonus)

Na K Pump 2008-2

OPENING QUESTION	**Describe the structure and function of the sodium potassium ATP ase pump**	**COMMENTS**
POINTS REQUIRED	**1.** **Antiport: catalyses hydrolysis of ATP to ADP to move 3 Na out cell in exchange for 2 K in.** **Maintains electrochemical gradient ECF (Electrogenic pump 3+ out / 2+ in = net 1+ out)** and is large part of basal energy consumption - 33% energy use by cells (70% neurons) **Coupled to transport other substances** (secondary active transport) e.g.glucose in SI mucosa,	Need 3 / 5 (1 or 2, 3, 4 or 5)
	2. α and ß subunits which pass through cell membrane Both heterogeneous α subunit intracellular binding sites for Na & ATP α subunit extracellular binding sites for K & ouabain ß subunit has no binding sites Na / K Variable distribution of α 1 + 2 and ß 1+2 subunits	
	3. When Na binds to α subunit, ATP also binds. ATP is converted to ADP causing change in protein configuration extruding Na out of cell. **K then binds extracellularly dephosphorylating α subunit which returns to original configuration releasing K into cytoplasm**	
PROMPTS	**Describe the structure of the sodium potassium pump** **Describe how the sodium potassium pump works** **What are the effects of the sodium potassium pump ?**	

Osmolality 2012-1

Question 4	4.1 What is normal serum osmolality?	~ 290mOsmol/L	**Within the range 280-300**
	4.2 What substances contribute to serum osmolality?	Principally (all but 20mOsmols) the ions (Na, K, Cl, HCO3). Rest is other cations & anions, urea, glucose. Much less so proteins (due to high MW). Possibly alcohols or mannitol.	**Na+, Cl- and one other**
	4.3 How does plasma differ in composition to intracellular fluid?	*Intracellular* K+ and proteins high, many more 'miscellaneous' phosphates Na+, Cl & HCO3 low, (Figure 1-1 page 3)	**Na, K, protein differences**

Osmosis & Tonicity 2011-1

2.4 Protein synthesis	What are the phases of protein synthesis Describe the process of secretion of proteins from cells	**Transcription of mRNA**; post transcriptional modification of mRNA; **translation of mRNA** to AA chain along **a ribosome** using tRNA; post translational modification of the protein in endoplasmic reticulum by hydroxylation, carboxylation, glycosylation, phosphorylation, cleavage and folding. Polypeptide sequences are cleaved off, eg prohormones to hormones. Some proteins have leader sequences that target **endoplasmic reticulum** and are secreted by **exocytosis**. Others are secreted from cytoplasm via ATP dependent membrane transporters.	

Protein Synthesis 2005-2

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