Physiology week 10- Cardiovascular (special) VIVAs

Question 1: Cerebral blood flow & its regulation. Ganong pp 611-620	i) What factors determine cerebral blood flow? Prompt: What about pressure or vascular factors? ii) Additional: Describe the process of autoregulation.	**(1) Pressures:** · **MAP** · **Intracranial pressure** / extra-cranial venous pressure (whichever is greatest). *Intracranial pressure is determined by intracranial blood volume, CSF volume, tissue oedema, SOL.* **(2) Cerebral arteriole tone** · **Autoregulation** Maintains normal CBF at MAPs of 65-140 mmHg (stretch response[myogenic], local [metabolic]); *Autoregulation may be lost/impaired by brain injury* · **pCO2** (effect on both arteriole tone and intracranial blood volume) · pO2 (at extremes) (3) Blood viscosity

3.3 Cerebral blood flow. Brain metabolism & O2 requirements Ganong pp 616-620	What factors determine cerebral blood flow?	**(4 of 5)** • Intracranial pressure • Local constriction/dilation of cerebral arterioles, autoregulation etc • MAP at brain level • Blood viscosity • Mean venous press at brain level
	What substances are important for brain metabolism?	• Oxygen ~49ml/min = 20% body O2 consumption • Glucose (major energy source) ~77mg/min • Glutamate (converted to glutamine as detox mech NH3) ~5.6mg/min

1.1 Factors affecting cerebral blood flow	Describe the factors involved in regulating cerebral blood flow Describe how blood flow can vary in different parts of the brain	**Arterial P, viscosity, Venous P**, local control of arterioles, CSF, **ICP. Monroe Kellie** doctrine. **Cushing** reflex. Local autoregulation **Active neurons attract blood flow** and oxygen in excess of needs; marked variation bl flow with activity. PET and fMRI imaging

2 a). What **chemical** factors regulate coronary blood flow	Increases in blood flow occur secondary to coronary vasodilation due to:. • Hypoxia, • Locally increased CO2, • H+, • K+, • lactate, • PGs, • adenine nucleotides, • adenosine	Hypoxia plus 3 others
2 b). Describe the **neural** regulation of coronary blood flow	Alpha–adrenergic receptors mediate vasoconstriction Beta–adrenergic receptors mediate vasodilation Vagal nerve stimulation dilates coronaries. Noradrenaline constricts coronaries (although noradrenergic nerves cause increased HR and contractility, with resultant metabolite prod and vasodilation- this is the effect with hypotension that maintains coronary flow)	Alpha–adrenergic – Vc, and beta–adrenergic – Vd effects.

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OPENING QUESTION	What are the factors which affect coronary blood flow?	**PROMPTS**	**COMMENTS**
POINTS REQUIRED	Aortic pressure changes, chemical and neural factors Autoregulation Chemical- low O2, Increased CO2, H+, K+, Lactate, prostaglandins, adenine nucleosides, adenosine Neural- NAD-pos ionotropic and chronotropic effects → vasodaltor metabolites-> cor vasodlation B-Blocker for inotropic and chronotropic effects→ then Nad → cor vasoconstriction via a receptors B receptors and vagus → vasodilation Low Blood press→ metabolic changes in myocardium → cor art vasodilation. Phase of cardiac cycle: more flow in diastole esp left cor art>right, heart rate Disease states that reduce flow: cor art disease, valve lesions -AS, raised venous press - CHF Chemical vasodilators: O2 lack, CO2, H+, K+, lactate, PGs, adenine etc, adenosine *Neural: AdrenoRs - alpha-constrict, beta-dilate, vagal - dilate	Is there any difference in coronary blood flow to the right and left ventricles?	Need 3 factors and 1 example of each.

1. (a)Describe how tissues regulate their own blood flow. Prompt- What are the proposed mechanisms of this process?	Most vascular beds have intrinsic capacity to compensate for moderate changes in perfusion pressure by changing vascular resistance and therefore maintaining constant bld flow. 1. Myogenic theory of autoregulation: Intrinsic contractile response of smooth muscle to stretch As pressure rises: blood vessels are distended → vascular smooth muscle surrounding vessels contract Law of Laplace: maintenance of given wall tension, as pressure rises, requires a decrease in radius 2. Metabolic theory of autoregulation Vasodilator substances tend to accumulate in active tissues when blood flow decreases → dilatation When blood flow increases → washed away Hypox, inc Co2, Inc H+, Inc lactate, inc K+, inc temp, histamine, adenosine	**1. Myogenic theory of autoregulation** **2. Metabolic theory of autoregulation** To pass must demonstrate understanding of both