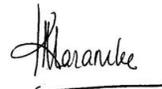


**Respiration and Gas Exchange Module - 39 hrs lectures/30 hrs practical  
(Timetabled parallel with Blood and Circulation Module)**

TOPICS/CONCEPTS	OBJECTIVES	Time	T/L activity	Responsible Department
	At the end of the module, the student should be able to;			
2014-1/SBM-2/01				
<b>Regional and cross-sectional anatomy of the thorax:</b>  <b>a. Osteology and surface marking</b>  <b>b. Chest wall (anterior thoracic wall)</b>  <b>c. thoracic cavity and pleura</b>  <b>d. Lungs and Airways</b>  <b>e. Diaphragm</b>  <b>f. Development</b>  <b>g. Cross-sectional Anatomy</b>	<b>a. <u>Osteology and surface marking</u></b> 1. Identify and orientate the bones that form the thoracic cage 2. State the boundaries of the thoracic inlet outlet 3. State and demonstrate the bony landmarks of the thorax 4. Count the ribs and intercostals spaces and demonstrate the surface markings of the lungs and pleura	2hrs	Practical	Anatomy
		1hr	Lecture	Anatomy
	<b>b. <u>Chest wall (anterior thoracic wall)</u></b> 1. Describe the arrangement of the muscles of the chest wall 2. Describe the arrangement of structures in the intercostal space 3. Describe the movement of the chest wall during respiration and state its mechanism 4. Describe the blood supply, nerve supply and lymphatic drainage of the chest wall and intercostals spaces 5. Draw and label the dermatomes of the chest wall	3hrs	Dissection	Anatomy
	<b>c. <u>Thoracic cavity and pleura</u></b> 1. Describe the boundaries of the mediastinum and its divisions 2. Describe the anatomy of the pleura and pleural cavities 3. Surface mark the pleura and lungs 4. State and describe the common clinical problems of the thoracic cavity (pleural effusion, pneumothorax, haemothorax) 5. Describe the anatomical basis of the pleural tap and surgical approaches to the thorax	3hrs	dissections	Anatomy
		1 hr	lecture	Anatomy



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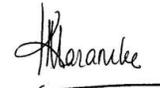
<p><b>d. <u>Lungs and Airways</u></b></p> <ol style="list-style-type: none"> <li>1. Identify the lungs and parts of the airways</li> <li>2. Describe the bronchial tree and bronchopulmonary segments</li> <li>3. Describe and identify the microscopic structures of the lungs and bronchial tree</li> <li>4. Correlate the structure of lungs and airways with its function</li> <li>5. Describe the blood supply, nerve supply and lymphatic drainage of lungs and airways</li> <li>6. Identify lungs and airways in relation to other structures in the thoracic cavity</li> <li>7. Describe the surface projections of the apex of the lungs and the fissures of the lungs</li> </ol>	3hrs	Dissection	Anatomy			
	2hr	PD (histology)	Anatomy			
	1 hr	Lecture (histology)	Anatomy			
	<p><b>e. <u>Diaphragm</u></b></p> <ol style="list-style-type: none"> <li>1. Describe the component parts of the diaphragm and state its functions</li> <li>2. Describe the nerve supply and blood supply of the diaphragm</li> <li>3. State and identify structures passing through the diaphragm including the vertebral levels</li> <li>4. Use the knowledge of Anatomy in examining the respiratory system</li> <li>5. State and describe the common clinical problems of the thoracic cavity</li> <li>6. Clinical correlations of diaphragm related to respiration</li> </ol>			0 hr	Dissections	Anatomy
	<p><b>f. <u>Development</u></b></p> <ol style="list-style-type: none"> <li>1. Development of the respiratory system and associated developmental abnormalities</li> </ol>			1 hr	Lecture	Anatomy
	<ol style="list-style-type: none"> <li>2. Describe the development of the diaphragm including its congenital abnormalities</li> </ol>			1 hr	Lecture	Anatomy
	<p><b>g. <u>Cross sectional Anatomy</u></b></p>					



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	<p>16. Understand the following terms; Dynamic lung compliance, static lung compliance, closing volume and closing capacity.</p> <p>17. Describe how airway resistance alters dynamic lung compliance.</p> <p>18. Define the factors that determine total lung capacity, functional residual capacity, and residual volume. Describe the mechanisms responsible for the changes in those volumes (which include closing volume and closing capacity) that occur in patients with emphysema and pulmonary fibrosis.</p> <p>19. Define “dependent lung” and discuss the mechanism underlying distribution of regional ventilation in various body positions.</p>			
<b>2014-1/SBM-2/03</b>				
<b>Assessment of lung function</b>	<p>1. Describe the basis of measuring lung volumes using spirometry.</p> <p>2. Define and explain the terms; tidal volume, expiratory reserve volume, inspiratory reserve volume, vital capacity, functional residual capacity, total lung capacity, residual volume.</p> <p>3. Observe how spirometry is performed.</p> <p>4. Obtain readings of peak flow rate with the peak flow meter.</p> <p>5. Identify normograms and determine lung volumes and capacities using normograms.</p> <p>6. Draw a spirogram resulting from a maximal expiratory effort. Label the forced vital capacity (FVC), timed forced expiratory volumes (FEV), and the maximal expiratory flow rate between 25-75% of FVC (FEF<sub>25-75%</sub>).</p>	3 hrs	Practical	Physiology
	<p>7. Differentiate between the two broad categories of restrictive and obstructive lung disease, including the spirometric abnormalities associated with each category.</p>	4 hrs	CCR	CCR group



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2014-1/SBM-2/04				
<b>Non-respiratory functions of the respiratory system</b>	<ol style="list-style-type: none"> <li>1. describe the defense mechanisms in the lungs and upper airways including mucociliary clearance, cough, sneezing and alveolar macrophages</li> <li>2. describe the role of the upper airways in warming and humidifying inspired air</li> <li>3. describe other functions of the respiratory system such as metabolic, olfactory, phonation.</li> </ol>	1 hr	Lecture	Physiology
2014-1/SBM-2/05				
<b>Gas exchange, diffusion of gases, and perfusion in the lung</b>	<ol style="list-style-type: none"> <li>1. Explain the term RQ (respiratory quotient).</li> <li>2. Define partial pressure and fractional concentration as they apply to gases in air. List the normal fractional concentrations and sea level partial pressures for O<sub>2</sub>, CO<sub>2</sub>, and N<sub>2</sub>.</li> <li>3. State the alveolar and blood gas pressures and discuss the factors that determine alveolar gas pressure</li> <li>4. Explain O<sub>2</sub> and CO<sub>2</sub> composition of alveolar gases</li> <li>5. Describe the process of gas exchange at the lungs in terms of the respiratory membrane, factors affecting gas exchange, role of diffusion and diffusing capacity</li> <li>6. Describe the functional anatomy, pulmonary vascular pressures and capillary dynamics of the pulmonary circulation</li> <li>7. Describe the regional differences in pulmonary blood flow in an upright person. Define zones I, II, and III in the lung, with respect to pulmonary vascular pressure and alveolar pressure.</li> <li>8. Describe the consequence of hypoxic pulmonary vasoconstriction on the distribution of pulmonary blood flow.</li> <li>9. Explain the term ventilation-perfusion inequality.</li> <li>10. Explain V/Q mismatch.</li> <li>11. Identify the average V/Q ratio in a normal lung. Explain how V/Q is affected by the vertical distribution of ventilation and perfusion in the healthy lung.</li> <li>12. Explain the oxygen cascade</li> </ol>	3hrs	Lecture	Physiology
		2hrs	SGD	Physiology



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<b>2014- 1/SBM-2/06</b>				
Transport of respiratory gases	<ol style="list-style-type: none"> <li>1. Explain how O<sub>2</sub> is transported in blood</li> <li>2. Draw the O<sub>2</sub> dissociation curve and explain why it has a sigmoid shape</li> <li>3. List the factors affecting the oxygen dissociation curve and state how each of them affects the affinity of Hb for O<sub>2</sub></li> <li>4. Explain how CO<sub>2</sub> is transported in blood</li> <li>5. Describe the importance of the chloride shift in the transport of CO<sub>2</sub> by the blood.</li> <li>6. Draw the carbon dioxide dissociation curves for oxy- and deoxy-hemoglobin.</li> <li>7. Explain the relationship between PO<sub>2</sub> and dissolved plasma O<sub>2</sub> content (Henry's Law).</li> <li>8. Discuss oxygen dissociation curve in anaemia and abnormal Hb</li> <li>9. Explain Bohr and Haldane effects</li> <li>10. Explain oxygen carrying capacity and oxygen delivery to tissues</li> </ol>	<p>2hrs</p> <p>3hrs</p> <p>2 hrs</p> <p>2 hrs</p>	<p>Lecture</p> <p>PD</p> <p>SGD</p> <p>Lecture (Obj. 7-10)</p>	<p>Biochemistry</p> <p>Biochemistry</p> <p>Biochemistry</p> <p>Physiology</p>
<b>2014- 1/SBM-2/07</b>				
Regulation of respiration	<ol style="list-style-type: none"> <li>1. Describe the regions in the CNS that play important roles in the generation and control of cyclic breathing</li> <li>2. explain the factors affecting rate and rhythm of respiration</li> <li>3. Give three examples of reflexes involving pulmonary receptors that influence breathing frequency and tidal volume. Describe the receptors and neural pathways involved.</li> <li>4. Recall the role of peripheral and central chemoreceptors in the control of ventilation. Identify the relative importance of each in sensing alterations in blood gases.</li> <li>5. Describe how changes in arterial PO<sub>2</sub> and PCO<sub>2</sub> alter alveolar ventilation, including the synergistic effects when PO<sub>2</sub> and PCO<sub>2</sub> both change.</li> <li>6. Describe the respiratory drive in a COPD patient, and predict the change in respiratory drive when oxygen is given to a COPD patient.</li> </ol>	1 hr	Lecture	Physiology



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	7. Explain the role of respiration in acid-base balance	2 hrs	Lecture	Physiology
<b>2014-1/SBM-2/08</b>				
Respiration in special circumstances	<p><b>1. Exercise</b></p> <p>a. Contrast the normal distribution of cardiac output with the distribution of cardiac output during aerobic (sustained) exercise and anaerobic (brief maximal burst) exercise. Include the local regulation of blood flow and the role of capillary reserve in altering skeletal muscle blood flow.</p> <p>b. Describe how pulmonary vascular resistance changes with alterations in cardiac output or pulmonary arterial pressure. Explain in terms of distention and recruitment of pulmonary vessels.</p> <p>c. Define <math>VO_{2MAX}</math> and identify situations in which it is limited by cardiac output and by pulmonary gas exchange.</p> <p>d. Describe the significance of the feed forward control of ventilation (central command) during exercise, and the effects of exercise on arterial and mixed venous <math>PCO_2</math>, <math>PO_2</math>, and pH.</p> <p>e. Define the effects of training on the heart and coronary circulation and how these changes contribute to an increase in <math>VO_{2MAX}</math>.</p> <p>f. Explain how each of the following can alter exercise performance: muscle fatigue, <math>VO_{2MAX}</math>, anaerobic threshold, gender, and age.</p> <p><b>2. Acclimatization to high altitude</b></p> <ul style="list-style-type: none"> <li>- Explain the oxygen cascade</li> <li>- Recall that <math>PO_2</math> in inspired air falls progressively with increase in altitude</li> <li>- State the altitude at which acute effects of hypoxia are felt.</li> <li>- Describe the acute effects of hypoxia</li> <li>- Explain the causation and the effects of the following in acclimatization to high altitude;</li> </ul>	3 hrs	Lecture	Physiology
		2hrs	SGD	Physiology
		3hrs	PD	Physiology
		2hr	Lecture	Physiology



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	<ul style="list-style-type: none"> <li>○ increased pulmonary ventilation</li> <li>○ increased RBC count and Hb</li> <li>○ raised diffusing capacity</li> <li>○ increased tissue vascularity</li> <li>○ increased ability of cells to utilize oxygen</li> </ul> <p>- State the anthropometric and physiological changes that are seen in natural acclimatization (adaptation) of those individuals native to high altitudes.</p> <p><b>3. <u>Deep-sea diving</u></b></p> <p>a. Describe the effects of hyperbaric pressure/ N<sub>2</sub> narcosis</p> <p>b. Describe the physiological basis of shallow water blackout during a breath-hold dive</p>				 Chairperson Curriculum Coordinating Committee Faculty of Medicine, University of Peradeniya
		1 hr	Lecture	Physiology	
<b>2014- 1/CLM-2/01</b>					
Imaging of respiratory organs of the thorax	1. correlate gross anatomy with biplanar and cross-sectional imaging	1 hr	Lecture demo	Radiology	
	2.Explain the principles of lung perfusion imaging	1hr	Lecture demo	NMU	
<b>2014- 1/CLM-2/02</b>					
Clinical examination of the respiratory system	Perform a physical examination of the respiratory system	3 hrs	PD	Physiology	
<b>2014- 1/CLM-2/03</b>					
Basic Life Support	Understand the importance of the Basic Life Support (BLS). Demonstrate how to perform BLS.	1 hr 2 hrs	Lecture PD	Anaesthesia	