

**AUSTRALIAN AND NEW ZEALAND COLLEGE
OF ANAESTHETISTS**

A.B.N. 82 055 042 852



SYLLABUS

**FOR THE BASIC SCIENCES IN
ANAESTHESIA AND INTENSIVE CARE**

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FOREWORD

This Syllabus for the basic sciences in Anaesthesia and Intensive Care is an important further step in development of the educational resources available to trainees

The second edition represents much hard work by the Primary Examination Committee under the leadership of Neville Gibbs and David Cottee. Important input was also provided by the Panel of Primary Examiners and a number of Fellows including Noel Roberts, Wally Thompson, Michael Cousins and Garry Phillips. Special thanks are due to Cherie Wilkinson, Manager Training and Examinations and Adele Brimelow, Administrative Officer, Primary Examinations for their tireless efforts in processing the numerous revision drafts.

Trainees will undoubtedly find the Syllabus helpful in guiding their study for the Primary Examination. The Syllabus also serves to outline the basic science that underpins the practice of Anaesthesia and Intensive Care Medicine.

Michael J. Cousins

President

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LEARNING OBJECTIVES FOR BASIC SCIENCES

IN ANAESTHESIA AND INTENSIVE CARE

INTRODUCTION

The purpose of these learning objectives is threefold:

- A guide to trainees for learning
- A guide to tutors and teachers
- A guide to examiners

This will ensure that trainees, tutors and examiners can all work from a common base. It is important to recognise that these learning objectives, while attempting to circumscribe the subject matter, are not designed to discourage trainees from pursuing greater depth or understanding.

Throughout the document specific wording has been used under the required abilities to indicate the level of knowledge and understanding expected, and a glossary of these terms is provided.

- Outline** Give the main features or general principles
- Define** Give the precise meaning
- Describe** Give a detailed account of
- Explain** Make plain, interpret, and account for

The accompanying texts are recommended as references to cover the subject matter; however, where there is a deficiency in these texts on specific areas other references are included. The material contained in the references provides a clear indication of the level of understanding required and the boundaries of the subject matter.

Trainees and tutors are encouraged to refer to the learning objectives as they form the basis for training and the examination. It is recognised that with constant changes in physiology and pharmacology this document will need to be regularly reviewed and revised as appropriate.

RECOMMENDED TEXTS

FOR THE BASIC SCIENCES IN ANAESTHESIA AND INTENSIVE CARE

Candidates are advised that all examination questions are based on information contained in the recommended texts

Please note that the most recent version of each of the following texts is the recommended text

General Text: Physiology and Pharmacology

Miller's Anesthesia / ed. by R D Miller - 6th ed - New York : Churchill Livingstone, 2004

Oh's Intensive Care Manual / ed by A D Bersten, N Soni and T E Oh - 5th ed : Butterworth Heinemann, 2003

Clinical Pain Management : Acute Pain / ed by D J Rowbotham and P E Macintyre - London : Arnold, 2003

Acute Pain Management : Scientific Evidence Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine -2nd ed – [Canberra] : NHMRC, 2005
<http://www.anzca.edu.au/resources/books-and-publications/acutepain.pdf>

Foundations of Anaesthesia: Basic Sciences for Clinical Practice / ed by H C Hemmings and P Hopkins – 2nd ed – Philadelphia : Mosby Elsevier, 2006

PHYSIOLOGY

General Physiology

Textbook of Medical Physiology / A C Guyton & J E Hall - 11th ed - Philadelphia : Elsevier-Saunders, 2005

Review of Medical Physiology / W F Ganong- 22nd ed : Lange Medical Books, 2005

Lecture Notes on Human Physiology / ed by J J Bray et al - 4th ed - Oxford : Blackwell Science, 1999

Principles of Physiology for the Anaesthetist / I Power & P Kam - 1st ed - London : Arnold, 2001

Australian Red Cross Blood Service: Transfusion Medicine Manual
www.transfusion.com.au/ResourceLibrary/resource_tmm.asp

New Zealand Blood Service: Transfusion Medicine Handbook
www.nzblood.co.nz/?t=29

Respiratory

Respiratory Physiology : the Essentials / J B West - 7th ed - Philadelphia : Lippincott Williams & Wilkins, 2005

Nunn's Applied Respiratory Physiology / A B Lumb and J F Nunn - 6th ed - Oxford : Elsevier-Butterworth Heinemann, 2005

Cardiovascular

Cardiovascular Physiology / R M Berne and M N Levy - 8th ed - St Louis : Mosby, 2001

Renal Physiology

Vander's Renal Physiology / D C Eaton and J P Pooler - 6th ed – New York : McGraw-Hill, 2005

Clinical Measurement

Basic Physics and Measurement in Anaesthesia / P D Davis and G N C Kenny - 5th ed - Edinburgh : Butterworth-Heinemann, 2002

Clinical Monitoring : Practical Applications for Anesthesia and Critical Care / ed by C L Lake, R L Hines & C D Blitt - Philadelphia : WB Saunders, 2001

PHARMACOLOGY

General Pharmacology

Pharmacology / H P Rang, J M Ritter and M M Dale - 5th ed - Edinburgh : Churchill-Livingstone, 2003

Goodman and Gilman's the Pharmacological Basis of Therapeutics / ed by L L Brunton - 11th ed - New York : McGraw-Hill, 2005

Basic and Clinical Pharmacology / B G Katzung - 9th ed - McGraw-Hill, 2004

Anaesthetic Pharmacology

Pharmacology and Physiology in Anesthetic Practice / R K Stoelting and S C Hillier – 4th ed - Philadelphia : Lippincott-Raven, 2006

Neural blockade : in clinical anaesthesia and management of pain / M J Cousins and P O Bridenbaugh - 3rd ed - Philadelphia : Lippincott, 1998

Anesthetic Pharmacology - Physiological Principles and Clinical Practice / A S Evers and M Maze - 1st ed – New York : Churchill-Livingstone, 2004

MacPherson, R. D. *Pharmaceutics for the anaesthetist. Anaesthesia*, 2001, 56 (10), 965-979

Statistics

Basic and Clinical Biostatistics / B Dawson-Saunders and R G Trapp – 4th ed – New York : McGraw-Hill, 2004

Statistical methods for anaesthesia and intensive care / P S Myles and T Gin - Oxford : Butterworth-Heinemann, 2001

PHYSIOLOGY

SECTION A - CELLULAR PHYSIOLOGY

1. General Instructional Objectives

An understanding of basic cellular physiology

2. Required Abilities

- a. To describe the cell membrane and its properties
- b. To describe the functions of mitochondria, endoplasmic reticulum, and other organelles
- c. To explain mechanisms of transport of substances across cell membranes including diffusion, facilitated diffusion, primary active transport and secondary active transport
- d. To explain the Gibbs-Donnan Effect
- e. To outline the role of cellular receptors and the function of secondary messengers within the cell
- f. To outline the sources of energy available to cells through metabolic processes
- g. To describe the composition of intracellular fluid and its regulation including the role of the sodium-potassium pump
- h. To describe the role of G proteins

SECTION B - RESPIRATORY PHYSIOLOGY

1. General Instructional Objectives

An understanding of the function and control of the respiratory system and the application of this knowledge

An understanding of the changes in abnormal physiological and common pathological conditions

2. Required Abilities

- a. To give a detailed account of basic applied respiratory physiology
- b. To explain the mechanisms by which respiratory function is altered
- c. To correlate changes in respiratory function with resultant changes in other body systems

I ANATOMY OF THE RESPIRATORY SYSTEM

1. General Instructional Objectives

An understanding of the anatomy of the respiratory system and its relation to function

2. Required Abilities

- a. To relate function of the upper airway to its structure
- b. To explain the structure of the chest wall and diaphragm and to relate these to respiratory mechanics

II - CONTROL OF VENTILATION

1. General Instructional Objectives

An understanding of the control of ventilation and an appreciation of the changes in ventilation in abnormal physiological and common pathological conditions

2. Required Abilities

- a. To describe the medullary and pontine respiratory control centres and explain how the ventilatory pattern is generated and controlled
- b. To describe the chemical control of breathing via central and peripheral chemoreceptors, and indicate how this is altered in abnormal clinical states
- c. To describe the reflex control of ventilation
- d. To describe the ventilatory response to exercise
- e. To explain the consequences of increased altitude on respiratory function
- f. To explain the consequences of pregnancy on ventilation
- g. To describe and explain the effects of anaesthesia on ventilatory control

III - MECHANICS OF BREATHING

1. General Instructional Objectives

An understanding of the elastic properties (static mechanics) and the flow resistive properties of the airways (dynamic mechanics) as well as the forces acting on the ventilatory system

The application of this knowledge to changes with anaesthesia and intensive care

2. Required Abilities

- a. To describe the inspiratory and expiratory process involving the chest wall, diaphragm, pleura and lung parenchyma
- b. To define compliance (static, dynamic and specific) and relate this to the elastic properties of the lung
- c. To explain the concepts of time constants and relate these to "fast" and "slow" alveoli
- d. To describe the elastic properties of the chest wall and to plot pressure-volume relationships of the lung, chest wall and the total respiratory system
- e. To describe the properties of surfactant and relate these to its role in influencing respiratory mechanics
- f. To explain the vertical gradient of pleural pressure and its significance
- g. To explain the physics of gas flow and the significance of the relationship between resistance and flow in the respiratory tract
- h. To describe the factors affecting airway resistance, and how airway resistance may be measured
- i. To define closing capacity and its relationship to airway closure and explain its clinical significance and measurement
- j. To describe the work of breathing and its components
- k. To describe altered lung mechanics in common disease states.

IV - PULMONARY GAS VOLUMES AND VENTILATION

1. General Instructional Objectives

An understanding of lung volumes and capacities and the application of this knowledge to normal and diseased respiratory states

2. Required Abilities

- a. To explain the measurement of lung volumes and capacities, and to indicate the normal values
- b. To describe the factors influencing lung volumes and capacities
- c. To define dead space and apply the Bohr Equation and Alveolar Gas Equation.
- d. To explain normal ventilation-perfusion matching, including the mechanisms for these as well as the normal values
- e. To describe the composition of ideal alveolar and mixed expired gases

V - DIFFUSIVE TRANSFER OF RESPIRATORY GASES

1. General Instructional Objectives

An understanding of the laws of diffusion and their application to capillary exchange of oxygen and carbon dioxide in the lung

2. Required Abilities

- a. To describe and explain the oxygen cascade
- b. To explain the capillary exchange of oxygen and carbon dioxide, and the relationship of erythrocyte transit to oxygen and carbon dioxide transfer
- c. To explain perfusion-limited and diffusion-limited transfer of gases
- d. To define diffusion capacity and its measurement
- e. To describe the physiological factors that alter diffusion capacity

VI - VENTILATION - PERFUSION INEQUALITIES

1. General Instructional Objectives

An understanding of the normal matching of ventilation and perfusion, the mechanisms causing ventilation-perfusion inequality and an appreciation of its clinical significance

2. Required Abilities

- a. To describe West's zones of the lung and explain the mechanisms responsible for them
- b. To explain the shunt equation
- c. To describe and explain regional ventilation-perfusion inequalities, their clinical importance, and changes with posture
- d. To outline the methods used to measure ventilation-perfusion inequalities
- e. To explain venous admixture and its relationship to shunt
- f. To explain the clinical significance of changes in anatomical and physiological dead space
- g. To explain the effect of ventilation-perfusion inequality on oxygen transfer and carbon dioxide elimination

VII - GAS TRANSPORT IN THE BLOOD

1. General Instructional Objectives

An understanding of the principles involved in transport of oxygen and carbon dioxide in blood and their applications in clinical practice

2. Required Abilities

- a. To describe the carriage of oxygen in blood
- b. To explain the oxyhaemoglobin dissociation curve and factors that may alter it such as carbon monoxide, temperature, carbon dioxide and hydrogen ion concentration and 2,3 diphosphoglycerate
- c. To describe the carbon dioxide carriage in blood including the Haldane effect, and the chloride shift
- d. To explain the carbon dioxide dissociation curve and its clinical implications
- e. To describe the oxygen and carbon dioxide stores in the body

VIII - PULMONARY CIRCULATION

1. General Instructional Objectives

An understanding of the special features of the pulmonary circulation and their relevance in clinical practice

2. Required Abilities

- a. To outline the vascular anatomy and structure of the pulmonary and bronchial circulations
- b. To describe the physiological features of the pulmonary circulation and compare them with those of the systemic circulation
- c. To explain the factors that affect pulmonary vascular resistance
- d. To describe the control of pulmonary vascular tone
- e. To outline the mechanisms which raise pulmonary vascular resistance, and to describe the circulatory effects of such a rise
- f. To describe the pulmonary circulation in the fetus and the newborn

IX - CLINICAL PULMONARY FUNCTION TESTS

1. General Instructional Objectives

An understanding of respiratory function tests that are routinely performed in a respiratory function laboratory and an ability to interpret the results

2. Required Abilities

- a. To distinguish between obstructive and restrictive lung disorders using the family of curves measuring forced expiratory volume, peak expiratory flow rate and vital capacity
- b. To outline methods used for measuring mechanics of breathing, including flow-volume loops, and to interpret such results
- c. To describe the carbon dioxide and oxygen response curves and how these may be used to assess the control of breathing
- d. To interpret and explain normal and abnormal blood gases
- e. To outline the measurement of lung volumes including functional residual capacity and residual volume

X - APPLIED RESPIRATORY PHYSIOLOGY

1. General Instructional Objectives

The use of knowledge of basic respiratory physiology to understand applied aspects that are encountered in clinical practice

2. Required Abilities

- a. To describe the physiological consequences of intermittent positive pressure ventilation and positive end-expiratory pressure
- b. To explain the physiological effects of hypoxaemia, hyper and hypocapnia, and carbon monoxide poisoning
- c. To explain the effects of a change in posture on ventilatory function
- d. To define humidity and give an outline of the importance of humidification
- e. To explain the importance of the cough reflex
- f. To explain the effects of general anaesthesia on ventilatory function
- g. To explain the effects of pregnancy on ventilatory function
- h. To explain the ventilatory changes accompanying the process of ageing
- i. To describe the differences in the respiratory system of the neonate compared with the adult
- j. To outline the non-ventilatory functions of the lungs
- k. To outline the effects of common pulmonary pathology on respiratory function

SECTION C - CARDIOVASCULAR PHYSIOLOGY

1. General Instructional Objectives

An understanding of cardiovascular physiology and its application to clinical practice

2. Required Abilities

- a. To give a detailed account of basic cardiovascular physiology
- b. To apply this knowledge to explain cardiovascular responses to physiological and pathological changes associated with altered cardiovascular function
- c. To correlate the principles of cardiovascular and other systemic responses in health with those in common disease states

I - STRUCTURE AND FUNCTION OF THE HEART

1. General Instructional Objectives

An understanding of the functional anatomy of the heart and its relationship to cardiac function

2. Required Abilities

- a. To describe the structure and functional significance of the conductive, excitatory and contractile elements of the heart

II - ELECTRICAL PROPERTIES OF THE HEART

1. General Instructional Objectives

An understanding of the basis of electrical activity of cardiac muscle and its relationship to basic mechanical events

2. Required Abilities

- a. To explain the ionic basis of spontaneous electrical activity of cardiac muscle cells (automaticity)
- b. To describe the normal and abnormal processes of cardiac excitation
- c. To explain the physiological basis of the electrocardiograph in normal and common pathological states
- d. To describe the factors that may influence cardiac electrical activity
- e. To describe and explain the mechanical events of the cardiac cycle and correlate this with electrical and ionic events

III - DETERMINANTS AND CONTROL OF CARDIAC OUTPUT

1. General Instructional Objectives

An understanding of the factors that determine cardiac output and its control and the application of this knowledge to clinical practice

2. Required Abilities

- a. To explain the Frank-Starling mechanism and its relationship to excitation-contraction coupling
- b. To define preload, afterload and myocardial contractility
- c. To describe the factors that determine preload, afterload and myocardial contractility
- d. To describe myocardial oxygen demand and supply, and the conditions that may alter each
- e. To describe Guyton's cardiac output curves and to explain factors that affect them
- f. To describe and explain vascular function curves and to correlate these with the cardiac output curves
- g. To describe the pressure-volume relationships of the ventricles and their clinical applications
- h. To integrate the factors that determine cardiac output

IV - THE PERIPHERAL VASCULAR SYSTEM

1. General Instructional Objectives

An understanding of the distribution and regulation of blood flow through the various components of the vasculature

2. Required Abilities

- a. To describe the distribution of blood volume and flow in the various regional circulations and to explain the factors that may result in redistribution of blood
- b. To explain the factors that determine systemic blood pressure and its regulation
- c. To describe total peripheral vascular resistance and factors that affect it
- d. To describe the mechanisms involved in local vascular control and autoregulation
- e. To describe the mechanisms involved in maintaining blood flow to individual organs in the presence of changed perfusion pressure (autoregulation)
- f. To describe the essential features of the micro-circulation including fluid exchange (Starling forces) and control mechanisms present in the pre- and post-capillary sphincters

V - CONTROL OF CIRCULATION

1. General Instructional Objectives

An understanding of cardiovascular responses to physiological and common pathological changes

2. Required Abilities

- a. To describe the role of the vasomotor centre and the autonomic nervous system in the regulation of cardiac output and venous return
- b. To describe the function of baroreceptors and to relate this knowledge to common clinical situations
- c. To explain the role of the autonomic nervous system in controlling systemic vascular resistance and redistribution of blood volume
- d. To explain the neural and humoral regulation of blood volume and flow
- e. To explain the integrated cardiovascular responses to exercise
- f. To explain the integrated cardiovascular responses to pregnancy
- g. To explain the integrated cardiovascular responses to anaesthesia and central neural blockade

VI - REGIONAL CIRCULATION

1. General Instructional Objectives

An understanding of the special features of regional circulations

2. Required Abilities

- a. To describe the relationship between organ blood flow and demand, and the role of autoregulation
- b. To describe the features of the coronary circulation and to explain the clinical significance of these
- c. To describe autoregulation in the cerebral circulation and the factors that may affect it
- d. To describe the renal circulation and to explain its significance in maintaining renal function
- e. To describe the hepatic and splanchnic circulation
- f. To describe the skin circulation
- g. To describe muscle (skeletal) circulation
- h. To describe utero-placental circulation

VII - APPLIED ASPECTS OF CVS PHYSIOLOGY

1. General Instructional Objectives

An understanding of the cardiovascular responses to common conditions in health and disease

2. Required Abilities

- a. To describe the responses to changes in posture
- b. To account for the cardiovascular changes seen in haemorrhage and hypovolaemia
- c. To explain the cardiovascular effects and responses in different forms of shock
- d. To explain the cardiovascular responses in pregnancy, exercise, cardiac failure, and during intermittent positive pressure ventilation, anaesthesia, positive end-expiratory pressure, and the Valsalva manoeuvre.
- e. To explain the cardiovascular changes accompanying the process of ageing

VIII - MEASUREMENT OF CVS FUNCTION

1. General Instructional Objectives

An understanding of the physics and the application of the principles involved in the measurement of blood flow and pressures within the circulation

2. Required Abilities

- a. To outline the physics of blood flow
- b. To give a detailed account of the various methods of measuring blood pressure
- c. To explain the various methods of measuring cardiac output as well as their limitations
- d. To outline methods and principles used to measure regional blood flow

SECTION D - RENAL PHYSIOLOGY

1. General Instructional Objectives

An understanding of the function of the kidneys and their control, including changes that occur in clinical practice

2. Required Abilities

- a. To describe the functional anatomy of the kidneys and to explain the physiology of renal blood flow
- b. To describe glomerular filtration and tubular function
- c. To explain the counter-current mechanisms in the kidney
- d. To explain the mechanisms involved in the regulation of renal function
- e. To outline the endocrine functions of the kidney
- f. To describe the role of the kidneys in the maintenance of acid/base balance
- g. To describe the role of the kidneys in the maintenance of fluid and electrolyte balance
- h. To describe the role of the kidneys in the maintenance of osmolality
- i. To describe the role of the kidney in the handling of glucose, nitrogenous products and drugs
- j. To describe the principles of measurement of glomerular filtration rate and renal blood flow
- k. To describe the physiological effects and clinical assessment of renal dysfunction
- l. To explain the renal responses to hypovolaemia
- m. To explain the effects of general anaesthesia on renal function

SECTION E - BODY FLUIDS AND ELECTROLYTES

1. General Instructional Objectives

An understanding of the basics of body fluids and electrolyte physiology and their application in health and disease

2. Required Abilities

- a. To explain the distribution of body fluids and their measurement
- b. To describe the function, distribution and physiological importance of sodium, potassium, magnesium, calcium and phosphate ions
- c. To outline the composition and functions of lymph
- d. To define osmotic pressure and to explain the factors that determine it
- e. To outline the significance of oncotic pressure, colloid osmotic pressure and reflection coefficients
- f. To describe the measurement of osmolality and the control mechanisms involving the regulation of osmolality

SECTION F - ACID BASE PHYSIOLOGY

1. General Instructional Objectives

An understanding of the chemistry and physiology of acid-base balance in the body and the application of this knowledge to clinical situations

2. Required Abilities

- a. To explain and describe acid-base chemistry using the Henderson-Hasselbalch equation
- b. To describe the chemistry of buffer mechanisms and to explain their relevant roles in the body
- c. To describe the regulation of acid-base balance
- d. To explain the principles of blood gas and acid-base analysis
- e. To interpret blood gas analysis and its management in clinical situations

SECTION G - NERVOUS SYSTEM PHYSIOLOGY

1. General Instructional Objectives

An understanding of basic neurophysiology and its application to clinical practice

2. Required Abilities

- a. To explain the basic electro-physiology of neural tissue
e.g. Resting membrane potential
Conduction of nervous impulses
Action potentials
Excitatory and inhibitory post-synaptic potentials
Synaptic function
- b. To describe the major sensory and motor pathways
- c. To describe the physiology of pain with respect to the mediators, pathways and reflexes. (see section in Pharmacology)
- d. To describe the physiology of cerebrospinal fluid
- e. To describe the autonomic nervous system and to explain its role in controlling body function
- f. To describe the major neurotransmitters and their physiological role
- g. To explain the physiology of the control of intra-cranial and intra ocular pressure
- h. To describe the integration of central nervous system activity via the cerebellum, hypothalamus, and limbic system
- i. To describe the physiology of sleep
- j. To outline the basis of the electroencephalogram

SECTION H - MUSCLE PHYSIOLOGY

1. General Instructional Objectives

An understanding of the physiology of striated and non-striated muscle and how structure and function are related

An understanding of the structure and function of the neuromuscular junction

2. Required Abilities

- a. To describe the comparative physiology of skeletal, smooth, and cardiac muscle
- b. To describe the muscle spindle and Golgi organ and to explain their physiological roles
- c. To describe the physiology of the neuromuscular junction and its receptors
- d. To describe the mechanism of excitation-contraction coupling
- e. To describe the different types of skeletal muscle fibres (i.e. fast or slow)
- f. To explain the concept of motor units
- g. To describe the monosynaptic stretch reflex
- h. To define single twitch, tetanus and Treppe effect, and explain their physiological basis
- i. To describe the relationship between muscle length and tension

SECTION I - LIVER PHYSIOLOGY

1. General Instructional Objectives

An understanding of hepatic function and the changes that are relevant to anaesthesia and intensive care

2. Required Abilities

- a. To describe the storage, synthetic, metabolic and excretory functions of the liver and to identify the physiological consequences of hepatic disease
- b. To describe the clinical laboratory assessment of liver function and hepatic failure
- c. To describe the handling of bilirubin in the body
- d. To describe the anatomical and physiological considerations in hepatic blood flow, and the changes that occur with anaesthesia
- e. To outline the reticulo-endothelial functions of the liver
- f. To explain the protective function of the liver between the gut and the body
- g. To describe the portal circulation and its significance

SECTION J - HAEMATOLOGY

1. General Instructional Objectives

An understanding of the normal physiology of blood and its constituents

An understanding of the mechanisms of haemostasis and coagulation relevant to anaesthesia, surgery and intensive care

2. Required Abilities

- a. To explain the origin and importance of blood groups
- b. To outline the constituents and functions of plasma
- c. To describe platelets and their role in coagulation
- d. To describe the intrinsic and extrinsic coagulation pathways
- e. To describe the normal mechanisms of preventing thrombosis including endothelial factors and natural anticoagulants
- f. To describe fibrinolysis and its regulation
- g. To outline the methods for assessing coagulation, platelet function and fibrinolysis
- h. To explain the physiological consequences of acute and chronic anaemia
- i. To outline the production of blood constituents including red blood cells, haemoglobin, and plasma proteins
- j. To outline the constituents of blood products, their source, role and risks
- k. To describe the changes during blood storage and the problems of massive blood transfusion and their management
- l. To describe the breakdown of haemoglobin
- m. To describe abnormal haemoglobins and their clinical significance

SECTION K - NUTRITION & METABOLISM

1. General Instructional Objectives

An understanding of the metabolic physiology of the fasting surgical patient, and the nutritional requirement of critically ill patients as well as the means available for the provision of nutrition

2. Required Abilities

- a. To define basal metabolic rate and to describe its measurement
- b. To describe the factors that influence metabolic rate
- c. To describe relevant, cellular biochemical pathways and the control of fat, carbohydrate and protein metabolism, including the role of vitamins and trace elements
- d. To explain the physiological principles of parenteral nutrition
- e. To describe the consequences of anaerobic metabolism
- f. To describe the physiological consequences of starvation
- g. To describe the metabolic consequences of sepsis, burns and trauma

SECTION L - THERMOREGULATION

1. General Instructional Objectives

An understanding of the significance of temperature control, the physiological mechanisms controlling and regulating body temperature and the effects of anaesthesia on body temperature

An understanding also of the differences between physiological processes available to neonates as compared with adults

2. Required Abilities

- a. To outline the mechanisms for heat transfer between the body and its environment
- b. To describe the mechanisms by which heat is produced by the body
- c. To describe the mechanisms by which heat is lost and gained by the body
- d. To explain the processes used for conserving as well as generating heat under situations of lowered environmental temperature, and the effects of anaesthesia on these processes
- e. To explain the processes used for losing heat as well as increasing heat loss under situations of raised environmental temperature, and the effects of anaesthesia on these processes
- f. To define thermoneutral zone, and describe the energy requirements for maintaining normal body temperature
- g. To explain how the neonate differs in the regulation of body temperature compared with the adult and to explain the physical and physiological reasons for these differences

SECTION M - IMMUNOLOGY

1. General Instructional Objectives

An understanding of basic immunological principles and their application to anaesthesia and intensive care

2. Required Abilities

- a. To use basic immunological principles to explain how the body defends against infection
- b. To identify effects of anaesthesia and critical illness on immune function
- c. To explain the immunological basis and pathophysiological effects of hypersensitivity
- d. To outline the principles of management strategies for anaphylactic/anaphylactoid reactions
- e. To describe the role of complement
- f. To describe the role of cytokines
- g. To describe passive and active immunity
- h. To outline the principles of tissue/organ transplantation and the mechanisms of rejection of allogeneic organs
- i. To understand the principles of tissue typing

SECTION N - ENDOCRINE PHYSIOLOGY

1. General Instructional Objectives

An understanding of the physiological effects of hormones and the derangements that result from dysfunction, including the various mechanisms by which hormones affect target cells

2. Required Abilities

- a. To describe the actions of pancreatic hormones and the control of their secretion
- b. To explain the control of blood glucose levels
- c. To describe the role of the hypothalamus in the integration of neuro-humoral responses
- d. To describe the control of secretion and the functions of pituitary hormones
- e. To describe the synthesis and functions of thyroid hormones and how their secretion is regulated
- f. To describe the control of secretion and the functions of adreno-cortical hormones
- g. To describe the control of secretion and the functions of adrenal medullary hormones
- h. To describe the control of secretion and the functions of renin and angiotension
- i. To describe the regulation of plasma calcium including the actions and control of vitamin D, parathormone and calcitonin
- j. To describe the role of prostaglandins and other autocooids
- k. To describe control of secretion and the functions of atrial natriuretic peptide

SECTION O - MATERNAL PHYSIOLOGY

1. General Instructional Objectives

An understanding of the physiological changes occurring during pregnancy and the application of this understanding to the management of the pregnant patient

2. Required Abilities

- a. To explain the cardiovascular and respiratory changes during pregnancy, their causes, and their consequences
- b. To explain the consequences of the supine posture during pregnancy
- c. To outline the functions of the placenta
- d. To describe the transfer of gases between mother and fetus including the double Bohr and Haldane effects
- e. To describe the endocrine changes that occur during pregnancy and their consequences
- f. To describe the haematological changes with pregnancy

SECTION P - FETAL AND NEONATAL PHYSIOLOGY

1. General Instructional Objectives

An understanding of fetal and neonatal physiology and the application of these to clinical practice

2. Required Abilities

- a. To describe the fetal circulation
- b. To describe the circulatory and respiratory changes that occur at birth
- c. To explain temperature regulation in the neonate and how this differs from the adult
- d. To compare the physiological differences in organ function between the neonate and the adult
- e. To explain the control of body fluids in the neonate and how the control and composition differ from the adult

SECTION Q - GASTROINTESTINAL PHYSIOLOGY

1. General Instructional Objectives

An understanding of basic gastrointestinal physiology and the application of this to the surgical and critically ill patient

2. Required Abilities

- a. To outline the autonomic and hormonal regulation of secretion from the gut
- b. To outline the composition and volumes of secretions from the alimentary tract including saliva, gastric fluid, bile and intestinal fluid
- c. To outline basic aspects of fat, protein, and carbohydrate digestion and absorption
- d. To describe the control of gastric motility and emptying
- e. To describe the physiology of swallowing and vomiting
- f. To describe the consequences of prolonged vomiting, bowel obstruction and malabsorption syndromes
- g. To explain the factors preventing reflux of gastric contents into the oesophagus

SECTION R - PRINCIPLES OF MEASUREMENT

1. General Instructional Objectives

An understanding of the physics involved in the measurement of relevant variables

2. Required Abilities

- a. To explain mathematical concepts such as exponential functions, integration and differentiation
- b. To explain electrical concepts such as current, potential difference, resistance, impedance, inductance and capacitance as they relate to biomedical apparatus
- c. To explain the SI system of units
- d. To outline the conversion between the different units of pressure measurement
- e. To describe the laws governing the behaviour of gases and liquids
- f. To describe the principles of measurement employed by apparatus in clinical use, including transducers, and to describe their calibration
- g. To describe the measurement of flow, pressure and velocity of fluids
- h. To describe the basic physics of ultrasound and the Doppler principle

SECTION S - CLINICAL MONITORING

1. General Instructional Objectives

An understanding of the principles of monitoring in clinical practice

The evaluation of the accuracy, reliability, convenience and hazards of methods of monitoring

2. Required Abilities

- a. To describe in detail the measurement the electrocardiogram including calibration, sources of errors and limitations
- b. To describe and to compare the methods of measuring blood pressure
- c. To describe and to compare the methods of measuring temperature
- d. To describe and to compare the methods of measuring humidity
- e. To explain in detail the principles of pulse oximetry including calibration, sources of errors and limitations
- f. To explain the principles of gases using ultraviolet or infra-red absorption, paramagnetic analysis, gas chromatography, mass spectrometry and Raman scattering
- g. To explain in detail the principles of capnography including calibration, sources of errors and limitations
- h. To describe and to compare the methods of measuring gas flow
- i. To explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis
- j. To describe the principles involved in ultrasound imaging in echocardiography

PHARMACOLOGY

SECTION A - GENERAL PHARMACOLOGY

I - PHARMACODYNAMICS

1. General Instructional Objective

A general understanding of how drugs work and how their actions may be modified. An understanding of the clinical application of this knowledge

2. Required Abilities

- a. To explain the concept of drug action with respect to:
 - receptor theory
 - enzyme interactions
 - physico-chemical interactions
- b. To explain receptor activity with regard to:
 - ionic fluxes
 - second messengers and G proteins
 - nucleic acid synthesis
 - evidence for the presence of receptors
 - regulation of receptor number and activity
- c. To define and explain dose-effect relationships of drugs with reference to:
 - graded and quantal response
 - therapeutic index
 - potency and efficacy
 - competitive and non-competitive antagonists
 - partial agonists, mixed agonist-antagonists and inverse agonists
- d. To describe efficacy and potency with reference to dose-response curves
- e. To explain the Law of Mass Action and describe affinity and dissociation constants
- f. To describe the theories of mechanism of action of general anaesthetic agents
- g. To describe the mechanisms of adverse drug effects

II - PHARMACOKINETICS

1. General Instructional Objective

An understanding of the fate of drugs in the body and how this may be affected by physiological and pathological disturbance

An understanding of the clinical application of this knowledge

2. Required Abilities

- a. To explain the concept of pharmacokinetic modeling of single and multiple compartment models and define:
 - half-life
 - clearance
 - zero and first order kinetics
 - volume of distribution
 - bio-availability
 - area under the plasma concentration time curve
 - extraction ratio
- b. To describe absorption and factors that will influence it with reference to clinically utilised sites of administration
- c. To describe factors influencing the distribution of drugs (e.g. protein binding, lipid solubility, pH, pKa) and their alteration in physiological and pathological disturbance
- d. To describe the mechanisms of drug clearance and how physiological and pathological disturbance may effect these
- e. To describe the mechanisms of non-hepatic and hepatic metabolism of drugs. To describe Phase 1 and Phase 2 reactions, hepatic extraction ratio and its significance, first pass effect, enzyme induction and inhibition
- f. To explain and apply concepts related to intravenous and infusion kinetics. To describe the concepts of effect-site and effect-site equilibration time and their clinical applications. To describe the concept of context sensitive half time and its clinical applications
- g. To calculate loading and maintenance dosage regimens
- h. To describe the pharmacokinetics of drugs administered in the epidural and subarachnoid space
- i. To explain clinical drug monitoring with regard to peak and trough concentrations, minimum therapeutic concentration and toxicity

III - VARIABILITY IN DRUG RESPONSE

1. General Instructional Objectives

An understanding of the factors that may alter inter- and intra-individual drug responses and the significance of this as applied in anaesthetic practice

2. Required Abilities

- a. To define tachyphylaxis, tolerance, addiction, dependence and idiosyncrasy
- b. To describe mechanisms of tolerance
- c. To describe alterations to drug response due to physiological change with special reference to neonates, the elderly and pregnancy
- d. To describe alterations to drug response due to pathological disturbance with special reference to cardiac, respiratory, renal and hepatic disease
- e. To classify and describe adverse drug effects
- f. To classify and describe mechanisms of drug interaction
- g. To outline the pathophysiology of drug abuse with particular reference to the peri-operative period and potential drug interactions (specific drugs to consider include alcohol, nicotine, benzodiazepines, opioids, cannabinoids, cocaine, amphetamines and ecstasy)
- h. To explain the mechanisms and significance of pharmacogenetic disorders such as malignant hyperpyrexia, porphyria, atypical cholinesterase and disturbance of cytochrome function
- i. To outline the management of malignant hyperthermia with particular reference to the pharmacology of dantrolene
- j. To describe immune mechanisms which may result in reactions to drugs, intravenous fluids and latex. To describe the management of anaphylactic and anaphylactoid reactions

IV - PHARMACEUTICAL ASPECTS AND DRUG DEVELOPMENT

1. General Instructional Objective

An appreciation of how drugs are developed, formulated and the importance of additives in drugs

2. Required Abilities

- a. To define shelf-life and outline factors that may influence drug potency during storage
- b. To describe methods of preserving shelf-life of drugs.
- c. To describe the mechanisms of action and potential adverse effects of buffers, anti-oxidants, anti-microbial and solubilizing agents added to drugs
- d. To outline the variations in generic nomenclature of commonly used drugs (e.g. epinephrine/adrenaline, lidocaine/lignocaine)
- e. To define isomerism and provide a classification with examples. To describe the clinical importance of isomerism
- f. To describe the processes by which new drugs are approved for research and clinical use in Australia, and to outline the phases of human drug trials (phase I-IV)

**SECTION B - PHARMACOLOGY OF DRUGS USED IN ANAESTHESIA,
INTENSIVE CARE AND PAIN MEDICINE**

I - INHALATIONAL ANAESTHETIC AGENTS

1. General Instructional Objectives

An understanding of the pharmacology of the inhalational anaesthetic agents and the clinical application of this knowledge

An understanding of the uptake, distribution and elimination of inhalational anaesthetic agents and the clinical application of this knowledge

An understanding of the pharmacological differences between these agents and the clinical importance of these differences

2. Required Abilities

- a. To describe the principles of vaporization of inhalational agents
- b. To explain the concepts of partition coefficients, concentration effect and second gas effect
- c. To describe the relationships between inhaled and alveolar concentration. To describe the factors that affect this and their clinical importance
- d. To explain the significance of the distribution of cardiac output and tissue partition coefficients on uptake and distribution of volatile agents
- e. To describe factors that affect recovery from inhalational anaesthesia. To compare induction and recovery
- f. To describe the properties of an ideal inhalational anaesthetic agent
- g. To describe the structure-activity relationships of inhalational agents
- h. To describe the pharmacology of nitrous oxide. To give a detailed account of its potential adverse effects
- i. To describe the comparative pharmacology of nitrous oxide, halothane, enflurane, isoflurane, desflurane, sevoflurane, xenon and ether
- j. To describe the cardiovascular effects of the inhalational agents
- k. To describe the central nervous system effects of the inhalational agents
- l. To describe the respiratory effects of the inhalational agents
- m. To describe the toxicity of the inhalational agents

II - INTRAVENOUS ANAESTHETIC AGENTS

1. General Instructional Objective

An understanding of the pharmacology of the intravenous anaesthetic agents and the clinical application of this knowledge

An understanding of the pharmacological differences between these agents and the clinical importance of these differences

2. Required Abilities

- a. To describe the properties of an ideal intravenous induction agent
- b. To describe the formulations of thiopentone, propofol, midazolam and ketamine
- c. To describe the central nervous system effects and proposed mechanisms of action of the intravenous anaesthetic agents
- d. To describe the pharmacokinetics of the intravenous anaesthetic agents. To compare the pharmacokinetics and the clinical implications of these differences
- e. To describe total intravenous anaesthesia with reference to the underlying pharmacological principles
- f. To describe the factors which affect recovery from intravenous anaesthesia.
- g. To describe the pharmacodynamics of propofol, thiopentone, midazolam, ketamine and etomidate. Provide a detailed account of the cardiovascular and respiratory effects of these agents
- h. To describe the adverse effects of individual agents
- i. To outline how physiological and pathological disturbance can alter the pharmacology of the intravenous anaesthetic agents

III - LOCAL ANAESTHETIC DRUGS

1. General Instructional Objectives

An understanding of the pharmacology of the local anaesthetic agents and the clinical application of this knowledge

An understanding of the pharmacological differences between these agents and the clinical importance of these differences

2. Required Abilities

- a. To describe the structure-activity relationships of local anaesthetic drugs
- b. To describe the mechanisms of action of local anaesthetic drugs
- c. To describe the formulations of local anaesthetics and their clinical importance
- d. To describe the pharmacokinetics of local anaesthetics and potential alterations with physiological and pathological disturbance
- e. To describe the pharmacodynamics of the local anaesthetics with particular reference to the neuronal, central nervous system and cardiovascular effects
- f. To explain the factors that determine the clinical effects of local anaesthetic drugs
- g. To compare the pharmacology of the local anaesthetics with particular reference to lignocaine, prilocaine, bupivacaine, levobupivacaine, ropivacaine, cocaine and procaine
- h. To describe local anaesthetic toxicity. To describe its prevention and management

IV - PAIN

1. General Instructional Objectives

An understanding of the basic physiological mechanisms involved in peripheral nociception, conduction, spinal cord modulation and central processing of pain

An understanding of the pharmacological agents used to provide acute and chronic pain relief

2. Required Abilities

- a. To define pain
- b. To describe pain pathways and mediators involved in nociception. To describe peripheral and central sensitization, gate control theory, preemptive and preventive analgesia
- c. To describe the pharmacology as pertaining to pain management of:
 - opioids
 - tramadol
 - local anaesthetic agents
 - NSAIDs
 - paracetamol
 - NMDA antagonists
 - anticonvulsants
 - antidepressants
 - corticosteroids
 - inhalational analgesics - nitrous oxide, methoxyflurane
- d. To describe the different modes of administration of analgesic agents and evaluate their clinical applications

V - OPIOID AGONISTS AND ANTAGONISTS

1. General Instructional Objectives

An understanding of the pharmacology of the opioid agents and the clinical application of this knowledge

An understanding of the pharmacological differences between these agents and their clinical implications

2. Required Abilities and Attitudes

- a. To describe opioid receptors
- b. To describe the mechanisms of action of opioids
- c. To describe the actions of agonists, partial agonists, mixed agonists-antagonists and antagonists
- d. To describe the pharmacokinetics of different routes of administration and the clinical implications with reference to intravenous, oral, subcutaneous, intramuscular, transdermal and patient controlled administration
- e. To describe the pharmacokinetics of intravenous opioids and their clinical applications with particular reference to morphine, fentanyl, alfentanil and remifentanil
- f. To describe the pharmacology of opioids deposited in the epidural space or cerebrospinal fluid
- g. To provide a detailed account of the pharmacodynamics of individual opioids and their clinical applications with particular reference to morphine, pethidine, codeine, fentanyl, alfentanil, remifentanil, sufentanil, codeine, methadone and oxycodone
- h. To describe the adverse effects of opioids. To describe the prevention and management of these adverse effects
- i. To describe the potential adverse drug interactions between opioids and other agents
- j. To describe the pharmacology of opioid antagonists

VI - NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

1. General Instructional Objective

An understanding of the role of the prostaglandin pathway in the production of pain and the modulation of this pathway to provide pain relief

2. Required Abilities

- a. To describe the eicosanoid pathway and the physiological role of prostaglandins
- b. To classify the non-steroidal anti-inflammatory drugs
- c. To describe the pharmacology of paracetamol and its toxicity
- d. To describe the pharmacology of aspirin and its adverse effects
- e. To outline the pharmacology of the non-selective COX inhibitors
- f. To outline the pharmacology of the selective COX 2 inhibitors
- g. To describe the adverse effects of the NSAIDS
- h. To describe the pharmacology of the injectable NSAIDS (ketorolac, diclofenac and parecoxib)

VII - NEUROMUSCULAR BLOCKING AGENTS

1. General Instructional Objectives

An understanding of the pharmacology of neuromuscular blocking agents and the clinical application of this knowledge

An understanding of the pharmacological differences between these agents and the clinical importance of these differences

2. Required Abilities

- a. To explain the physiology of neuromuscular transmission and how this may be interfered with to produce muscle relaxation
- b. To describe depolarizing and non-depolarising block
- c. To describe the post-junctional and pre-junctional receptors
- d. To outline the properties of an ideal neuromuscular blocking agent
- e. To describe and evaluate different methods of monitoring the neuromuscular junction
- f. To give a detailed account of the pharmacology of suxamethonium including its undesirable properties
- g. To describe the pharmacokinetics of the neuromuscular blocking agents. To describe the clinical implications of the pharmacokinetic differences
- h. To describe the pharmacodynamics of the non-depolarising muscle relaxants with particular reference to cisatracurium, atracurium, rocuronium, vecuronium, mivacurium and pancuronium
- i. To describe the physiological and pathological factors that may modify responses to muscle relaxants
- j. To describe the adverse effects of muscle relaxants
- k. To describe the physiological and pathological factors which may effect recovery from neuromuscular blockade

VIII - ANTICHOLINESTERASE DRUGS

1. General Instructional Objectives

An understanding of the pharmacology of anticholinesterase drugs and their clinical applications

2. Required Abilities

- a. To classify the anti-cholinesterase drugs in relation to mechanism of action
- b. To compare and contrast the pharmacodynamics and pharmacokinetics of neostigmine, edrophonium, pyridostigmine and physostigmine
- c. To describe the adverse effects of anticholinesterase agents
- d. To outline the effects and treatment of poisoning with organophosphate compounds

IX - ANTICHOLINERGIC DRUGS

1. General Instructional Objectives

An understanding of the pharmacology of the anticholinergic drugs and their clinical applications

2. Required Abilities

- a. To describe the pharmacology of acetylcholine and the muscarinic and nicotinic receptors
- b. To compare and contrast the pharmacodynamics and pharmacokinetics of atropine, hyoscine and glycopyrrolate
- c. To describe the effects of overdose of anti-cholinergic drugs and its management

X - PHARMACOLOGY OF THE AUTONOMIC NERVOUS SYSTEM

1. General Instructional Objectives

An understanding of the physiology and pharmacology of the autonomic nervous system

An understanding of the clinical application of this knowledge

2. Required Abilities

- a. To describe the physiological roles of the sympathetic and parasympathetic nervous systems
- b. To describe the physiological actions of adrenergic, cholinergic, and dopaminergic receptors including the subtypes and their cellular effects
- c. To describe the synthesis, fate and release of adrenergic and cholinergic transmitters
- d. To describe the structure activity relationships of adrenergic and cholinergic agents
- e. To compare and contrast the mechanism of action and effects of sympathomimetic and cholinomimetic agents used clinically
- f. To describe pharmacology of the alpha 1, alpha 2, beta 1 and beta 2 adrenergic agonists and their clinical applications
- g. To describe clinically important drug interactions with the autonomic nervous system

XI - ADRENOCEPTOR BLOCKING AGENTS

1. General Instructional Objectives

An understanding of the physiological consequences of alpha and beta receptor blocking agents as well as their detailed pharmacology

2. Required Abilities

- a. To explain mechanisms and physiological consequences of alpha 1, alpha 2, beta 1 and beta 2 receptor blockade
- b. To classify alpha and beta receptor blocking agents according to their pharmacokinetic and pharmacodynamic properties
- c. To describe the pharmacology of alpha receptor blocking agents and apply this to their clinical use
- d. To describe the pharmacology of beta blockers with particular reference to propranolol, atenolol, metoprolol, esmolol, carvedilol, sotalol and labetalol
- e. To describe the clinical uses of beta receptor blocking agents and their potential adverse effects

XII - ANTI-HYPERTENSIVE DRUGS

1. General Instructional Objectives

An understanding of the pharmacology of anti-hypertensive agents and the clinical application of this knowledge

2. Required Abilities

- a. To classify the mechanisms of action of the anti-hypertensive agents
- b. To describe the pharmacology of centrally acting agents such as clonidine and alpha-methyl dopa
- c. To outline the actions of ganglion blocking agents
- d. To describe the pharmacology of agents which act at the adrenergic nerve ending
- e. To describe the pharmacology of alpha and beta blockers with reference to the management of hypertension
- f. To describe the physiology and pharmacology of the vascular endothelium and smooth muscle with particular reference to nitric oxide
- g. To describe the pharmacology of calcium antagonists with reference to the management of hypertension
- h. To describe in detail the pharmacodynamics and pharmacokinetics of sodium nitroprusside and glyceryl trinitrate including their adverse effects
- i. To describe the pharmacology of the ACE inhibitors and angiotensin receptor antagonists with reference to the management of hypertension
- j. To outline the pharmacology of hydrallazine and the potassium channel activators (nicorandil and minoxidil)

XIII - ANTI-ARRHYTHMIC DRUGS

1. General Instructional Objectives

An understanding of the physiological and pharmacological basis of antiarrhythmic therapy

An understanding of the pharmacology of antiarrhythmic agents and their clinical applications

2. Required Abilities

- a. To classify antiarrhythmic agents by their electro-physiological activity and mechanisms of action
- b. To describe the pharmacology of the sodium channel blocking agents with particular reference to lignocaine and flecainide
- c. To describe the pharmacology of the beta blockers with reference to their antiarrhythmic properties
- d. To describe the pharmacology of the potassium channel blockers with particular reference to amiodarone, sotalol and ibutilide
- e. To describe the pharmacology of the calcium antagonists with reference to their antiarrhythmic properties
- f. To describe the pharmacology of digoxin with reference to its antiarrhythmic properties
- g. To describe the pharmacology of adenosine with reference to its antiarrhythmic properties
- h. To describe the pharmacology of magnesium with reference to its antiarrhythmic properties
- i. To describe the adverse effects of the anti-arrhythmic agents with particular reference to the potential pro-arrhythmic properties

XIV - THERAPY OF CARDIAC ARREST, ISCHAEMIA AND FAILURE

1. General Instructional Objectives

An understanding of the pathophysiology and therapy of cardiac arrest, myocardial ischaemia and cardiac failure

2. Required Abilities

- a. To describe the international cardiopulmonary resuscitation guidelines
- b. To describe the role of defibrillation and its potential benefits and risks during cardiac arrest
- c. To describe the pharmacology of adrenaline, vasopressin, amiodarone and lignocaine with reference to cardiopulmonary resuscitation
- d. To describe the pharmacology of drugs used to manage myocardial ischaemia/infarction with particular reference to nitrates, beta blockers, calcium antagonists, anti-platelet agents, anti-coagulants and fibrinolytic agents
- e. To describe the pharmacology of drugs used to manage acute or chronic cardiac failure with particular reference to sympathomimetics, phosphodiesterase inhibitors, digoxin, diuretics, ACE inhibitors, nitrates and beta blockers

XV - NEUROPHARMACOLOGY

1. General Instructional Objectives

An understanding of the pharmacology of neurotransmitters and their receptors

An understanding of the pharmacology of anxiolytic, hypnotic, anti-depressant, anti-psychotic, anti-convulsant, anti-parkinsonian and anti-migraine medication

2. Required Abilities

- a. To describe the physiology and pharmacology of neurotransmitters and their receptors with particular reference to GABA, excitatory amino acids, acetylcholine, noradrenaline, dopamine and serotonin
- b. To describe the pharmacology of anxiolytic/hypnotic agents with particular reference to benzodiazepenes and barbiturates
- c. To describe the comparative pharmacology of the benzodiazepines with particular reference to midazolam, diazepam, lorazepam and flumazenil
- d. To outline the pharmacology of the antidepressant medications and their adverse effects. To describe the potential adverse drug interactions with these agents
- e. To outline the pharmacology of antipsychotic medication
- f. To outline the mechanisms of action and pharmacology of the anticonvulsants drugs
- g. To outline the pharmacology of the antiparkinsonian drugs
- h. To outline the pharmacology of drugs used to treat migraine

XVI - ANTI-EMETIC DRUGS

1. General Instructional Objectives

An understanding of the physiological basis of vomiting and the pharmacological basis of anti-emetic drugs

2. Required Abilities

- a. To describe the pharmacodynamics and pharmacokinetics of dopamine antagonists, anti-cholinergic agents, serotonin antagonists, anti-histamines and steroids
- b. To critically appraise the clinical usage of these drugs

XVII - RESPIRATORY PHARMACOLOGY AND THERAPEUTIC GASES

1. General Instructional Objectives

An understanding of the pharmacological management of asthma and pulmonary hypertension

An understanding of the pharmacology of oxygen and nitric oxide and their clinical applications

2. Required Abilities

- a. To describe the pharmacology of anti-asthma drugs with particular reference to beta 2 agonists, corticosteroids, anticholinergics, leukotriene antagonists and theophylline
- b. To outline the pharmacology of drugs used to treat pulmonary hypertension
- c. To describe the pharmacology of oxygen including its manufacture and adverse effects
- d. To describe the pharmacology of nitric oxide with particular reference to its inhaled use

XVIII - HISTAMINE AND SEROTONIN

1. General Instructional Objectives

An understanding of the pharmacology of histamine, serotonin and the agents acting at these receptors

2. Required Abilities

- a. To describe the roles of histamine and serotonin receptor subtypes
- b. To outline the pharmacology of histamine antagonists
- c. To outline the pharmacology of drugs acting via effects on serotonin or serotonin receptors

XIX - DIURETICS

1. General Instructional Objectives

An understanding of diuretics and their clinical implications

2. Required Abilities

- a. To outline a physiological basis of classifying diuretics related to their site of action
- b. To describe the actions of mannitol, frusemide, thiazides, aldosterone antagonists and carbonic anhydrase inhibitors
- c. To outline the side-effects of the diuretics
- d. To describe the major applications and toxicities of thiazides, loop diuretics and potassium-sparing diuretics

XX - DRUGS AND COAGULATION

1. General Instructional Objectives

An understanding of the physiological basis of clotting and thrombolysis and the application of this knowledge to the pharmacology of anti-coagulants, anti-platelet drugs, thrombolytic agents and anti-fibrinolytic agents

2. Required Abilities

- a. To classify the anti-coagulants
- b. To describe the pharmacodynamics and pharmacokinetics of heparin and low molecular weight heparins including their side-effects
- c. To describe the mode of action and side effects of protamine
- d. To describe the pharmacology of warfarin
- e. To classify and describe the pharmacology of anti-platelet drugs
- f. To describe the fibrinolytic pathway and outline the pharmacology of the thrombolytic agents
- g. To outline the pharmacology of antifibrinolytic agents such as epsilon aminocaproic acid, tranexamic acid and aprotinin

XXI - OBSTETRIC PHARMACOLOGY

1. General Instructional Objectives

An understanding of the physiological changes in pregnancy and their pharmacological implications

An understanding of the pharmacology of drugs used in pregnancy

2. Required Abilities

- a. To explain the physiological consequences of pregnancy and its pharmacological implications
- b. To describe the pharmacology of oxytocic agents with special reference to oxytocin derivatives, ergot derivatives and prostaglandins
- c. To describe the pharmacology of tocolytic agents with particular reference to beta 2 agonists, calcium antagonists, magnesium, inhalational anaesthetics, nitrates and NSAIDS
- d. To explain the factors which influence the transfer of drugs across the placenta to the fetus
- e. To outline the potential effects on the fetus and neonate of drugs administered during pregnancy
- f. To outline the potential effects on the neonate of drug administration in association with lactation

XXII - ENDOCRINE PHARMACOLOGY

1. General Instructional Objectives

An understanding of the physiological and pharmacological basis of drugs used in endocrine disorders

2. Required Abilities

- a. To describe the pharmacology of insulin preparations and their use
- b. To outline the pharmacology of the oral hypoglycaemic agents
- c. To outline the mode of action and side-effects of thyroid hormones and anti-thyroid drugs
- d. To describe the pharmacology of steroid drugs and their adverse effects
- e. To outline the pharmacology of glucagon
- f. To describe the pharmacology of vasopressin and its analogues

XXIII - GASTROINTESTINAL PHARMACOLOGY

1. General Instructional Objectives

An understanding of the physiology of gastric physiology and its pharmacological manipulation

2. Required Abilities

- a. To describe the pharmacology of the non-particulate and particulate antacids
- b. To describe the pharmacology of the histamine 2 antagonists
- c. To describe the pharmacology of the proton pump inhibitors
- d. To outline the pharmacology of misoprostol and sucralfate

XXIV - INTRAVENOUS FLUIDS

1. General Instructional Objectives

An understanding of the physiological basis of the use of colloids and crystalloids as intravenous fluids

2. Required Abilities

- a. To describe the composition, pH, and osmolality of crystalloids and colloids used in clinical practice
- b. To evaluate their effects and fate when used in volume replacement
- c. To compare the pharmacology of colloids such as albumin, gelatin derivatives, polysaccharide derivatives and starch solutions with crystalloids such as lactate solutions and normal saline

XXV - PHARMACOLOGICAL BASIS OF POISONING

1. General Instructional Objectives

An understanding of the general principles of treating poisoning and the pharmacology of specific treatments

2. Required Abilities

- a. To outline methods which decrease absorption and enhance drug elimination such as activated charcoal, emetic agents, gastric lavage, haemodialysis and charcoal haemoperfusion
- b. To describe the physiological effects and management of overdose of agents such as paracetamol, aspirin, tricyclic anti-depressants, sedatives, cyanide, digoxin, and organophosphates

XXVI - CHEMOTHERAPEUTIC DRUGS

1. General Instructional Objectives

An understanding of the general principles of treating infections and the pharmacology of specific antimicrobials

An understanding of the principles of cancer chemotherapy and potential adverse effects

2. Required Abilities

- a. To outline the pharmacology of antimicrobial drugs
- b. To outline the interactions between antimicrobial and drugs used peri-operatively
- c. To explain the principles of antibiotic prophylaxis
- d. To outline the pharmacology of antiseptics and disinfectants
- e. To outline the pharmacology of antiviral agents
- f. To outline the pharmacology of antifungal agents
- g. To outline the pharmacology of cancer chemotherapeutic agents with particular reference to problems in the peri-operative period

SECTION C - STATISTICS

1. General Instructional Objectives

An understanding of scientific method and its application in research, including the appropriate use of statistical notation and tests

The demonstration of the capacity to critically evaluate published research reports

2. Required Abilities

- a. To describe the stages in the design of a clinical trial, taking into account the
research question and hypothesis
literature review
statistical advice
ideal study protocol to minimise the risk of bias and to achieve
optimum power of the study
ethical issues and informed consent
data collection and processing
- b. To explain the concepts in statistics such as distribution of data and frequency
distributions, measures of central tendency and dispersion of data, and the appropriate
selection and application of non-parametric and parametric tests in statistical
inference
- c. To explain the principles of errors of statistical inference and describe techniques to
minimise such errors through good study design
- d. Have an understanding of sources of bias and confounding in medical research and
methods available that can reduce such bias
- e. To describe the features of a diagnostic test, including the concepts of sensitivity,
specificity, positive and negative predictive value and how these are affected by the
prevalence of the disease in question
- f. To describe the various statistical methods used to estimate risk
- g. To describe the features of evidence-based medicine, including levels of evidence,
meta-analysis and systematic review