

**UNIVERSITY OF PAPUA NEW GUINEA
SCHOOL OF MEDICINE AND HEALTH SCIENCES
DIVISION OF BASIC MEDICAL SCIENCES**

**DISCIPLINE OF BIOCHEMISTRY AND MOLECULAR BIOLOGY
BACHELOR IN MEDICAL LABORATORY SCIENCES – BMLS YEAR 3**

**CLINICAL BIOCHEMISTRY – 1:
FIRST SEMESTER: 2010**

COURSE CODE: 2.34803 CREDIT POINTS: = 3

(Two lectures, a tutorial and three hours practical each week)

No	Lecture Titles	Lecturer	No of Lectures
1.	Quality Assurance in Clinical Chemistry	GG	3
2.	Fluids and Electrolyte Balance	VJT	3
3.	Renal Function: (Glomerular and Tubular function tests, Acid – Base balance)	VJT	5
4.	Gastric, Pancreatic & Intestinal Functions	AM	5
5.	Lipids and Lipoproteins – Diagnostic significance	GG	4
6.	Carbohydrate Homeostasis	VJT / NW	5
7.	Liver Function Tests	GG	4
8.	Thyroid Hormones & Thyroid Function Tests	VJT	4
9.	Parathyroid Hormones	AM / NW	3

AM = Assoc Prof. A. Masta;

VJT = Assoc Prof. V. J. Temple

GG = Mr. G. Gerega;

NW = Mr. Nigani Willie;

Assessment at end of semester:

Practical classes and Assignments (60%); Examination (40%)

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CLINICAL BIOCHEMISTRY – II

SECOND SEMESTER: 2010

CREDIT POINTS = 3

COURSE CODE: 2.34804

(Two lectures, a tutorial and three hours practical – attachment at the PMGH Clinical Chemistry Laboratory each week)

No.	Lecture Title	Lecturer	No of Lectures
1.	Diagnostic tests for Gonadal Function	VJT / NW	5
2.	Diagnostic tests for Adrenal Function	GG	5
3.	Nucleic Acid and Diagnostic Application	AM	5
4.	Tumor Markers	AM / NW	4
5.	Clinical Enzymology	VJT / NW	5
6.	Porphyryns and Disorders of Porphyrin (Porphyrias)	GG	4

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Assessment at the end semester:

Practical classes and Assignments (60%); Examination (40%)

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BACHELOR IN MEDICAL LABORATORY SCIENCES – BMLS YEAR 3

**CLINICAL BIOCHEMISTRY – 1:
FIRST SEMESTER: 2010**

COURSE CODE: 2.34803 CREDIT POINTS: = 3

(Two lectures, a tutorial and three hours practical each week)

Quality Assurance in Clinical Chemistry: Mr. G. Gerega

Quality Laboratory procedures, Quality Control, Quality Assessment, Quality Improvement and Quality Planning; Control of Pre-analytical and Analytical variables; Specimen Collection and Processing; Factors affecting composition of body fluid; Control Materials/Charts. Establishment and uses of reference values; SI units; Safety Issues

Fluids and Electrolytes: Assoc. Prof. V. J. Temple

Define electrolytes and fluids balance. Major electrolytes in plasma; Distribution of electrolytes & H₂O in intra and extracellular fluids (extra and intracellular compartmentalization); Importance of Na⁺, K⁺, HCO₃⁻, Mg²⁺ and other ions, Osmolality/osmotic controls, chloride shift in red cells, sodium/water cycle balance; Disorders of fluid & electrolyte absorption. Renin-Angiotensin-Aldosterone system; Control of ADH secretion; Hypothalamic Regulation of water balance, causes of depletion & excess of H₂O; Pathophysiology of Hyponatraemia in SIADH. Hyponatraemia and Hypokalemia (causes); Determinants of Renin release & control of ECF volume and osmotic pressure; Atrial Natriuretic peptide (ANP): effects on Na⁺ and H₂O

Renal Function: Assoc. Prof. V. J. Temple

Functions of the Kidney – to include endocrine links in the kidney and hydrogen ion excretion in the kidney; Test for Glomerular function: to include understanding of Clearance, Creatinine Clearance, collection of urine, Serum Creatinine and Urea, Proteinuria; Renal Tubular Function: to include Tubular dysfunction, Investigation of tubular function – osmolality measurements in plasma and urine, water deprivation test, acid load test, specific proteinuria, glycosuria, aminoaciduria; Specific Tubular defects: Renal stones, urinalysis; Acute Renal Failure – an overview: Pre-renal (reduced renal perfusion), Post-renal obstruction, Renal (nephron damage); Chronic Renal Failure – an overview: to include – sodium and water metabolism, potassium metabolism, acid-base balance, calcium, and phosphate metabolism.

Gastric, Pancreatic & Intestinal Function: Assoc. Prof. A. Masta

Gastrointestinal hormones (Gastrin, CCK, Secretin, VIP, GIP, others); Enzyme of the Gastrointestinal system; Enzymes of the Gastric content, Pancreatic enzymes, enzymes of the Intestinal Mucosa; Gastric Function Tests (Gastric residue and its components); Tests for Pancreatic Exocrine function (Secretin test, Secretin-CCK test, Trysin and Chymotrypsin in stool); Gastric, pancreatic & intestinal Diseases (major gastric diseases, pancreatic/intestinal diseases, mal-digestion & mal-absorption).

Lipids and Lipoproteins – Diagnostic significance: Mr. G. Gerega

Overview: Malabsorption of lipids. The interrelationship between plasma Lipids, Lipoproteins and Apolipoproteins; Disorders in plasma Lipoproteins; Hyperliproteinemia / Hypolipoproteinemia; Methods for investigating plasma Lipoprotein disorders; The Basic Principles of methods for Lipid and Lipoprotein diagnostic tests

Carbohydrate Homeostasis: Assoc Prof. V. J. Temple

Glucose homeostasis: to include the following – the need for glucose; disposal of high glucose intake (role of insulin). Glucose homeostasis during fasting: to include role of the liver (utilization of hepatic glycogen – role of glucagons); the skeletal muscle; Gluconeogenesis; regulation of Gluconeogenesis; Hyperglycemia and Hypoglycemia – to include effect of the insulin counter-regulatory hormones; Diabetes mellitus: IDDM and NIDDM – Overview. Diagnosis of Diabetes mellitus: to include urine testing, blood glucose (random blood glucose, fasting blood glucose, Oral Glucose Tolerance Test – to include interpretation of OGTT); Monitoring of DM: to include long-term indices of diabetic control; glycated hemoglobin; fructosamine; microalbuminuria. Laboratory investigation of hypoglycemia: to include blood glucose; plasma insulin; insulin/glucose ratio; plasma C-peptide.

Liver Function Tests: Mr. G. Gerega

Liver function tests (LFTs) and their significance; Biochemical parameters for LFTs – Bilirubin, AST, ALT, ALP, Total Protein, Albumin, GGTP, 5'-Nucleotidase, Prothrombin time. Significance and critical assessment of each parameter used. Answers to two frequently asked questions about LFTs; Hyperbilirubinemia and Jaundice – Laboratory assessment

Thyroid Hormones & Thyroid Function Tests: Assoc Prof. V. J. Temple

Secretions of Thyroid Gland. Thyroid Hormonogenesis (secretion & formation in thyroid cell); Structures & functions of Thyroid hormones & Iodinated Metabolites; Synthesis of iodine-containing thyroid hormone, metabolism of Iodine; Biological actions of thyroid hormones, transport (role of Thyroglobulin & albumin) & metabolism; Regulation of TSH; Clinical significance of Thyroid hormones; Hypothyroidism; Hyperthyroidism; Goiter (Iodine - deficiency & treatment; Evaluation methods for thyroid functions; Inherited defects of thyroid hormones

Parathyroid Hormones: Assoc Prof. A. Masta

Functions of parathyroid gland (PTH); Secretions and functions of Calcitonin; Paget's disease; Clinical significance of Parathyroid hormones; Hypoparathyroidism; Hyperparathyroidism; Cretinism

Diagnostic Test for Gonadal Function: Assoc Prof. V. J. Temple

Hormone-Receptor Interactions. Mechanism of action of Lipophilic hormones (with special reference to Steroid hormones). Hormone Response Element (HRE); Sex Steroid Hormones; Hypothalamic – Pituitary – Gonadal Axis. Male Gonadal function; Disorders of Male Sex Hormones; Female Gonadal function; Disorders of Female Sex Hormones; The Adrenal Screen in Female; Endocrine Investigation in the Sub-fertile Female

Diagnostic Tests for Adrenal Function – Diagnostic tests: Mr. G. Gerega

Some causes and consequences of Adrenal Insufficiency (Adrenocortical Hypo-function): Adrenal insufficiency or (Adrenocortical insufficiency), Primary, Secondary, or Tertiary, Primary adrenocortical insufficiency, or Addison's disease, (insufficient hormone production, congenital adrenal hyperplasia (CAH), enzyme inhibitors (e.g., Metyrapone), or cytotoxic

agents (e.g., mitotane); Secondary adrenal insufficiency; Tertiary adrenal insufficiency; Biochemical features of Adrenal Insufficiency (Hyponatremia, Hyperkalemia and Elevated serum urea); Screening and Diagnosis test for Adrenocortical Insufficiency (Failure); Definitive test for the Diagnosis of the condition: The short Cosyntropin (also called Synacthen, Cortrosyn or Tetracosactrin); Prolonged Cosyntropin-stimulation (Rose) test. Diagnosis of Secondary Adrenocortical Insufficiency; Depot (long) Synacthen Test;

Nucleic Acid biochemistry and Diagnostic Application: Assoc Prof A. Masta

Review Nuclei Acid/Composition and Structure. Review DNA replication, transcription and protein synthesis. Nucleic Acid Enzymes: Tools for Molecular Biology (restriction enzymes, DNA polymerase, DNA ligase, reverse transcriptase). Developments in molecular biology and DNA recombinant technology (nucleic and hybridization, DNA sequencing, RFLP, DNA amplification); Polymerase Chain Reaction (PCR) and its Applications. Techniques used in detection of Genetic Variation. Diagnostic Application (detection of infectious agents, genetic diseases, HLA typing, malignant genes/cells, forensic medicine)

Tumor Markers: Assoc Prof. A. Masta

Some of the most commonly measured tumor markers; Human Chorionic Gonadotropin (HCG); Alpha-Fetoprotein (AFP); Lactate Dehydrogenase (LDH); Prostate-Specific Antigen (PSA); Prostatic Acid Phosphatase (PAP); Carcinoembryonic Antigen (CEA); Neuron-Specific Enolase (NSE). Other tumor markers of importance: CA 125; CA 19-9; CA 15-3; CA 27-29

Clinical Enzymology: Assoc Prof. V. J. Temple / Mr. N. Willie

Enzymes of clinical interest: Acid phosphatase (ACP); Transaminases: Alanine aminotransferase (ALT, old name is SGPT); Aspartate aminotransferase (AST, old name is SGOT); Alpha-Amylase (AMS); Alkaline phosphatase (ALP); Creatine kinase (CK); Gamma-Glutamyl-transferase (GGT); Enzymes in Liver function test – See Lecture notes on Liver Function Test (Term 2, 2001) for the significance of the enzymes in the diagnosis of LFT. Glucose 6-phosphate dehydrogenase (G6PD); Lactate dehydrogenase (LDH or LD); Lipase (LPS); Plasma cholinesterase; Enzymology and a Heart Attack (MI); Summary of some of the most important clinical enzymes.

Porphyryns and Porphyrin Disorders (Porphyrias): Mr. G. Gerega

Porphyryns and their significance; Biosynthesis of Porphyrin and Heme – an overview; Types of Porphyria (to include erythropoietic and hepatic); Porphyrin disorders (Porphyrias) – AIP, HC VP, and PCT; Diagnosis of Porphyrias. Limitations in the diagnosis of porphyrias

Assessment: Projects, Class Assignments and PMGH Attachment (60%); Examination (40%)

Recommended Textbooks:

1. Lecture Notes: Clinical Biochemistry, 7th Ed., Edited by: G. Beckett, S. Walker, P. Rae, P. Ashby; Blackwell Publishing, Malaysia, 2008
2. Clinical Biochemistry (Illustrated Colour Text), 4th Ed., A. Gaw, R. A. Cowan, D. St. J. O'Reilly, M. J. Stewart & J. Shepherd; Churchill Livingstone, Sydney, 2008.
3. Lecture Notes: Clinical Biochemistry, 7th Ed., Edited by: G. Beckett, S. Walker, P. Rae, P. Ashby; Blackwell Publishing, Malaysia, 2008.