NATIONAL POSTGRADUATE MEDICAL COLLEGE OF NIGERIA

RESIDENCY TRAINING CURRICULUM

FACULTY OF PATHOLOGY

APPROVED BY THE SENATE ON 5TH DECEMBER, 2019

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COLLEGE REGISTRAR

National Postgraduate Medical College of Nigeria

Faculty of Pathology

Revised Training Handbook/Curriculum

for

Residency Programme in Pathology

1. COMMON GROUND ELIGIBILITY FOR JUNIOR RESIDENCY IN PATHOLOGY

Eligibility:

1. MBBS or equivalent registerable with MDCN

2. Full registration with MDCN

3. Possession of current practicing license or verifiable evidence of payment

4. The trainee must have passed the Primary Fellowship examination of the Faculty of Pathology of the NPMCN or that of the West Africa College of Physicians (WACP) after it is regularized with the College, before starting the Junior residency training.

2. AIM OF THE TRAINING IN PATHOLOGY

The aim of the training in Pathology is to produce very competent Pathologists and diagnosticians who will be able to support clinical care and public health from the clinical laboratory perspective, and also able to manage/direct the pathology (clinical) laboratory in the most efficient and effective manner to ensure the delivery of safe and quality pathology services in a professional, ethical and timely manner with integrity and honesty consistent with the obligations of a medical specialist.

3. COMMON GROUND EXTERNAL ROTATIONS FOR JUNIOR RESIDENCY IN PATHOLOGY

After the first nine months in the specialty, the trainee will externally rotate through other specialties in Pathology; namely, Chemical Pathology, Medical Microbiology and Parasitology, and Morbid Anatomy and Histopathology. The trainee is expected to spend at least three months in each posting and is required to participate in all the activities of each department including clinic-pathological conferences. The trainee must be proficient in all the routine laboratory procedures of each department, take calls, give seminars that will be graded and provide clinical service where appropriate (e.g. STI, Infectious Disease, Endocrine and Metabolic Clinics). In Morbid Anatomy, the trainee must conduct post-mortems during the posting under supervision and later independently. In particular emphasis should be laid on the surgical pathology of the lymphoreticular system.

The trainee will be assessed at the end of each posting and a report of performance is forwarded to the trainer in Haematology.

Junior residents will also start formal academic and clinical components of the training.

4. ANATOMIC PATHOLOGY

Junior Residency Training (JRT)

4.1 SPECIFIC OBJECTIVES FOR JUNIOR RESIDENCY TRAINING

1. Will understand the principles of microscopy and appropriate use of the light microscope.
2. Should be able to perform basic laboratory procedures including surgical cut-up, tissue processing, microtomy and staining procedures.
3. Will be able to report histopathology slides.
4. Will be able to dissect bodies according to disease specifications and preserve anatomical relationships. It is presumed that the candidates already have a sound knowledge of normal anatomy and histology.
5. Will be able to fluently present and convincingly demonstrate organs at autopsy.
6. Will be able to interpret autopsy findings with sound clinical and morphological correlations
7. Will be able to write autopsy reports in acceptable patterns.
8. Will be able to advise clinicians on nature of specimens for optimal assessment crucial to the management of patients.
9. Will be able to design and implement simple Quality Assurance procedures.
10. Will be able to deliver academic seminars and clinicopathological presentations using ICT tools and skills.

4.2 COMPETENCIES FOR JUNIOR RESIDENCY TRAINING

1. Should understand the principles of microscopy and appropriate use of the light microscope.
2. Should be able to perform basic laboratory procedures including surgical cut-up, tissue processing, microtomy and staining procedures.
3. Should be able to report histopathology slides.
4. Be able to dissect bodies according to disease specifications and preserve anatomical relationships. It is presumed that the candidates already have a sound knowledge of normal anatomy and histology.
5. Should be able to fluently present and convincingly demonstrate organs at autopsy.
6. Should be able to interpret autopsy findings with sound clinical and morphological correlations
7. Should be able to write autopsy reports in acceptable patterns.
8. Should be able to advise clinicians on nature of specimens for optimal assessment crucial to the management of patients.
9. Should be able to design and implement simple Quality Assurance procedures.
10. Should be able to deliver academic seminars and clinicopathological presentations using ICT tools and skills.

4.3 Course Content for Junior Residency Training

First year of Training

a) *A formal introduction to the histology laboratory for the first one month so as to see how specimens are processed prior to delivery for histopathological appraisal.*

1. Laboratory posting entails observership and hands-on experience as detailed in Module 1 below:

Laboratory posting	Lecture/Seminar/Tutorial Practical/Bench work/ Surgicals / Autopsy

	i. Tissue Preservation: Principles of fixation/types of fixatives ii. Routine Tissue Processing: Surgical cut-up, Tissue processing, embedding, Microtomy and Staining, mounting iii. Prevention of laboratory hazards iv. Prevention of artefacts v. Prevention of laboratory hazards

b) *Following the introductory period, the trainee will receive instruction and practical experience in further aspects of Anatomical Pathology (Morbid Anatomy and Histopathology) for the next 8 months.* This should consist of three months of autopsy/postmortem dissection followed by 5 months of Surgical Pathology in which the candidate participates in actual grossing of surgical pathology specimens and reporting for review with Consultants. The detailed knowledge and competencies expected of the trainee are in the Tables of Specifications presented in Modules 1 to 5.

Module 2

Surgical Pathology (General pathology)	**Lecture/Seminar/Tutorial/ Bench work/Surgicals/ Autopsy** Mechanisms of cellular growth and differentiation Cellular injury: types, causes and mechanisms. Cell death: Necrosis and Apoptosis. Cellular adaptation of growth and differentiation. Pathological calcification and intracellular accumulation Acute inflammation: definition, benefits, vascular and cellular response. Chemical mediators of inflammation. Chronic inflammation: Chronic non-specific and chronic granulomatous.

Types of wound, Mechanisms of tissue healing and repair.

Oedema, hyperaemia and congestion.

Haemostasis and Thrombosis, haemorrhage

Embolism, Ischaemia and Infarction

Pathology of Shock.

Pathology of DIC.

Basis of inheritance: Chromosome, DNA structure, genes and mutation.

Mendelian disorders.

Cytogenetic disorders.

Single gene disorders with non-classic inheritance.

Molecular diagnosis of genetic disorders

Introduction to immunology: the normal immune system and principles of immunopathology

Human Leucocyte Antigens and the Major Histocompatibility Complex

Cytokines

Hypersensitivity disorders

Autoimmune diseases

Amyloidosis

Transplantation disorders

Definition, Nomenclature and characteristics of Neoplasms

Aetiology and epidemiology of Neoplasms

Biology of tumour growth and metastasis

Host response to Neoplasia and clinical features

Laboratory diagnosis of Neoplasia

Carcinogenesis

Paraneoplastic syndromes

Role of immunohistochemistry and tumour markers in tumour diagnosis

	Protein Energy malnutrition Pathology of Obesity Vitamin disorders (hypo and Hypervitaminosis) Environmental diseases I: chemical and drugs – Alcohol and street drugs Air Pollution and Tobacco Pathology of Radiation injury Haemoglobinopathies General principles of microbial pathogenesis
Module 3	
Surgical Pathology (Systemic pathology)	**Lecture/Seminar/Tutorial/ Bench work/Surgicals/ Autopsy** GIT I: Oesophageal and Gastric disorders GIT II: Small and Large Intestine disorders I GIT III: Small and Large Intestine disorders II GIT IV: Liver diseases including viral hepatitis and neoplasms GIT V: Gall bladder and Exocrine Pancreatic diseases. Respiratory System I: Congenital disorders Respiratory System II: Upper respiratory tract infections and pneumonias Respiratory System III: Tuberculosis and Fungal infections Respiratory IV: Lung abscess and Empyema thoracis Respiratory V: Chronic obstructive pulmonary disease Respiratory VI: Pneumoconiosis Respiratory VII: Lung Neoplasms Endocrine system I: Pancreas – Diabetes Mellitus and Adrenal gland disorders

Endocrine system II: Pituitary gland disorders

Endocrine system III: Thyroid gland disorders

Skin I: Leprosy, Buruli ulcer and deep mycosis.

Skin II: Neoplasms

Male Reproductive tract disorders I: Congenital disorders, Infections and inflammatory disorders.

Male Reproductive tract disorders II: Neoplasms

Female Reproductive System I: Cervical and Uterine disorders

Female Reproductive System II: Ovarian disorders

Female Reproductive System III: Fallopian tubes

Breast Diseases: benign and malignant disorders

Cardiovascular I: Congenital heart disorders

Cardiovascular II: Hypertension

Cardiovascular III: Rheumatic heart disease and Infective Endocarditis

Cardiovascular IV: Cardiomyopathies

Cardiovascular V: Angina pectoris, Chronic Ischaemic heart disease, Myocardial infarction, and Sudden cardiac death

CNS I: Congenital disorders

CNS II: CNS Infections.

CNS III: Neurotrauma and vascular lesions.

CNS IV: Neurodegenerative diseases

CNS V: CNS Neoplasms

Diseases of Head & Neck disorders including Neoplasms

Ophthalmologic disorders including Neoplasms

Musculoskeletal System I: Infections

Musculoskeletal System II: Neoplasms

	Musculoskeletal System III: Connective tissue disorders Haematopathology I: Lymphomas Haematopathology II: Myeloid, Spleen and Thymic disorders Urinary system I: Kidney: Congenital disease, Urinary system II: Renal Infections: Acute and Chronic Pyelonephritis Urinary system III:: The Glomerulonephritides Urinary Systemic IV: Kidney: Nephritic and Nephrotic Syndromes Urinary System V: Pathology of Acute and Chronic Renal failure Urinary System VI: Neoplasms and bladder diseases Paediatric neoplasms
Module 4	
Tropical Pathology	**Lecture/Seminar/Tutorial/Bench work/Surgicals/ Autopsy**
	Malaria Leprosy Fungal infections Syphilis HIV and AIDS with emphasis on disease presentation and morphological variation in the tropics Schistosomiasis Tuberculosis and Atypical Mycobacterial infections Leishmaniasis Onchocerciasis

Module 5

Autopsy/ Forensic Pathology	**Lecture/Seminar/Tutorial/Bench work/Surgicals/ Autopsy**
	Autopsy Pathology: types of autopsy, techniques of dissection and interpretation.
	Overview of forensic autopsies
	Overview of court procedures
	The Nigerian coroner's system
	Legal aspects of medical practice
	Nigerian/international laws (civil and criminal)
	Autopsy examination in mass casualties
	Forensic aspects of haematology
	Forensic paediatrics
	Forensic psychiatry
	Firearms injuries
	Industrial injuries/occupational hazards
	Sexual offences
	Homicides and suicides

4.4 External Rotation

After the first 9 months in Anatomical pathology, the resident will proceed for 3 months rotation in each of the other three disciplines of Pathology namely: Chemical Pathology, Haematology and Blood Transfusion and Medical Microbiology and Parasitology. The resident is required to participate in all the activities of each department. The resident must be proficient in all the routine laboratory procedures of each department, give seminars that will be graded and provide clinical service where appropriate (e.g. STI, Infectious Disease, Endocrine and Metabolic and Haematology Clinics and Blood Bank). The resident will be assessed at the end of each posting and a report of performance is forwarded to the trainer/Head of Department in Anatomic Pathology.

4.5 Last 6months of the Second Year of JRT

The resident *will return to the Anatomical Pathology department after the 9 months of external rotation to receive instruction and practical experience in further aspects of Anatomical Pathology (Surgical Pathology and Autopsy Pathology) for the remaining 6months of the Junior Residency before qualifying to sit for the Part I FMCPath Examination*

4.6 Methods of Training-JRT

Methods of training include apprenticeship, Self-directed learning, Practical Seminar, Teaching seminar, Clinicopathological conferences (at least once a month), Guest /special lecture, Autopsy round, FNAC clinic, Benchwork, Journal club, Case /Clinical presentation/audit , Update/revision courses, External rotation

Apprenticeship: The resident will require dedicated periods of training with a trainer consultant. This will be especially important where skills are developed for recognition of various patterns cum morphological assessment with emphasis on disease variants and their clinical and prognostic significance.

Directed self-motivated training: The resident will also develop skills in directed but self-motivated training (standard sub-specialty textbooks, CDs, DVDs, Atlases, journals, videos etc). Adequate time must be provided for such learning (minimum half day per week).

Library facilities should be provided and journal clubs, scientific and clinico-pathological seminars should be organised on a regular basis.

Didactic lectures by consultants in postgraduate training: Consultants in department of Pathology should make it a matter of duty to make presentations to residents and teach them on specific topics with appropriate illustrations. These will complement the seminars of the residents.

Guest lecturers could also be invited to give special lectures on a quarterly basis.

1.5 Assessment of Junior Residency Training

At the end of the first two years the trainee will be qualified to sit for the Part I FMCPath examination majoring in Anatomical Pathology.

4.7 Senior Residency Training (SRT)

SPECIFIC OBJECTIVES FOR SENIOR RESIDENCY TRAINING

1. Will have a more advanced knowledge and competence in all branches of anatomical pathology for diagnosis and proper patient management.
2. Will be able to perform routine surgical pathology with minimal supervision.
3. Will be able to interpret slides of cytology specimens, to perform and interpret Fine Needle Aspiration Cytology (FNAC); including ultrasound/Image-guided procedures.
4. Will be able to interpret frozen sections.
5. Will be able to carry out and interpret medicolegal autopsies.
6. Will understand and possess hands-on skills in special laboratory techniques (histochemistry, Immunohistochemistry and other molecular techniques).
7. Supervise junior residents.
8. Will have the competence to institute and implement the components of the Quality Management Systems in the laboratory
9. Will engage in research in an area of interest, present and defend the same as a dissertation during a viva at the Part II examination.
10. Some residents may wish to spend one year of laboratory attachment in an area of research interest in a more developed centre, usually abroad. Candidates who are motivated should be encouraged and duly supported to later sub-specialise at centres of excellence abroad or locally.

4.8 COMPETENCIES FOR SENIOR RESIDENCY TRAINING.

1. Should have a more advanced knowledge and competence in all branches of anatomical pathology for diagnosis and proper patient management.
2. Should be able to perform routine surgical pathology with minimal supervision.

3. Should be able to interpret slides of cytology specimens, to perform and interpret Fine Needle Aspiration Cytology (FNAC); including ultrasound/Image-guided procedures.
4. Should be able to interpret frozen sections.
5. Carry out and interpret medicolegal autopsies.
6. Should understand and possess hands-on skills in special laboratory techniques (histochemistry, Immunohistochemistry and other molecular techniques).
7. Supervise junior residents.
8. Should have the competence to institute and implement the components of the Quality Management Systems in the laboratory
9. Engage in research in an area of interest, present and defend the same as a dissertation during a viva at the Part II examination.

4.9 COURSE CONTENT OF THE SENIOR RESIDENCY TRAINING (SRT)

This stage is to continue to broaden the diagnostic experience and understanding the principles of diagnostic pathology, mechanisms of diseases and pathophysiology of disorders, staging diseases and giving specific reasons why and how death occurs as well as measuring clinical audit. The candidate spends a minimum 3 years of active training. The course content includes the following:

1. Surgical pathology
2. Autopsy and forensic pathology
3. Cytopathology
4. Special laboratory techniques (Histochemistry, Immunohistochemistry and other molecular techniques).
5. Dissertation Writing
6. Laboratory Management as contained in the Quality Management System

Special Topics (Module 1)

Courses **Seminars/Workshops/Guest lectures/Clinico-pathological Conference**

Autopsy	
Pathologist	The Pathologist and the society: the Police, the court processes, allied health workers/industrial relations mass disaster, death certification and population data management national security Exhumation Coroners Act and experience of court proceedings and procedures
Surgical Pathology	Breast & Gynaecological Pathology Paediatric Pathology GIT & Liver Pathology Renal Pathology Neuropathology Molecular Biology and Diagnostics Frozen section Radiological-pathology conference
Special Techniques	Photography including photomicrography and simple illustration techniques Introduction to transplantation pathology Cytogenetics Immunohistochemistry-Principles, techniques and use in diagnosis and patient management.
Cytopathology	FNAC Fluid Cytology Scrappings/exfoliative cytology Exposure to both Conventional cytology, Liquid based as well as preparation of Cell block

Management and Research Methodology Courses (Module 2)

Course Management	Intensive Course in Various aspects of
Quality Management Systems in the Laboratory	General concept of quality and Standard The Quality System Essentials

	Quality Assurance Quality Control Clinical/Laboratory Audit Laboratory Accreditation Laboratory Documents - quality manuals, standard operating procedures, etc Archiving Practical aspects of QMS
Health/Hospital resource management	Healthcare system management Health policy formulation and planning Hospital Human Resource management including labour matters, Hospital financial management Legal aspect of Medical practice.
Research Ethics & Methodology	Definition, Spectrum & type of health research design, Ethical considerations, Statistical methods, Basic principles and methods of writing papers for publications, Dissertation writing, Grant Writing etc
Teaching training mentorship skills	Teaching training mentorship skills acquisition workshop acquisition workshop

CHEMICAL PATHOLOGY

5 SPECIFIC OBJECTIVES FOR JUNIOR RESIDENCY TRAINING:

At the end of this phase of the programme the trainee will be able to:

1. Revise and build up on knowledge of undergraduate Chemical Pathology.
2. Acquiring skills in patient preparation, sample collection, transport, storage and preparation of sample for analysis.
3. Be knowledgeable in laboratory safety including control of chemical, physical, microbiological and radiation hazards
4. Be familiar with the various types of instruments and techniques used in Chemical Pathology laboratory for analysis of body fluids.
5. Have a good knowledge of pathophysiology of disease processes and management of biochemical derangements
6. Be proficient in the interpretation of all the results generated in the Chemical Pathology laboratory in relation to clinical information; and ordering of further investigations for the purpose(s) of establishing diagnosis; and prognostication.
7. Understand the basics of clinical Laboratory management including quality management system.
8. Acquire knowledge and understanding of laboratory path of work flow and handling of emergency or urgent samples;
9. Have a working knowledge of basic statistics, including calculations of mean, standard deviation, confidence limits, coefficients of variation etc.;
10. Learn the theory and practice of reference values, quantities and units
11. Have hands on exposure on all laboratory benches

12. Understand the purpose of all reagents used in particular procedures and their preparation, be able to describe the chemical reactions involved, list sources of known interference, and be able to discuss critically the advantages and disadvantages of the method used compared with alternative techniques.
13. Perform and interpret dynamic function tests e.g. OGTT
14. Participate actively in patient management.
15. Participate in the departmental Journal Club.

5.1. COMPETENCIES FOR JUNIOR RESIDENCY TRAINING

1. Has revised and built up knowledge of undergraduate Chemical Pathology.
2. Can now prepare patients, collect, transport, and store specimens. Understands factors that may affect reliability of results at every stage of the pre-analytical phase including anticoagulants and preservatives regulations and precautions.
3. Can discuss biochemical basis of various diseases and good laboratory practice.
4. Understands the application of the principles and use of common glass wares, reagent grade water, calculations routinely used in clinical chemistry and instrumentation in Chemical Pathology laboratory.
5. Can independently carry out analyses of electrolytes, glucose, proteins, bilirubin, calcium, phosphorus, uric acid, cholesterol, triglycerides and various other analytes for tests profiles of organ functions such as renal, liver, heart, thyroid and gonads in different types of body fluids.
6. Understands the basic principles that undergird analytical methodologies of commonly measured clinical chemistry analytes
7. Understands and discuss the basic principles of laboratory quality assurance, quality control and quality management system

8. Can apply laboratory results for making interpretative comments to contribute to patient management, monitoring of treatment and prognosis or outcome of diseases.
9. Has a working knowledge of basic statistics, including calculations of mean, standard deviation, confidence limits, coefficients of variation etc.;
10. Has learnt the theory and practice of reference values, quantities and units;
11. Now has hands on exposure on all laboratory benches
12. Now understands the purpose of all reagents used in particular procedures and their preparation, and can describe the chemical reactions involved, list sources of known interference, and can discuss critically the advantages and disadvantages of the method used compared with alternative techniques.

5.2 TEACHING AND LEARNING METHODS:

Trainees are expected to achieve the competencies described in the curriculum through a variety of learning methods. There will be a balance of different modes of learning from formal teaching programmes to experiential learning 'on the job'. The proportion of time allocated to different learning methods may differ depending on the nature of a particular rotation and the trainee's personal efforts and learning style.

Trainees will learn clinical skills appropriate to their level of training through attachments within the department through the various types of situations outlined below:

Learning with peers - There are many opportunities for residents to learn with their peers via small group sessions, formation of self-help groups and learning sets.

Work-based experiential learning - The specific content of work-based experiential learning is decided by each accredited institution but includes active participation in:

Medical specialty clinics. After initial induction, trainees will review patients in outpatient clinics, under direct supervision. The degree of responsibility taken by the trainee will increase as competency increases. As experience and clinical competence increase trainees will assess 'new' and 'review' patients and present their findings to their clinical supervisor (Consultants or senior registrars). There should be formal opportunities for the supervisor to review decisions made in the outpatient clinic and opportunity for residents to review patients along with their supervisors.

Personal ward rounds and provision of on-going clinical care on specialist consults or referrals received in the department or unit. Every patient seen, on the ward or in outpatients, provides a learning opportunity, which will be enhanced by following the patient through the course of their illness. Patients so seen should provide the basis for critical reading and reflection of clinical problems in relation to their laboratory investigation results.

Consultant-led ward rounds. Each time a resident observes a consultant or fellow trainee (senior or junior) seeing a patient or their relatives is an opportunity for learning. Ward rounds should be led by a consultant and include feedback on clinical and decision-making skills.

Multidisciplinary team meetings.

Clinical-Pathologic seminars or Grand rounds and other situations where clinical problems are discussed with clinicians in other disciplines. These provide excellent opportunities for observation of, and participation in, clinical reasoning.

Practical laboratory experience.

This will be gained by working in the laboratory, to gain familiarity with analytical procedures and techniques, working with various groups of staff within the laboratory, e.g., lab technicians, medical lab scientists and biomedical scientists and via attendance of laboratory educational, clinical and quality management meetings. Emphasis will be placed on the laboratory clinician interface during clinical liaison with clinicians dealing with the patients from which the samples have been taken whether seen on the wards, in out-patients or during surgeries.

Formal postgraduate teaching. The content of these sessions is determined by the local accredited institutions, affiliated recognised Universities and should be based on the curriculum. There are many opportunities throughout the year for formal teaching in the local postgraduate teaching sessions and at regional, national and international conferences and association meetings. Many of these are organised by the National Postgraduate Medical College of Nigeria and the West Africa College of Physicians,

Pathologists or Laboratory medicine professional Associations (e.g. College of Nigerian Pathologists (CNP) and the Association for Clinical Chemists of Nigeria (ACCN).

Suggested activities include:

1. Case presentations
2. Journal clubs
3. Research and audit projects presentations
4. Lectures and small group teaching
5. Grand rounds
6. Clinical skills demonstrations and teaching
7. Clinical audits and evidence based-medicine courses
8. Joint specialty meetings.

All these should be designed to cover aspects of the training programme outlined in this curriculum.

Independent self-directed learning. Residents will use this time in a variety of ways depending upon their stage of training.

Suggested activities includes but not limited to the following:

1. Personal reading, including web-based resource materials
2. Maintenance of personal residency training portfolio
3. Audit and research projects
4. Reading journals (electronic, online or hard copies)
5. Achieving personal learning goals beyond the essential, core curriculum based on personal interest
6. Communication and consultation skills through observed consultations and formal training
7. Learning through teaching of medical students, other health care professionals and patient support groups.

Formal study courses. It is encouraged that time be made available to attend formal courses, subject to local conditions of service.

1. Diploma or clinical attachment training courses
2. MSc courses in Chemical Pathology
3. Nutrition courses

Rotations and routines: The trainee shall rotate through various benches (reception, separation, analyte panel benches, quality management unit, research units e.t.c) in the

Chemical Pathology laboratory. Trainees are also expected to take emergency/call duties in the laboratory and be involved in the running of departmental metabolic and obesity clinic.

Laboratory Work: general routine laboratory bench work exposures, special investigations, dynamic tests etc.***Clinical Responsibilities:*** outpatient clinics, ward coverage, intensive care and emergency units.

Weekly Educational Programmes: Seminars, Tutorials, Journal review, Pathology grand rounds (with sister pathology depts.) and medical grand rounds.

During the first two years of training, the trainee spends at least 6-9 months in Chemical Pathology before proceeding on 3 months rotation each through the other pathology specialties (Medical Microbiology, Anatomical Pathology and Haematology & Blood Transfusion). Afterwards, trainees would then return to Chemical Pathology and spend an additional 6-9 months as applicable (i.e. a total of 15 months in Chemical Pathology) before applying for the Part I examination. Trainees in Chemical Pathology are required to have a thorough working knowledge of laboratory aspects of Chemical Pathology as well as general competence in the field. Candidates need to have a sound knowledge of laboratory procedures, analytical methods and instrumentation and practical familiarity with:

1. The analytical procedures being performed in an approved laboratory;
2. The interpretation of laboratory results with respect to both the patient's disease and test reliability
3. The management and organisation of a laboratory.

This knowledge can only be gained through supervised laboratory work and contact with clinical cases exhibiting abnormal biochemical parameters. Practical experience should be supplemented by reading appropriate textbooks and journals, discussion groups, seminars, lectures and clinical meetings.

NB: Trainees should refer to the Table of Specification for Chemical Pathology for more details.

5.3 Junior Residency Programme

General Laboratory Procedures

1. Methods of generating requests for laboratory tests; requisition forms, computerized order entry, selective requests versus organ system profiles; screening procedures; 4 function tests; prearranged batteries of tests or algorithms to answer specific clinical problems.
2. Specimen collection, identification, transport, delivery, preparation and preservation. Patient preparation for tests. Collection on neonates. Anticoagulants and preservatives. Regulations and precautions regarding transport of biological specimens.

5.4 LABORATORY SAFETY

1. **Statistics:** Concepts of probability and significance, standard deviation, confidence limits, t-test, F-test, analysis of variance, Chi-square, linear and other regression, difference plots, non-parametric testing. Sensitivity, specificity, predictive value and ROC curve.
2. Precision, accuracy, errors of laboratory instruments; standardization units (S.I. and conventional); internal quality control, external quality control; Statutory proficiency testing programs. Primary and secondary standards. Reference materials (International reference materials) and reference methods. Evaluation and comparisons of methods and instruments.

5.5 INSTRUMENTATION

Instruments essential to the operation of a clinical chemistry laboratory. Trainees should understand the principles of analysis, be able to set up and operate the instruments, know their inherent errors, general maintenance, defects and potential problems, and be able to "troubleshoot" or assist repair personnel.

They should conduct experiments under the direction of their consultants. Trainees should understand the criteria for instrument selection.

1. Spectrophotometers, reflectometers and nephelometers.
2. Flame photometers (emission and atomic absorption)
3. Ion selective electrodes (ISE): electrolytes and other applications.
4. Blood gas apparatus
5. Electrophoresis and densitometer equipment

6. Automated and semi-automated analysers for general chemistry, immunologic techniques, chemiluminescence, fluorescence polarization: discrete, centrifugal, random access and batchers; reagent cassette and thin film analysers.
7. Automatic sampling and pipetting devices.
8. General laboratory equipment such as centrifuges, water baths, balances, microscopes, pH meters.
9. Water quality requirements; Water purification systems, stills, de-ionizers, methods of checking the quality of water. Reverse osmosis.
10. High performance liquid chromatography.
11. Small instruments for satellite and point-of-care testing.

5.6 Techniques Used in Chemical Pathology

Trainees should have both a theoretical and practical knowledge of suitable examples of each technique

1. General Techniques: Solvent extraction, selection of buffers; freeze drying; dialysis; concentration, ultrafiltration; preparation of derivatives, Calibration techniques.
2. Spectrophotometric Techniques: Molar absorptivity, reflectance, absorbance, transmittance; fluorometry, nephelometry, chemiluninescence and turbidimetry.
3. Enzymatic Techniques: Enzyme and isoenzyme measurement methods (fixed incubation and kinetic methods); standardization and optimization of methods; stability of enzymes.

5.7 Analytical Methods

Trainees should be familiar with the theoretical principles of the methods, the factors which govern the choice of methods and their evaluation. The concepts of definitive and reference methods and standard reference materials should be understood. They must be competent in the performance of the tests, and should have performed supplementary experiments under the guidance of the supervisor, to examine aspects of some tests in depth. The sensitivity, specificity and predictive value of the tests should be assessed in relation to their interpretation, Potential effect of drugs on the interpretation of test results and clinical application and cost benefits.

1. Bilirubin - total, conjugated (direct)
2. Blood gases and Ph
3. Calculi (renal)
4. Renal functions: Urea, creatinine, uric acid, clearance studies
5. Electrolytes: sodium, potassium, chloride, C02 (HC03-), total and free (ionized)

calcium, phosphorus (inorg.), magnesium.

6. Enzymes: alkaline phosphatase (ALP), amylase, creatinine kinase (CK), gamma-glutamyltransferase (GGT), alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LD), lipase, amylase.
7. Faecal analysis - fat, occult blood
8. Glucose
9. Glycated haemoglobin (HbA1c)
10. Hormone tests: Quantitative hCG, Thyroid function tests etc.
11. Diagnostic Procedures/dynamic tests: Dexamethasone suppression test etc.
12. Iron - serum, iron binding capacity, iron saturation, transferrin, ferritin
13. Ketones - Blood and urine
14. Lipids: cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol, apolipoproteins
15. Proteins: serum total, albumin, electrophoresis (serum, urine and CSF), complements, urinary microalbumin, C-reactive protein.
16. Spinal fluid - glucose, protein
17. Specific Proteins/Tumour markers: prostate specific antigen (PSA) carcinoembryonic antigen (CEA); alpha-fetoprotein (AFP); chorionic gonadotropin (CG).
18. Urinalysis (including microscopy)

Training Portfolios contents for junior residency

1. Evidence of admission into the residency programme and acceptance of offer
2. Copies of letters of posting for extra-departmental rotations
3. Evidence of satisfactory completion of extra-departmental rotations
4. Evidence of satisfactory completion of analytical bench rotations in the Chemical Pathology laboratory
5. Evidence of emergency and clinical call duties undertaken
6. Evidence of assessments undertaken
7. Evidence of examinations taken and results
8. Evidence of attendance at departmental seminars (including topics of those seminars presented by the candidate), case reviews, journal clubs, updates courses, workshops, conferences
9. Copies of biannual performance evaluation form

5.8 ROTATING RESIDENTS

The basics of the objectives below are expected of a rotating Resident within the period of 3 months:

1. Revise and build up on knowledge of undergraduate Chemical Pathology.
2. Acquiring skills in patient preparation, sample collection, transport, storage and preparation of sample for analysis.
3. Be knowledgeable in laboratory safety including control of chemical, physical, microbiological and radiation hazards
4. Be familiar with the various types of instruments and techniques used in Chemical Pathology laboratory for analysis of body fluids.
5. Have a good knowledge of pathophysiology of disease processes and management of biochemical derangements
6. Be proficient in the interpretation of all the results generated in the Chemical Pathology laboratory in relation to clinical information; and ordering of further investigations for the purpose(s) of establishing diagnosis; and prognostication.
7. Understand the basics of clinical Laboratory management including quality management system.
8. Acquire knowledge and understanding of laboratory path of work flow and handling of emergency or urgent samples
9. Learn the theory and practice of reference values, quantities and units
10. Have hands on exposure on all laboratory benches
11. Understand the purpose of all reagents used in particular procedures and their preparation, be able to describe the chemical reactions involved, list sources of known interference, and be able to discuss critically the advantages and disadvantages of the method used compared with alternative techniques.
12. Perform and interpret dynamic function tests e.g. OGTT
13. Participate actively in patient management.
14. Participate in the departmental Journal Club.

5.9 COMPETENCIES

Within the period of 3 months, the trainee

1. Has revised and built up knowledge of undergraduate Chemical Pathology.

2. Can now prepare patients, collect, transport, and store specimens. Understands factors that may affect reliability of results at every stage of the pre-analytical phase including anticoagulants and preservatives regulations and precautions.
3. Can discuss biochemical basis of various diseases and good laboratory practice.
4. Understands the application of the principles and use of common glass wares, reagent grade water, calculations routinely used in clinical chemistry and instrumentation in Chemical Pathology laboratory.
5. Can independently carry out analyses of electrolytes, glucose, proteins, bilirubin, calcium, phosphorus, uric acid, cholesterol, triglycerides and various other analytes for tests profiles of organ functions such as renal, liver, heart, thyroid and gonads in different types of body fluids.
6. Understands the basic principles that undergird analytical methodologies of commonly measured clinical chemistry analytes
7. Understands and discuss the basic principles of laboratory quality assurance, quality control and quality management system
8. Can apply laboratory results for making interpretative comments to contribute to patient management, monitoring of treatment and prognosis or outcome of diseases.
9. Has learnt the theory and practice of reference values, quantities and units;
10. Now has hands on exposure on all laboratory benches
11. Now understands the purpose of all reagents used in particular procedures and their preparation, and can describe the chemical reactions involved, list sources of known interference, and can discuss critically the advantages and disadvantages of the method used compared with alternative techniques.
12. Can perform and interpret dynamic function tests e.g. OGTT
13. Has participated actively in patient management.
14. Has participated in the departmental Journal Club.

6.0 TEACHING AND LEARNING METHODS:

1. Case presentations
2. Journal clubs
3. Research and audit projects presentations
4. Lectures and small group teaching
5. Grand rounds
6. Clinical skills demonstrations and teaching
7. Clinical audits and evidence based-medicine courses
8. Joint specialty meetings.
9. Learning with peers
10. Independent self-directed learning
11. Practical Laboratory experience
12. Multidisciplinary team meetings.
13. Medical specialty clinics
14. Work-based experiential learning
15. Consultant led rounds.

6.1. SENIOR RESIDENCY

SPECIFIC OBJECTIVES FOR SENIOR RESIDENCY TRAINING:

In addition to meeting the requirements stated above for Part I candidates, the Part II candidate should fulfil the following:

1. Detailed knowledge of Chemical Pathology instrumentation;
2. Participation in running the Metabolic Clinic;
3. A three-month rotation in Internal medicine or Paediatrics (1 month each in nephrology, endocrinology and cardiology);
4. Research methodology course;
5. Health management course;
6. Laboratory based research project;
7. Perform advanced bench work such as hormonal analysis, osmolality measurements;

8. Perform and interpret dynamic function tests
9. Critical interpretation and signing of laboratory results;
10. Participate in molecular diagnostic techniques such as DNA/RNA isolation;
11. Lead and participate actively in patient management
12. Take emergency and clinical duty calls
13. Lead and participate in the departmental Journal Club
14. Supervision of junior residents.

6.2. COMPETENCIES FOR SENIOR RESIDENCY TRAINING

1. Can plan, develop and manage common analytical techniques and procedures, and make good choices of methods and equipment including validation and verification of methods.
2. Can manage the clinical laboratory path of workflow including quality management systems.
3. Can critically interprete laboratory-derived information in relation to clinical findings; and order further investigations for the purpose(s) of establishing diagnosis, prognosis and assisting patient management.
4. Has known the modes of presentation of acute and chronic biochemical and metabolic disorders.
5. Understands principles that undergird instrumentation and analytical methodologies of clinical chemistry analytes and their application in the interpretation of laboratory results.
6. Develops and manages laboratory budgets efficiently and effectively
7. Understands laboratory and hospital procurement policies

8. Can demonstrate proficiency in aetiology, pathophysiology, laboratory investigations and clinical management of metabolic disorders in departmental metabolic and obesity clinics, clinical endocrinology, renal medicine and the intensive care units
9. Demonstrate proficiency in undertaking clinical liaison at the laboratory clinician interface
10. Demonstrate proficiency in undertaking clinical research methodology including research proposal writing, grantsmanship up to publication of manuscripts in peer review journals

6.3 TEACHING AND LEARNING METHODS:

Trainees are expected to achieve the competencies described in the curriculum through a variety of learning methods. There will be a balance of different modes of learning from formal teaching programmes to experiential learning 'on the job'. The proportion of time allocated to different learning methods may differ depending on the nature of a particular rotation and the trainee's personal efforts and learning style.

Trainees will learn clinical skills appropriate to their level of training through attachments within the department through the various types of situations outlined below:

Learning with peers - There are many opportunities for residents to learn with their peers via small group sessions, formation of self-help groups and learning sets.

Work-based experiential learning - The specific content of work-based experiential learning is decided by each accredited institution but includes active participation in:

Medical specialty clinics. After initial induction, trainees will review patients in outpatient clinics, under direct supervision. The degree of responsibility taken by the trainee will increase as competency increases. As experience and clinical competence increase trainees will assess 'new' and 'review' patients and present their findings to their clinical supervisor (Consultants or senior registrars). There should be formal opportunities for the supervisor to review decisions made in the outpatient clinic and opportunity for residents to review patients along with their supervisors.

Personal ward rounds and provision of ongoing clinical care on specialist consults or referrals received in the department or unit and during medical ward attachments

(Internal Medicine and Paediatrics). Every patient seen, on the ward or in outpatients, provides a learning opportunity, which will be enhanced by following the patient through the course of their illness. Patients so seen should provide the basis for critical reading and reflection of clinical problems in relation to their laboratory investigation results.

Consultant-led ward rounds. Each time a resident observes a consultant or fellow trainee (senior or junior) seeing a patient or their relatives is an opportunity for learning. Ward rounds should be led by a consultant and include feedback on clinical and decision-making skills.

Multidisciplinary team meetings. Clinical-Pathologic seminars or Grand rounds and other situations where clinical problems are discussed with clinicians in other disciplines. These provide excellent opportunities for observation of, and participation in, clinical reasoning.

Practical laboratory experience. This will be gained by working in the laboratory, to gain familiarity with analytical procedures and techniques, working with various groups of staff within the laboratory, e.g., lab technicians, medical lab scientists and biomedical scientists and via attendance of laboratory educational, clinical and quality management meetings. Emphasis will be placed on the laboratory clinician interface during clinical liaison with clinicians dealing with the patients from which the samples have been taken whether seen on the wards, in out-patients or during surgeries.

Formal postgraduate teaching. The content of these sessions is determined by the local accredited institutions, affiliated recognised Universities and should be based on the curriculum. There are many opportunities throughout the year for formal teaching in the local postgraduate teaching sessions and at regional, national and international conferences and association meetings. Many of these are organised by the National Postgraduate Medical College of Nigeria and the West Africa College of Physicians, Pathologists or Laboratory medicine professional Associations (e.g. College of Nigerian Pathologists (CNP) and the Association for Clinical Chemists of Nigeria (ACCN).

Suggested activities include:

1. Case presentations
2. Journal clubs
3. Research and audit projects presentations
4. Lectures and small group teaching rounds
5. Clinical skills demonstrations and teaching

6. Clinical audits and evidence based-medicine courses
7. Joint specialty meetings.

All these should be designed to cover aspects of the training programme outlined in this curriculum.

Independent self-directed learning. Residents will use this time in a variety of ways depending upon their stage of training.

Suggested activities includes but not limited to the following:

1. Personal reading, including web-based resource materials
2. Maintenance of personal residency training portfolio
3. Audit and research projects
4. Reading journals (electronic, online or hard copies)
5. Achieving personal learning goals beyond the essential, core curriculum based on personal interest
6. Communication and consultation skills through observed consultations and formal training
7. Learning through teaching of medical students, other health care professionals and patient support groups.

6.4 Rotations and routines:

Undergo a twelve weeks posting (average of 6 weeks each) in Paediatrics and Internal medicine especially the cardiology, renal and endocrinology units for further clinical exposure. Be involved in the running of departmental metabolic and obesity clinic. Trainees are expected to gain some form of exposure in the teaching of undergraduate medical students as well as supervision of junior residents. It includes both laboratory and clinical programmes. Residents undergoing this phase of training will take part in all departmental activities at advanced level. He would undertake a Clinical and Laboratory-based Research that will be presented as a Dissertation for Part II Final FMCPath Examination. A Senior Resident is deemed to have completed his/her training if He/she has completed cumulative 36 months of rotations (inclusive of the three months for Internal Medicine and Paediatrics and the optional one year exposure abroad) and excluding the periods of annual leaves and any other interruptions. In addition, part of this time (12 - 24 months) should be used for a relevant clinical and

laboratory-based research project approved by the NPMCN that will be presented in part fulfilment of the FMCPath Part II examination.

6.5 Senior Residency Programme:

General Laboratory Procedures

1. Laboratory reporting systems: Ensuring that the information reaches the attending physician within a time-frame for appropriate action. Critical values. Directing attention to abnormal results when necessary; providing clinical interpretation when appropriate.
2. Keeping laboratory records, retention policies; workload measurement systems. Preparation and maintenance of proper laboratory manuals. Accreditation requirements.
3. Assessing the quality, stability and costs of reagents, commercial "kits", near-patient and laboratory instruments and analysers; strategies to select instruments.
4. Biological variations: Understanding the concept of pre-analytical variables.

6.6 Instrumentation

Trainees should understand the principles of analysis, be able to set up and operate the instruments, know their inherent errors, general maintenance, defects and potential problems, and be able to "troubleshoot" or assist repair personnel.

They should conduct experiments under the direction of their consultants.

Trainees should understand the criteria for instrument selection.

1. Polymerase chain reaction cyclers and other amplification techniques.
2. Osmometers.
3. Fluorometers.
4. Gas chromatographs.
5. Liquid scintillation counters.
6. Infra-red/ultraviolet spectrophotometer.
7. Refractometers.
8. Isoelectric focusing.
9. Ultracentrifuge.
10. Mass spectrometers.
11. Flow cytometers.
12. Amino-acid analyzer.

6.7 Techniques Used in Chemical Pathology

1. Immunologic and Competitive Binding Techniques: Immunodiffusion, immunoelectrophoresisimmunoblotting and immunofixation; Immunoassays: isotopic and non-isotopic, competitive, non-competitive or immunometric, liquid or solid-phase etc
2. Chromatographic Techniques: HPLC/GC/TLC
3. Electrophoretic Techniques
4. Isotope Techniques: Counting techniques etc

Molecular Biology Techniques Principles and methods of DNA and RNA isolation, purification, polymerase chain reaction (PCR).

6.8 Analytical Methods

Trainees should be familiar with the theoretical principles of the methods, the factors which govern the choice of methods and their evaluation. The concepts of definitive and reference methods and standard reference materials should be understood. They must be competent in the performance of the tests, and should have performed supplementary experiments under the guidance of the supervisor, to examine aspects of some tests in depth. The sensitivity, specificity and predictive value of the tests should be assessed in relation to their interpretation, Potential effect of drugs on the interpretation of test results and clinical application and cost benefits.

1. Cardiac Markers: CK-2 (CKMB), troponins, myoglobin
2. Drug analysis: acetaminophen, aminoglycosides, phenobarbital, phenytoin, etc
3. Enzymes: alkaline phosphatase (ALP), amylase, creatine kinase (CK), gamma-glutamyltransferase (GGT), alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LD), lipase, amylase.
4. Glycated serum proteins (fructosamines)
5. Iron - serum, iron binding capacity, iron saturation, transferrin, ferritin
6. Ketones - Blood and urine
7. Metanephrines, catecholamines, VMA
8. Osmolality
9. Porphyrins - (qualitative/quantitative)
10. Specific Proteins/Tumour markers: prostate specific antigen (PSA) carcinoembryonic antigen (CEA); alpha-fetoprotein (AFP); chorionic gonadotropin (CG).

11. Vitamins: vitamin B12, folate, Schillings test.
12. Trainees should understand the theoretical basis of the tests, and the clinical interpretation. If the tests are available in another training centre other than their own, the trainees should gain practical experience with as many of them as possible.
13. Amino acids screen:
14. Chromatography;
15. Ammonia analysis
16. Amniotic fluid analysis: bilirubin, alpha-fetoprotein, fetal lung maturity testing
17. Vitamin analysis (A, B, C, E,)
18. Drugs of abuse screen or quantitative
19. Enzymes electrophoresis: CK, LD, ALP
20. Other Hormone Tests: 17-hydroxyprogesterone, 11-deoxycortisol, corticotropin (ACTH) etc
21. Metals - copper, lead, mercury, zinc, aluminium.
22. Proteins: alpha-1-antitrypsin, fibrinogen, cryoglobulin, haptoglobin, immunoglobulin IgE
23. Hemoglobins: HBA1cPyruvate/Lactate
24. Sugars - galactose, lactose, urine chromatography.
25. Tumor markers: 5-HIAA, PTHrP, CA 125, CA 19-9.
26. Bone markers; pyridinoline cross-links, hydroxyprolline
27. Tests not commonly requested in Biochemistry; clinical knowledge is required, but only general, regarding the type of analytical approach.
28. Amino acids: hydroxyproline; branched chain aminoacidemia, etc.
29. Antibodies: e.g. anti-ds-DNA; anti-nuclear antibodies, anti-thyroglobulin
30. Bile acids
31. Breath tests: hydrogen (jejunal disaccharidases); $^{I4}C02$ (bile acids)
32. Lipoprotein electrophoresis
33. Metals - arsenic; chromium.

6.9 General and Interpretive Clinical Biochemistry

1. The prime objective in the education of chemical pathologists is to impart an understanding of the appropriateness of a laboratory test for a particular patient at a particular time.
2. They must be familiar with the meaning of sensitivity and specificity of tests and the importance of prevalence in determining the predictive value of a test result.

3. Trainees should know the details of the various tests of organ function, as well as the laboratory determinations involved, the relative merits of multiphasic screening, organ profiling versus cost effective testing protocols.
4. They should know the biochemical and pathological mechanisms of tissue injury, as well as the factors underlying the tests and the principles of management of the common clinical disorders.
5. Trainees must be able to advice on the choice of tests when necessary and on the interpretation of laboratory results when appropriate.

7.0 Organ System Diseases

1. Fluid and electrolyte disorders
2. Acid-base and respiratory function
3. Disorders of the kidney and urinary tract
4. Cardiovascular disorders and hypertension
5. Hematologic disorders; porphyrins, haem and bile pigments
6. Hepatobiliary disorders
7. Gastrointestinal and pancreatic disorders
8. Immune system
9. Musculoskeletal, arthritic and rheumatic disorders
10. Endocrine disorders
11. Metabolic and genetic diseases
12. Diabetes mellitus and other carbohydrate diseases
13. Calcium, magnesium, the parathyroids and bone diseases.
14. Proteins, disorders of protein metabolism and nutrition
15. Disorders of purine and pyrimidine metabolism
16. Lipids and lipoprotein disorders
17. Molecular diagnosis of genetic defects
18. Cell regulation and disorders of signal transduction
19. Prenatal diagnosis, assessment and monitoring of high risk pregnancy
20. Paediatric clinical biochemistry
21. Vitamins, trace elements and environmental toxins
22. Pharmacology / toxicology / therapeutic drug monitoring
23. Biochemical aspects of oncology
24. Geriatric clinical biochemistry

7.1 Laboratory Management

Laboratory Data Processing and Computing

1. Use of computers in quality control and management; use of computers for calculating analytical results (e.g. non-linear functions).
2. General aspects of system design; central vs. stand-alone systems, host computers and equipment interfaces.
3. Laboratory information systems (LIS), Hospital information systems (HIS)
4. Personal computer use; word processing, spreadsheets, database, graphics, statistics, presentations, email, internet.
5. Security of data storage and transmission.
6. Appropriate access control to patient information.

Preparation of operating budgets:

1. General aspects of financial management of laboratories,
2. Cost-analysis (tests and instruments);
3. Justification of providing new services or rejecting existing ones; o Lease and purchase decision analysis; o Delegation of budget responsibilities, workload statistics.

Laboratory design:

1. Designing laboratories for different types and sizes of institutions: o Selection of equipment and systems for the laboratory,
2. Concepts of workstation consolidation, o Work flow analysis,
3. Concepts in laboratory automation (sample transportation systems, modular systems, robotics).

Laboratory safety:

1. Fire, chemical, radiation and infection control (body substance precautions), o Hazardous waste and transport of hazardous materials.

Training of technical staff:

1. Familiarity is needed with the syllabi of various training programmes; o Knowledge of the teaching requirements and level of knowledge of each staff cadre
2. Understanding of qualifications of technologists and scientists trained in other countries.

Record keeping:

1. Standard operating procedures
2. Quality control programmes

3. Patient data retrieval.

Personnel management:

1. Personnel policy manual;
2. Job descriptions;
3. Labour relations;
4. Delegation to a laboratory manager,
5. Legal requirements for laboratory operation:
6. Knowledge of relevant government guidelines
7. Personal liability.

Hospital organization:

1. Interactions between the laboratory service and the rest of the hospital,
2. Professional ethics.

Quality Management System:

1. The twelve Quality System Essentials
2. Total quality management;
3. Development and monitoring of quality indicators.

Public relations:

1. Hospital and community.

Emergency and clinical call duty services.

Training Portfolios contents for senior residency

1. Evidence of admission into the residency programme and acceptance of offer
2. Copies of letters of posting for rotation
3. Evidence of satisfactory completion of rotations
4. Evidence of satisfactory completion of analytical bench rotations in the Chemical Pathology laboratory
5. Evidence of emergency and clinical call duties undertaken
6. Evidence of assessments undertaken
7. Evidence of examinations taken and results
8. Attendance at updates, courses, workshops, conferences
9. Evidence of conference presentation (local /international)
10. Ethical clearance for dissertation
11. Copy of proposal assessment report by college assessor
12. Copy of annual performance and evaluation form

7.2 SPECIFIC OBJECTIVES FOR JUNIOR RESIDENCY

1. Understanding of the various sections of the Haematology laboratory
2. Preparation of thick and thin peripheral blood films
3. Understanding of different types of stains used in the Haematology Laboratory
4. Staining of peripheral blood and bone marrow films
5. Understanding the structure and function of the bone marrow
6. Identification of normal and abnormal haemopoietic cell on peripheral blood and bone marrow films including parasites
7. Ability to carry out differential counts on peripheral blood and bone marrow films
8. Ability to fill and seal micro-haematocrit capillary tubes
9. Ability to use the micro-haematocrit centrifuge and micro-haematocrit reader
10. Understanding the principles behind the different grades of automated blood counts and differential and the use of controls
11. Ability to interpret results from haematology automated counter results
12. Understanding the various causes of haemolysis and associated peripheral blood and bone marrow appearances
13. Understanding the principles of electrophoresis
14. Interpreting electrophoretic strips
15. Understanding the principles of antigens and antibodies and their interactions
16. Understanding the principle of blood donation and blood use
17. Understanding the various blood products and their preparations
18. Understanding the use of blood products and means of separating them
19. Understanding the haemostatic principles and pathways
20. Understanding the principles of manual coagulation tests such as PT, aPTT, TT

21. Understanding the principles of automated coagulometer and platelet aggregometers
22. Understanding the cell cycle and principles of chemotherapy
23. Understanding the various classes of chemotherapeutic agent, their routes of administration and side effects and toxicities
24. Understanding the principles of molecular biology with respect to genes, DNA and RNA, amplification, probes, hybridization etc.
25. Understanding the importance of detailed medical history, physical examination and basic investigations in the diagnosis of haematological disorders

7.3 COMPETENCIES FOR JUNIOR RESIDENCY TRAINING

At the end of the two years RTH, the trainee must have acquired the necessary skills in

1. Preparation of Peripheral blood and bone marrow films
2. Staining of peripheral and bone marrow films
3. Supervised experience in bone marrow aspiration and trephine biopsy
4. Reading and manual counting on peripheral blood and bone marrow films
5. The Use of Micro-haematocrit centrifuge
6. The Use of types of bench centrifuges
7. The Operation of haematology automated cell counter
8. Determination of plasma clotting time in PT, aPTT, TT
9. Carrying out clotting factor assays
10. Use of automated coagulometer and platelet aggregometer
11. Computer appreciation and use of other ICT modalities
12. Competence in clerking, physical examination on patients, and making correct clinical assessment

13. Ability to determine relevant laboratory investigation to be carried out in line with clinical findings

7.4 Specification for the Junior Residency Training Program

1. Blood Cells and Functions. Introduction to Clin. Haematology
2. Anaemias (Nutritional Deficiencies, marrow failure, others)
3. Medicine and) Haemolytic Disease of the New born
4. Haemolytic Anaemias (acquired & inherited)
5. Haemostasis and Bleeding Disorders. AIDS
6. Malignancies: Lymphoproliferative &Myeloproliferative Disorders, Plasma Cell Neoplasia
7. Medical Microbiology & Parasitology
8. Histopathology
9. Medical Microbiology & Parasitology

7.5 Junior Residency Training

A formal introduction to laboratory haematology is required during the first three months of RTH. Laboratory haematology will include instruction and hands-on experience in routine haematology/haemato-oncology, blood transfusion medicine, haemostasis and coagulation, and special tests, laboratories.

The trainee will spend a minimum of two weeks in blood transfusion, four weeks in general haematology (for stains preparation, diagnostic blood counting, peripheral blood film and bone marrow slides reporting) and two weeks in haemostasis and bleeding disorders. The remaining five weeks will be for clinical exposure.

This will be followed by major rotations through the units of haematology, and participations in out and in-patient managements including, emergency bench calls from 4 pm to 8 am; and all-day during the weekends and public holidays. Clinical calls are also compulsory for all residents during the call periods as for emergency bench calls.

The trainee will be instructed in methods for obtaining bone marrow aspiration and trephine, preparation of marrow slides from the aspirate and touch or roll preparations from the trephine. Resident must be conversant with preparation of basic stains. Trainees will also be exposed to Fine Needle Aspiration Biopsy techniques.

Clinical training during this induction period will include supervised participation in in-patient and outpatient management of haematological disorders including clinical on-call as appropriate.

There will be an assessment at the end of these rotations.

Following the introductory period, the trainee will receive instruction and practical experience in other aspects of haematology and rotate through other specialities in pathology, for the rest of the 1st Year of training and part of the 2nd.

7.6 Three months posting to Haematology department

Objectives:

At the end of the training trainees will be able to

1. Demonstrate an understanding of common haematological diseases, their investigation and management.
2. Interpret routine haematological laboratory results and respond appropriately
3. Perform basic Haematology investigations including bone marrow aspiration and their interpretation
4. Perform basic blood bank investigations and manage a hospital blood bank
5. Demonstrate an understanding of the management of a General Hospital Haematology Laboratory with diagnostic and interpretative ability.

Competences

1. Describe the structure and function of the bone marrow and secondary lymphoid organs and the role of haemopoietic growth factors in bone marrow function,
2. Describe the red cell and red cell disorders, white cell and white cell disorders, Platelets and platelet disorders
3. Describe the aetiopathogenesis, presentation, diagnosis, prognosis and management of common haematological disorders such as nutritional anaemia, common haemolytic anaemias, bone marrow failure, acute and chronic leukaemias, malignancies of the lymphoreticular system, common bleeding disorders and common thrombophilias
4. Fully examine, investigate, stage and manage common haematological disorders e.g. various types of anaemias, Haemoglobinopathies, leukaemias, lymphomas, multiplemyeloma, myeloproliferative diorders, haemolytic diseases and disorders of Haemostasis and Bleeding Disorders
5. Fully examine, investigate, stage, institute a management programme and follow up patients with HIV/ AIDS

6. Describe the physiology of coagulation, coagulation inhibition and fibrinolysis.
7. Describe the structure and function of platelets and acquired and inherited diseases of platelets.
8. Describe common bleeding disorders and thrombophilia, their diagnosis and management.
9. Describe procedures in blood donor selection, blood testing, processing and storage.
10. Describe the hazards of transfusion therapy, their investigation and management.
11. Describe and explain bedside blood transfusion procedures.

Cometencies

At the end of the rotation, the resident should be able to

1. Collect, store and transport patient specimens.
2. Show competence in the use of basic equipment e.g. microscope, colorimeter, spectrophotometer, water bath, centrifuge, automatic cell counter.
3. Show competence in the preparation and use of basic haematological stains
4. Prepare and stain thin blood film.
5. Perform bone marrow aspirate, spread and stain.
6. Perform full blood count, ESR, and calculate red cell indices
7. Comment on thin blood film of common Haematological disorders including haemolytic and nutritional anaemia, and Leukaemia.
8. Perform and interpret screening tests for bleeding disorders and follow on tests.
9. Perform and interpret basic tests for the diagnosis of haemoglobinopathies
10. Clerk patients and follow them up in an outpatient clinic.
11. Investigate suspected cases of anaemia.
12. Diagnose and treat patients with anaemia
13. Perform phlebotomy and acquire skills in blood storage, screening for transfusion transmissible diseases, blood grouping and cross matching including diagnosing and treating the hazards of transfusion.

7.7 LEARNING AND TEACHING METHODS

The trainee will require dedicated periods of training with a trainer consultant. This will be especially important where skills are developed from pattern recognition, especially morphology but also clinical examination. The trainee will also develop skills in directed but self-motivated training (text books, journals, videos etc.). Adequate time must be

provided for such learning (minimum half day per week). Library facilities, journal clubs, scientific and clinical seminars should be provided.

Throughout the training period, there will be an increasing use of in-service experience for training purposes. At no time should this service load become such that the trainee fails to benefit from clinical or laboratory service work.

The learning methods and activities are summarised under the following:

1. Work-based Apprenticeship learning

i. Haematology clinics: trainees are exposed to both formal and informal learning in the consultant outpatient clinics under supervision. The level of responsibility increases with competency level.

ii. Consultant led ward rounds: trainees are exposed to inpatient and emergency management during consultant ward rounds. This should involve active participation at the decision making process

iii. Resident ward rounds: participation in resident ward rounds provides opportunity for residents to learn from ongoing clinical care of haematology and other patients with related disorders in the wards. Seeing patients provides an opportunity for clinical reading and reflection of clinical and laboratory problems

iv. *Rotations and bench work in the haematology laboratories* provide essential opportunities for focused practice in blood and bone marrow morphology, experience of analytical methodologies and data interpretation, quality assurance procedures, and laboratory management. Under supervision the trainee will evaluate and interpret investigations and provide clinical advice to colleagues in other disciplines. The degree of responsibility taken by the trainee will increase as competency develops, from observation, to supervised practice of increasingly complex cases.

v. *Multi-disciplinary team meetings* are integral parts of haematology practice. Observation of, and interaction with colleagues (nurses, clinicians in other disciplines such as histopathologists, radiologists, paediatricians and biomedical scientists) provides learning opportunities including development of clinical reasoning skills. Participation in these meetings are compulsory

vi. *Supervised on call experience: This* allows trainees to develop skills required to manage patients appropriately when fewer diagnostic and treatment resources are available. Supervised on call allows immediate feedback to trainees and provides opportunities to develop competency in clinical reasoning and decision making skills in emergency situations

Other learning methods include:

2. **Learning with Peers** - Presenting at clinical, morphology and laboratory meetings and participation in journal clubs offers opportunity for in depth background reading as well as practice of critical thinking and communication skills

Formal Postgraduate Teaching – Trainees are exposed to formal teaching all through the residency-training period. These teachings include 6- monthly compulsory update/revision courses organised by the faculty of pathology. Also, case presentations, research and small group teaching, grand rounds, clinical skills demonstrations. In addition, residents are also encouraged to attend the annual scientific meeting of the Nigeria Society for Haematology and other related international conferences

Independent Self-Directed Learning. Trainees are encouraged to consolidate their learning outside the core curriculum by reading, including web-based haematology materials, Journals of The Annals of Tropical Pathology and Nigerian Journal of Haematology are free for residents), other indexed journals like the British Society for Haematology, Haematological, the European Journal of Haematology and African Sanguine as well as other online resources are available to residents including BloodMed and specialty specific webinars.

7.8 ACTIVITIES

The trainee shall:

1. Rotate through haematology routine and special laboratory, blood bank and TTI screening laboratory
2. Be involved in the running of haematology Day care unit, out-patient clinic and in patient on the wards
3. Be involved in all departmental academic activities

Module 1 - Basic Haematology: Haematopoiesis, Blood Cells and Functions, and Introductory Clinical Haematology.

1. Haematopoiesis, Stem Cell and Blood Cells & Growth factors

2. Erythropoiesis, red cell metabolism and benign disorders of erythropoiesis
3. Haemoglobin structure, function and metabolism
4. Bone marrow structure and functions
5. Lymphatic structure and functions
6. Leucocytes structure & function; benign disorders of leucocytes
7. The platelet Structure & function
8. History taking, physical examination of common haematological disorders
9. Innate and adaptive immunity

Module 2: Non-haemolytic anaemias

Topic

1. Iron deficiency anaemia: iron metabolism; aetiopathogenesis; clinical features; laboratory features, differential diagnosis; management and prevention.
2. Megaloblastic anaemia: Vitamin B12 metabolism, Folate metabolism; causes and pathogenesis of megaloblastic; clinical features; laboratory features, differential diagnosis; management and prevention
3. Iron overload: aetiology; pathogenesis; laboratory diagnosis, clinical features and management. Chelating agents in iron overload
4. Bone marrow failure: Aplastic anaemia, causes, laboratory and clinical features, management
5. Bone marrow failure: Fanconi anaemia, pure red cell aplasia

Module 3: Transfusion Medicine and Haemolytic Disease of the Newborn

Topic

1. The Blood bank: organization, infrastructure & basic equipment, counseling room, bleeding room, donor resting room
2. Blood donor organisation: donor organisers, phlebotomists, types of blood donors, donor care
3. Donor blood screening for transmissible infections: HBV, HCV, HIV, Syphilis, etc.
4. Medical screening of blood donors; Bleeding room procedures
5. Grouping antisera: sources; avidity; antigen/antibody reaction enhancing agents
6. Laboratory procedures: ABO and Rhesus blood grouping (Tile and Tube techniques); antibody screening, direct and indirect anti-human globulin tests, Cross matching;
7. Laboratory procedures: Component preparation, red cell concentrates, fresh frozen plasma (FFP), frozen plasma (FP), platelet concentrates, cryoprecipitate, etc.; indications for component use

8. Clinical transfusion practice: checking of donor/recipient data at bed side; hazards of blood transfusion, investigation and management of transfusion reactions
9. Red cell substitutes
10. Parentage dispute and blood group serology
11. Haemolytic disease of the newborn (ABO, Rhesus, others): diagnosis and management
12. Laboratory safety and quality assurance in transfusion practice

Module 4: Haemolytic Anaemias (acquired and inherited)

Topic

1. Haemolytic anaemias: Classification, laboratory and clinical features
2. Haemoglobinopathies: Sickle cell disorders, aetiopathogenesis, incidence, diagnosis, management
3. Haemoglobinopathies: Thalassaemic syndromes, aetiopathogenesis, incidence, diagnosis, management
4. Inherited haemolyticanaemias: G6PD deficiencies, hereditary spherocytosis, hereditary elliptocytosis. Diagnosis and management
5. Acquired haemolyticanaemia: malaria, septicaemia and other infections
6. Acquired haemolyticanaemia: Paroxysmal nocturnal haemoglobinuria (PNH)
7. Immune haemolyticanaemia: Autoimmune haemolyticanaemia
8. Laboratory methods other than haemoglobin electrophoresis: Direct and indirect antihuman globulin tests; osmotic fragility test; acidified-serum lysis test (Ham's test), Schumm test

Module 5: Haemostasis and Bleeding Disorders, Acquired immune deficiency syndrome

Topic

1. Physiology of haemostasis, coagulation and fibrinolysis
2. Platelets structure and functions
3. Aetiopathogenesis of bleeding and thrombotic disorders
4. Thrombophilia: Congenital and Acquired. Causes, investigations and treatment
5. Inherited bleeding disorders
6. Acquired bleeding disorders

Anticoagulant therapy, other methods of management of bleeding & thrombotic disorders

7. Laboratory techniques: PT and INR; APTT; TT; fibrinogen assay
8. Laboratory techniques: Platelet function studies (bleeding time, aggregation tests, etc.)
9. Laboratory techniques: specific factor assays (VIII & IX); identification of inhibitors; assays of proteins C & S, antithrombin III and lupus anticoagulant. Heparin assay
10. Acquired immunodeficiency syndrome
11. Laboratory procedures: HIV screening techniques, CD4 counting techniques, PCR techniques and Viral load in infants and adults living with AIDS.

Module 6: Haematologic Malignancies: Lymphoproliferative, Myeloproliferative & Plasma Cell Disorders

Topic

1. Aetiopathogenesis
2. Classification, staging, prognosis
3. Clinical presentation, investigation, complication
4. Laboratory diagnostic methods: Fine needle aspiration (FNA) and histologic biopsy of tissues; cytochemistry and immunophenotyping of tumour cells; cytogenetic characterisation of tumour cells;
5. General investigations of haematologic cancers: FBC, ESR, Serum biochemistry including LFTs, Viral screening (HBV, HCV & HIV), Radiology (chest X-ray, ultrasonography, computed tomography, magnetic resonance imaging (MRI), etc.
6. Cancer chemotherapy and cancer immunotherapy
7. Targeted therapy in haematologic cancers
8. Treatment of haematologic cancers
9. Common childhood tumours

Module 7: Paediatric and Obstetrics Haematology

Topic

1. Inherited and acquired anaemias in pregnancy
2. Inherited and acquired bleeding disorders in pregnancy
3. Management of venous thromboembolism in pregnancy
4. Management of haematological disorders in pregnancy
5. Inherited and acquired bleeding disorders in children

6. Haemoglobinopathies and other anaemias in children
7. Haematological malignancies in children

SENIOR RESIDENCY TRAINING (SRT)

7.9 LEARNING OBJECTIVES FOR SENIOR RESIDENCY

1. Understanding the principles of refrigerated centrifuge, cell separators, and apheresis machines
2. Understanding and solving paternity disputes
3. Understanding the principles of high performance liquid chromatography
4. Have an understanding of the process of equipment selection, purchase and maintenance
5. Understanding the processes involved in laboratory and hospital management and the role of Haematologists as managers
6. Have an understanding of quality assurance, quality control including total quality management
7. Understanding the processes involved in setting up a blood bank at primary, secondary and tertiary levels including solving problems of supply
8. Understanding the principles underlying teaching and training
9. Understanding the processes involved in tissue transplantation
10. Understanding the role of molecular biology in the diagnosis and management of haematological disorders
11. Understanding the processes involved in planning, executing and reporting a research project as well as grantmanship
12. Understanding the principles of ethics in medical practice and biomedical research
13. Understanding practical and theoretical differences in laboratory management and technical procedures when dealing with neonatal and Paediatric samples.

This includes: understanding

i. The significance of age related reference ranges

ii. Small volume sample integrity and sample processing

iii. Cross-matching/provision of blood products for neonates

iv. Differences in morphological features in Paediatric blood films compared to adults.

8.0 COMPETENCIES FOR SENIOR RESIDENCY

At the end of the Senior Residency Training, the trainee must be proficient in the:

1. Use of Refrigerated centrifuge for preparation of blood products
2. Use of apheresis machines
3. Administration of parenteral chemotherapeutic agents
4. Ability to make clinical judgment in difficult situations
5. Use of PCR Machine
6. Interpretation of haematology results and giving clinical advice
7. Setting questions and grading of scripts

8.1 TEACHING/CURRICULUM FOR SENIOR RESIDENCY TRAINING

Candidates undergoing senior resident postings are expected to have a sound theoretical and practical knowledge of haematological practice but will not have had a great deal of unsupervised experience in applying that knowledge. The second phase of training is thus devoted to acquiring this self-sufficiency in the specialty. There will also be exposure to management issues and the trainee should be involved in the teaching of medical and paramedical students, as well as supervision of junior residents.

This phase will also be used by the trainee to expand interests in particular aspects of haematology and to develop a wider expertise in these aspects e.g. haemato-oncology, haemostasis and transfusion medicine.

If possible, and if desired by the trainee, more extended time can be spent in sub-speciality training. In addition part of this time (12 – 24 months) should be used for a relevant clinical and laboratory-based research project approved by the NPMC that will be presented in part fulfilment of the FMCPath Part II examination.

8.2 Required Facilities for Senior Resident Training

1. Specified out-patient duties with the opportunity to see new patients, determine the diagnostic approach and therapy appropriate to their condition. There will be close collaboration with consultant colleagues and referring medical colleagues. Such experience is essential.
2. Increasing opportunity to oversee the care of in-patients. There must be regular, structured strategic discussion over management policy between consultants, trainee, nursing and paramedical staff so that the trainee acquires the skills needed for effective team work.
3. The opportunity to be actively involved in the daily management of the Haematology laboratory with full participation in management discussions. Trainees should be encouraged to attend appropriate management courses. Such management instruction should include laboratory computer systems, quality control, audit, potential of automation and near patient testing.
4. Familiarity with radiation techniques and the use of radioisotopes where possible.
5. Regular update discussions of academic and practical aspects of haematology including the availability of appropriate journals.
6. Rotations at this level of training shall include blood transfusion, internal medicine, paediatric haematology and haemostasis for which secondment to other departments/centres may be necessary. The actual details and duration of exposure to each specialty should be a minimum of three months.

Addition Formal/Informal training

1. Blood transfusion practice including the identification of antibodies; methods for preparing leukocyte depleted blood products and their use; identification and management of auto-antibody diseases, both warm and cold; methods of HLA typing. There should be instruction in methods for preparing blood components and in available techniques for rendering blood products safer from virus contamination and transmission. A formal blood transfusion course of four weeks would be appropriate.
2. Formal and informal instruction in indication, techniques and problems of allogeneic and autologous haemopoietic progenitor cell transfusions. Trainees should have experience in a transplant unit during this year.

3. More detailed instruction in clinical and laboratory aspects of coagulation including specific factor assays, identification of inhibitors, techniques for measuring protein C, S, antithrombin III, lupus anticoagulant and such additional factors as from time to time become important. This practical experience should be linked to instruction in the theory of coagulation and fibrinolysis.
4. Clinical and laboratory aspects of platelet disorders including numerical and functional abnormalities and the use and limitation of platelet function studies. Such practical experience needs to be linked to an understanding of platelet function and interaction with vessel wall. Mechanisms and use of antiplatelet drugs.
5. Clinical and theoretical instruction in radioisotope methods in haematology. Clinical experience means knowledge of the usefulness of isotopes in clinical practice and interpretation of results. It is not necessary at this stage to have 'hands-on' experience.

Basic theoretical and interpretative knowledge of radioisotope tests is desirable during the training and trainees who wish to obtain more experience are encouraged to do so.

Before signing trainees for examinations, trainers may use reasonable procedure to determine the readiness of otherwise of the candidate for the said examination.

MEDICAL MICROBIOLOGY

JUNIOR RESIDENCY

8.3 OBJECTIVES OF THE TRAINING IN MEDICAL MICROBIOLOGY

The objectives of the programme are in line the general objectives of training in Pathology, and include but are not limited to:

1. Provide understanding of the general characteristics of infectious agents and their pathogenesis and diseases
2. Provide a broad understanding of the diagnosis and management of infectious disease from a clinical and laboratory perspective
3. Acquire the diagnostic techniques required in the practice of clinical microbiology
4. Acquire understanding of the areas of clinical microbiology - bacteriology, immunology and genetics, infection control, virology, mycology, parasitology and public health
5. Acquire the communication skills required for the practice of clinical microbiology and the teaching skills necessary for effective practice
6. Acquire the management skills required in the running of the microbiology laboratory, the practice of clinical governance and audit as well as quality management system.
7. Knowledge of the health protection aspects of clinical microbiology such as infection prevention and control, surveillance of health care associated infection, antibiotic stewardship etc.
8. Experience of research and development projects and critical assessment of published work so as to contribute in a team and individually to the development of the service

9. The acquisition of life-long habits of reading, literature searches, consultation with colleagues, attendance at scientific meetings, and the presentation of scientific work that are essential for continuing professional development (CPD)

8.4 COMPETENCIES FOR JUNIOR RESIDENCY

Competencies expected to be acquired at this stage of the programme shall include ability to

1. Appropriately collect, transport and store patients' specimens
2. Analyze/process all types of samples received from patients.
3. Use basic equipment such as microscopes, weighing balance, ELISA reader and washer, water bath, autoclave, centrifuge, incubators, counting chamber, and other manual and automated equipment available in the laboratory for the purpose of appropriately processing patients/clients specimens.
4. Prepare and use basic Microbiological/Parasitological stains and media.
5. Appropriately select culture media for the appropriate specimens and also incubate under appropriate atmosphere, temperature and duration.
6. Isolate discrete bacterial colonies on the appropriate media
7. Identify pathogenic organisms contained in specimens
8. Perform simple and special stains like Gram stain, Acid Fast Stains, Auramine stains, H/E stains etc.
9. Perform standard antibiotic sensitivity testing with appropriate controls and correctly interpret the results and generate reports for the clinician/customer.
10. Evaluate quality of specimen, and advise clinicians on the appropriateness of samples for an infectious disease condition.
11. Handle issues concerning laboratory safety.

12. Document specimen data in the laboratory information system and retrieve same with ease when the need arises
13. Manage infections like malaria, tuberculosis, sepsis, pneumonia, meningitis, blood stream infections, sexually transmitted infections, pyogenic infections, typhoid, dysentery, ulcers, urinary tract infection, infective diarrhoea, HIV, etc.
14. Take clinical and pathology services (medical) laboratory call duties with little supervision
15. Describe the basic structure of bacteria, viruses, parasites, fungi and the principles of immunology
16. Describe the pathogenesis, virulence factors, diseases, epidemiology, clinical features, laboratory diagnosis, management, prevention and control of bacterial, viral, parasitic, fungal and immunological diseases especially those prevalent in the tropical and sub-Saharan environments

8.5 LEARNING METHODS

Seminars, Tutorials, Workshops, Conferences; residents are encouraged to attend local and international conferences, Grand rounds, Laboratory rounds, Ward rounds, Self-directed learning, Hands on laboratory processes and procedure, and periodic involvement in sample processing, Training available through equipment and kit manufacturers, Call duties, Rotations in other departments, (Call duties, grand rounds, laboratory rounds, ward rounds, bench procedure, all constitute based experiential learning)

8.6 Rotations and routines

The resident will be required to be instructed in the major clinical and laboratory aspects of Medical Microbiology all through the period of training.

All residents in Medical Microbiology and Parasitology will rotate through all sections of the laboratory including the bacteriology, mycobacteriology, mycology, parasitology, virology, immunology and molecular laboratories/benches. They will also be involved

in patient management. Clinical and laboratory calls are mandatory and critical components of the training. The resident shall also participate in the running of Infectious diseases/Sexually transmitted infections (STIs) clinics.

Training departments will design their weekly routines to include laboratory bench procedures and result interpretations, seminars/tutorials, call duties, bench/ward rounds, clinics etc.

8.7 COURSE CONTENT: JUNIOR RESIDENCY PROGRAMME

COURSES	SPECIFIC TOPICS/ PROCEDURES
INTRODUCTION TO GENERAL & CLINICAL MICROBIOLOGY	Classification of micro-organisms Bacterial structure and function Growth, nutrition and cultivation of bacteria Bacterial Genetics Normal Body Flora Sterilization and Disinfection Safety Procedures in the Laboratory Culture media: Basic composition, classification and importance in classification of micro-organisms Antimicrobial Agents Antimicrobial susceptibility testing Rational Antibiotic Use Antibiotic Resistance Sepsis Syndromes /Septic Shock Infections of the Respiratory Tract Central Nervous System Infections Gastrointestinal Tract Infections SexuallyTransmitted Infections and Urinary Tract Infections Viral Hepatitis

	Haemorrhagic fevers Infections in Neutropenic/Immunocompromised Hosts Nosocomial Infections Zoonosis and Reverse Zoonosis Skin, Soft Tissue and Infections Laboratory diagnosis of microbial infections

COURSES	**SPECIFIC TOPICS/ PROCEDURES**
INTRODUCTION TO GENERAL & CLINICAL MICROBIOLOGY	Classification of micro-organisms Bacterial structure and function Growth, nutrition and cultivation of bacteria Bacterial Genetics Normal Body Flora Sterilization and Disinfection Safety Procedures in The Laboratory Culture media: Basic composition, classification and importance in classification of micro-organisms Antimicrobial Agents Antimicrobial susceptibility testing Rational Antibiotic Use Antibiotic Resistance Sepsis Syndromes /Septic Shock Infections of the Respiratory Tract Central Nervous System Infections Gastrointestinal Tract Infections SexuallyTransmitted Infections and Urinary Tract Infections Viral Hepatitis Haemorrhagic fevers

	Infections in Neutropenic/Immunocompromised Hosts	
	Nosocomial Infections	
	Zoonosis and Reverse Zoonosis	
	Skin, Soft Tissue and Infections	
	Laboratory diagnosis of microbial infections	
BACTERIAL PATHOGENS ANDASSOCIATED DISEASES	Staphylococci	Staphylococcus: *Staphylococcus aureus* and Coagulase negative Staphylococci
	Streptococci and Enterococcus	Streptococcus General classification, Lancefield classification, Anaerobic cocci Enterococci
	Gram positive anaerobic bacilli of clinical significance	Bacillus Listeria Corynebacteria *Erysipelothrixrhusiopathiae*
	Gram negative cocci of medical significance	Pathogenic Neisseria *Neisseria meningitides* *Neisseria gonorrhoeae* Non-pathogenic Neisseria and Moraxella

Enterobacteriaceae	*E.coli*,Klebsiella, Enterobacter, Proteus, Salmonella, Shigella, Serratia Yersinia other genera
Fastidious gram negative rods	Haemophilus organisms Brucella HACEK organisms
Spiral (curved or S-shaped) gram negative rods	Vibrio Helicobacter Campylobacter
Pseudomonads and similar rods	Pseudomonas *Stenotrophomonas, Burkholderia, Aeromonas, Acinetobacter*
Atypical bacteria	Chlamydiae Spirochetes: Treponema, Borrelia, Leptospira Rickettsial Diseases Legionella/Bartonella/ Bordetella/Francisella Actinomyces and Nocardia

		Mycoplasma and Ureaplasma
	Anaerobes	Clostridium Bacteriodes, Prevotella, Porphyromonas, Fusobacterium
	Mycobacteria	M. tuberculosis, M. tb complex, M. avium complex M. leprae, Nontuberculous Mycobacteria
	Laboratory diagnosis of bacterial infections	
PARASITIC INFECTIONS	Classification of Parasitic Diseases	
	Protozoa and diseases	Entamoeba: *E. histolytica, E. coli, E. hartmanni* Free Living Amoeba: Acanthamoeba, Naegleria, Giardia lamblia, Balantidium coli Cryptosporodia,Isospora, Cyclospora Trichomonas Plasmodia Trypanosomiasis:

	East and West African, South American Leishmaniasis: Cutaeneous, Visceral, Mucocutaeneous
	Toxoplasmosis
Nematodes and diseases	Hookworm*:* *Necatoramericanus* and *Ancylostomaduodenale*
	Strongyloidiasis, Myiasis
	Trichuristrichuria
	Ascariasis, Enterobius
	Trichinella
	Toxocariasis
	Cutaeneous larva migrans, Visceral larva migrans
	Brugia, Loasis, ,Onchocerciasis, Wuchereria, Dracunculus
Cestodes and diseases	Taeniaspp
	Diphyllobothrium
	Echinococcus
	Hymenolepsis, Spirometra
	Schistosomiasis

	Trematodes and diseases	Fasciolaspp, *Fasciolopsisbuski* *Paragonimuswestermani* *Clonorchissinensis*
	Vectors and diseases	*Insect*
	Laboratory Diagnosis of Parasitic Diseases	
MYCOLOGY AND MYCOSES	General properties and Classification of Fungi	
	Superficial mycoses: Pityriasisversicolor, Tineanigra, White Piedra, Black piedra	
	Cutaneous mycoses: Dermatophytosis Candidiasis of skin, mucosa, or nails	
	Subcutaneous mycoses: Sporotrichosis, Chromoblastomycosis, Mycetoma, Phaeohyphomycosis	
	Systemic mycoses: Coccidioidomycosis, Histoplasmosis, Blastomycosis, Paracoccidioidomycosis	
	Invasive fungal infections	
	Opportunistic mycoses: Systemic candidiasis Cryptococcosis, Aspergillosis, Mucormycosis	
	Antifungal Drugs	
	Laboratory Diagnosis of Fungal Diseases	
VIROLOGY AND ASSOCIATED	Properties and Classification of Viruses	
	Hepatitis Viruses and diseases	
	Herpesviridae and diseases	

INFECTIONS	Papillomaviridae and diseases
	Poxviridae and diseases
	Adenoviridae and diseases
	Polyomaviridae and diseases
	Parvoviridae and diseases
	Picornaviridae and diseases
	Reoviridae andCaliciviridae and diseases
	Coronaviridae and diseases
	Flaviviridae and diseases
	Filoviridae and diseases
	Rhabdoviridae and diseases
	Orthomyxoviridae and diseases
	Paramyxoviridae and diseases
	Arenaviridae and diseases
	HIV and other retroviruses and diseases
	Antiviral Therapy and diseases
	Other RNA viruses and diseases
	Prions
	Diagnostic Techniques for Viral Infections
IMMUNOLOGY	Innate Immunity
	Acquired Immunity
	Humoral Immunity
	Cell Mediated Immunity
	Disorders of Immunity
	Vaccines and Immunization
	Immunological/Serological Diagnosis of Microbial Infections in the laboratory

8.8 Training Portfolio for junior residency

The training portfolio serves as a documented summary of essential activities that the resident has been involved in or undergone. All hard copies need to be filed in the portfolio and a summary should be compiled and placed as the 1st page within the portfolio. It is the resident's responsibility to keep records up-to-date. The supervisor should review and sign off completed portfolio summary sheet. The portfolio needs to be presented at the examination venue at the beginning of each fellowship examination which will be reviewed by the chief examiner or designee. The signatories may be contacted to confirm evidence of satisfactory completion.

Portfolio contents for Junior Residency

1. Evidence of admission into the residency programme and acceptance of offer
2. Copies of letters of posting for rotation
3. Evidence of satisfactory completion of rotations
4. Evidence of assessments undertaken
5. Evidence of examinations taken and results
6. Attendance at updates, courses, workshops, conferences
7. Evidence of conference presentation (local /international)
8. Copy of annual performance and evaluation form

8.9 LEARNING METHODS

Teaching

Seminars

Tutorials

Work-based experiential learning (Call duties, grand rounds, laboratory rounds, ward rounds, bench procedure)

Participation in meetings including management meetings in the department

Workshops

Presentations at local and international conferences

Journal review

Clinico-pathological meetings

Interdepartmental meetings

Participation in outbreak control activities

Self-directed learning

Hands on laboratory processes and procedure, and periodic involvement in sample processing

Training available through equipment and kit manufacturers

Call duties

Rotations in other departments

A minimum of four hours/week should be devoted to lectures/seminars/tutorials, sixteen hours/week to bench (laboratory) work and twelve hours to clinical work.

Active training for senior residency shall be for a minimum of 156 weeks. In addition a resident shall take a minimum of 32 hours of call duties per week leading to a minimum total of 4992 hours.

9.0 Rotations and routines

The duration of this phase of the programme is a minimum of thirty six months of active training (excluding periods of interruption and annual leave). Residents shall also undergo an eight weeks rotation in internal medicine (infectious diseases and dermatology), four weeks in paediatrics (NICU/SCBU/EPU/IDU), and two weeks each in trauma, burns and adult ICU. Residents shall also engage in approved research work leading to the production of dissertation.

Weighing (credit units)

Twelve (12) hours of teaching/seminar/tutorial constitute a unit, while forty five (45) hours of experiential based learning (Call duties, grand rounds, laboratory rounds, ward rounds, bench procedure) constitute one credit unit

9.1 COMPETENCIES FOR SENIOR RESIDENCY

At the completion of the training the Resident should be able to:

1. Effectively and efficiently manage and or direct any level of clinical laboratory
2. Institute and apply quality management system in the laboratory

3. Effectively and efficiently deploy human and material resources to achieve institutional objectives
4. Troubleshoot problems and non-conformities in the laboratory, and perform all laboratory tests in clinical laboratory, and demonstrate higher levels of competences stated in the part I section,
5. Deploy new technologies, processes and procedures in the laboratory
6. Manage complicated infectious disease cases such as Pneumonias, Meningitis, Tuberculosis, HIV, STIs, UTIs, Blood stream Infections, other CNS infectious, Malaria and other systemic and local infections.
7. Demonstrate full understanding and show competence in the investigation and control of outbreaks.
8. Demonstrate understanding antimicrobial resistance issues including but not limited to surveillance and containment, as well as the use of surveillance report in control of resistance
9. Demonstrate understanding of the setting up and running of infection control committee and programme.
10. Apply relevant standards and institutionalise ethical conducts in the laboratory
11. Demonstrate confidence in discussing patients' problems with colleagues in other specialties, and organise clinico-pathological conferences.
12. Organise continuing professional development for staff
13. Organise and conduct training for medical students, residents doctors and members of the allied medical professions as may be necessary
14. Demonstrate knowledge of existing regulations pertaining to the practice of medicine and Pathology

15. Demonstrate competence in basic concepts of research methodology and epidemiology, and be able to critically analyze relevant published research literature and conduct research.
16. Write a comprehensive laboratory report.
17. Organise and or lead antibiotic stewardship programmes.
18. Demonstrate ability to communicate laboratory reports to clinicians and discuss their application in the management of patients and advise on further investigations and line of management.

9.2 COURSE CONTENT OF SENIOR RESIDENCY PROGRAMME

COURSES	KNOWLEDGE AND SKILLS TOPICS
QUALITY MANAGEMENT SYSTEM	General concept of quality and Standard The Quality System Essentials Quality Assurance Quality Control Clinical/Laboratory Audit Laboratory Accreditation Laboratory Documents - quality manuals, standard operating procedures, etc Archiving Practical aspects of QMS
MANAGEMENT OF SYSTEMIC INFECTIONS	Central Nervous system infections Respiratory system Infections Gastrointestinal Infections Urinary tract Infections Cardiovascular system Infections Genital Infections Musculoskeletal infections

	Eye infections Ear, Nose and Throat Infections Skin and Soft tissue Infections Immunodeficiency States Sepsis Invasive Fungal Infection Tropical Infections Antimicrobial Therapy Laboratory Techniques/Diagnosis of Systemic Infections
CLINICAL MICROBIOLOGY IN PREGNANCY	Pregnancy and Immune system Pregnancy specific infections – toxoplasmosis; STIs, UTIs, Fungal Malaria in Pregnancy Antimicrobials in pregnancy Screening tests in pregnancy
ADVANCES IN CLINICAL MICROBIOLOGY	Emerging Infections Advances in Laboratory diagnosis of Infections Automations and New technologies
ANTIMICROBIAL STEWARDSHIP	Antimicrobial Resistance and Surveillance Setting up and sustaining of AMS programmes Antibiotics Prescribing and Audit Policy and Guidelines Antimicrobial Sensitivity Testing and Interpretation; Antimicrobial Resistance detections in the Laboratory

INFECTION PREVENTION AND CONTROL	Health care associated infections and Surveillance Infection control programmes, Policies and Guidelines Pre-exposure prophylaxis Bio-safety Bio-security Detection of MRSA, VRE, CROs, MDROs, etc
PUBLIC HEALTH MICROBIOLOGY & PREVENTIVE MEDICINE	Occupational Acquired Infections Vaccines and vaccinations Food and Water safety Community out-break management
HISTORY TAKING & CLINICAL EXAMINATION	Communication skills-Due courtesies Proper sequence in history taking-attention to details Proper review of systems Legible documentation in summary sheet
RESARCH METHODOLOGY AND DISSERTATION	Literature reviews Systemic reviews and Meta-analysis Study designs Referencing Sampling techniques Grantsmanship Bio-statistics and Epidemiology Dissertation

GENOMICS/ BIOINFORMATICS	Extraction/Purification techniques –DNA, RNA, Protein Hybridisation Amplification Typing, Sequencing and Analysis Detection methods – electrophoresis, mass spectrometry etc Laboratory techniques Molecular Diagnosis
LEADERSHIP & MANAGEMENT	Human resource management Communication skills and Advocacy Health Related Acts, Regulations and Policies Clinical governance and professional practice Medical Ethics and laboratory practice Finance Management
SEXUALLY TRANSMITTED INFECTIONS	Bacterial Viral Fungal Parasitic Social aspects of STIs Laboratory Diagnosis of STIs

9.3 Assessments for senior residency

The resident will be assessed in a number of different ways during the programme and must pass the yearly in course assessment as one of the requirements for satisfactory completion of this stage of residency.

Assessments should be done regularly without significant disruption to workplace productivity. It is important to refer to the detailed portfolio requirements.

Residents must submit to the College a supervisor endorsed report for each year of training, including periods of rotation. Copies of all reports should be kept in the portfolio.

Workplace-based assessment

Workplace-based assessment allows the resident to be assessed at regular intervals in the workplace by an appropriately trained, qualified and experienced assessor.

Residents will be expected to undertake workplace-based assessment throughout the entire duration of their training in medical microbiology.

Trainers have responsibility for initiating the workplace-based assessments and ensuring that they have completed the required number by the required dates.

Residents can also identify suitable opportunities to have their competence assessed by a qualified assessor and provide the appropriate form.

Residents will be evaluated weekly on the bench. Each rotation will also be assessed by bench specific objectives as outlined in the workbook.

Other assessments include:

1. Seminar presentations (Minimum of 12 per year)
2. Case-based discussions (CBD) (minimum of 6 satisfactory outcomes required per year)
3. Evaluation of Clinical/Management Events (ECE) (minimum of 4 satisfactory outcomes required per year
4. Dissertation proposal presentation and progress reports

Satisfactory outcome will be determined by the qualified and college recognized assessor.

Training Portfolio for senior residency

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which will be reviewed by the chief examiner or designee. The signatories may be contacted to confirm evidence of satisfactory completion.

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3. Evidence of satisfactory completion of rotations
4. Evidence of assessments undertaken
5. Evidence of examinations taken and results
6. Attendance at updates, courses, workshops, conferences
7. Evidence of conference presentation (local /international)
8. Ethical clearance for dissertation
9. Copy of proposal assessment report by college assessor
10. Copy of annual performance and evaluation form