NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

1 Modderfontein Road, Sandringham, 2031
Tel: +27 (0)11 386 6000

May 2020

National Institute for Communicable Diseases

Medical Scientist Intern Training Program - Microbiology

Introduction

The National Institute for Communicable Diseases (NICD) provides laboratory based surveillance and diagnostic testing for diseases of public health importance to South Africa and the Southern African region. The NICD also sends outbreak response teams to sites confronted with infectious disease epidemics. The NICD houses national and regional referral laboratories. The NICD comprises various centres, each of which focuses on different diseases and syndromes, including rabies, polio, hepatitis, measles, HIV, tuberculosis, malaria, diarrhoeal diseases, fungal diseases, antimicrobial resistance, nosocomial infections, sexually transmitted infections, respiratory diseases and meningitis. The NICD serves as an expert authority, providing advice to Department of Health and medical practitioners. The NICD is a resource to all universities and technical colleges in South Africa, with multiple training programs in place and a strong complement of university-affiliated staff. The NICD is a division within the National Health Laboratory Service (NHLS), the national public laboratory diagnostic network.

Teaching and training occurs across various centres and divisions within the NICD including: Centre for HIV and Sexually Transmitted Infections (CHIVSTI); Centre for Enteric Diseases (CED); Centre for Respiratory Diseases and Meningitis (CRDM); Centre for Tuberculosis (CTB); Centre for Healthcare-Associated Infections, Antimicrobial Resistance and Mycoses (CHARM); Centre for Emerging Zoonotic and Parasitic Diseases (CEZPD); Centre for Vaccines and Immunology (CVI); Division of Biosafety and Biosecurity; and Division of Public Health Surveillance and Response.

Centre for HIV and Sexually Transmitted Infections (CHIVSTI)

The Centre for HIV & Sexually Transmitted Infections (STI) is a resource of knowledge and expertise in HIV and other regionally relevant STIs to the South African Government, to SADC countries and to the African continent at large, in order to assist with the planning of policies and programs related to the control and effective management of HIV/STIs. The Centre also aims to be a place of academic excellence in terms of both research and teaching/training. The Centre has a strong track record in the research disciplines of HIV virology, HIV immunology, HIV/STI epidemiology, HIV/STI diagnostics and HIV-STI interactions, as well as in successful supervision of PhD and MSc students.

Laboratory techniques/tests offered:

- Phenotypic identification of *Neisseria gonorrhoeae* (culture, Gram stain and biochemical tests)
- *N. gonorrhoeae* antimicrobial susceptibility testing (E-Test and agar dilution)
- Nugent scoring for the diagnosis of bacterial vaginosis on Gram-stained smears
- Detection of Donovan bodies in Giemsa stained smears

- Real time molecular identification of genital discharge causing pathogens: *N. gonorrhoeae, Chlamydia trachomatis, Mycoplasma genitalium and Trichomonas vaginalis*
- Real time molecular identification of genital ulcer causing pathogens: Herpes Simplex Virus (HSV), *Haemophilus ducreyi, Treponema pallidum* and *Lymphogranuloma venereum*
- Serological assays for: *T. pallidum* (RPR, TPAb and TPPA), HSV- 2 (ELISA)

Assignments/Assessments:

- Participation in all routine laboratory tests
- Participation in all quality assurance activities
- Participation in all teaching activities
- Research project(s): interns will be given small semi-independent research project(s) which would usually take 2-4 months to complete
- Presentations: interns will be expected to attend all NICD scientific presentations and CHIVSTI journal club meetings. Interns will be expected to participate and give presentations at these meetings
- Meetings and report back to manager, head of department and senior medical scientist: Interns will have discussion, feed-back, verbal assessment and question/answer sessions

Centre for Enteric Diseases (CED)

The Centre for Enteric Diseases (CED) is concerned with activities related to surveillance of pathogens associated with diarrhoea and enteric fevers, and investigation/response to enteric disease outbreaks (including foodborne and waterborne disease outbreaks). CED is tasked with developing strategies and providing information to combat diarrhoeal diseases in South Africa. CED monitors trends in diarrhoeal pathogen incidence and identifies areas for the introduction of additional interventions.

The bacterial division of the CED collects data on patients presenting throughout South Africa with both invasive and non-invasive disease caused by *Salmonella* species (including *Salmonella* Typhi), *Shigella* species, *Vibrio cholerae*, *Listeria monocytogenes* and diarrhoeagenic *Escherichia coli*. In order to make these data representative and reflective of disease burden in each province in the country, we actively motivate all diagnostic laboratories throughout the country to voluntarily submit limited demographic details and isolates to us centrally. In exchange, we offer serogrouping and serotyping results, regular feedback (quarterly reports by province sent to every laboratory participating) and aggregated numbers are published in the NICD Bulletin. In addition to serogrouping and serotyping, E-tests are used to determine the minimum inhibitory concentration (MIC) of each isolate to antimicrobial agents, according to CLSI guidelines. The bacterial division also performs genotypic characterization of isolates, which includes various PCR tests and whole-genome sequencing (WGS) analysis. PCR tests are used to assist with diagnosis of particular pathogens and elucidate the presence of particular virulence (toxin) genes, such as those found in toxigenic *E. coli* and toxigenic *V. cholerae*. The molecular epidemiology of some bacterial pathogens is continually being elucidated, specifically that of outbreak or epidemic-prone pathogens such as *Salmonella* Typhi, *L. monocytogenes* and *V. cholerae* O1. The molecular epidemiology of bacterial pathogens is investigated via WGS. Analysis of WGS data is used to assess the genetic relatedness of isolates, for investigation of clusters and outbreaks. Core-genome multi-locus sequence typing (cgMLST) and single nucleotide polymorphism (SNP) analysis, are the two most commonly used tools to assess the genetic relatedness of isolates. These WGS data are interpreted together with epidemiological data to assist with investigation of outbreaks and identification of the source of outbreaks.

Laboratory tests offered (bacteriology division of the CED):

- *Salmonella* species: identification, serotyping and antimicrobial susceptibility testing
- *Shigella* species: identification, serotyping and antimicrobial susceptibility testing
- *V. cholerae* (O1 and non-O1): identification, serotyping and antimicrobial susceptibility testing

- Diarrhoeagenic *Escherichia coli*: identification (via conventional PCR to detect for virulence genes), serotyping and antimicrobial susceptibility testing
- *Listeria monocytogenes*: identification and antimicrobial susceptibility testing
- Stool processing to extract DNA and RNA
- *Campylobacter* species: real-time PCR identification
- *V. cholerae* and cholera toxin: real-time PCR identification
- *Salmonella* species, *Salmonella* Typhimurium and *Salmonella* Enteritidis: real-time PCR identification
- Whole-genome sequencing (WGS) of bacteria
- Metagenomics analysis of specimens
- Analysis of WGS data to investigate the genetic relatedness of bacterial isolates
- Analysis of WGS data using multi-locus sequence typing (MLST), core-genome MLST and single nucleotide polymorphism analysis
- Analysis of WGS data to investigate clusters of isolates and investigate outbreaks

Training activities, assignments and assessments (bacteriology division of the CED):

- Participation in all routine laboratory tests
- Participation in all quality assurance activities
- Participation in all teaching activities
- Research project(s): interns will be given small semi-independent research project(s) which would usually take 2-4 months to complete. Research projects should culminate in submission of a short internal report (3-6 pages) or preparation of a manuscript for publication in a peer-reviewed journal
- Presentations: interns will be expected to attend all NICD scientific presentations and CED journal club meetings. Interns will be expected to participate and give presentations at these meetings
- Meetings and report back to managers: interns will have monthly meetings with their principle trainer to have discussion, feedback, verbal (oral) assessment and question/answer sessions

Centre for Respiratory Diseases and Meningitis (CRDM)

The Centre for Respiratory Diseases and Meningitis (CRDM) is a resource of surveillance, diagnostics, expertise and research in the field of communicable respiratory diseases and meningitis for South Africa and the African continent. The centre generates data and provides expertise related to respiratory diseases and meningitis of public health importance to the South African National Department of Health, health care providers, regional and international collaborators, to assist with the planning of public health policies and programs and response to respiratory disease and meningitis outbreaks. The CRDM is also a source of capacity building and formal training within South Africa and the African region.

Microbiology laboratory techniques/tests offered:

- Phenotypic (culture, Gram stain, biochemical tests, serotyping/grouping) identification and characterisation of *Neisseria meningitidis*, *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Corynebacterium diphtheriae, Streptococcus agalactiae* and *Streptococcus pyogenes*
- Antimicrobial susceptibility testing (disc diffusion, E-Test, broth dilution)
- Molecular (real-time PCR) identification and serotyping/grouping of *N. meningitidis, H. influenzae, S. pneumoniae, C. diphtheriae, S. agalactiae* and *S. pyogenes*
- Real-time PCR identification of atypical pneumonia-causing pathogens – *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae, Legionella* spp., *Bordetella pertussis*
- Molecular strain characterisation using multilocus sequence typing (MLST) and whole genome sequencing of bacterial and viral pathogens causing respiratory disease
- Multi-pathogen/syndromic PCR panels for detecting a range of respiratory pathogens (bacteria and viruses)

- Syndromic surveillance for pneumonia and influenza-like illness (influenza and RSV)
- Covid-19 PCR
- Serology – exposure to flu/RSV/Covid-19 serology testing (theoretical and observational)

Assignments/Assessments:

- Phenotypic – interns will be given 'spots' i.e. agar plates with bacterial cultures and will have to identify and characterise independently
- Molecular/genotypic – this is ongoing as interns are included in the bench rotations for the 2-year period so perform the tests routinely throughout the duration of the internship (all results authorised by senior staff).
- Routine participation in quality management activities/tasks and technical audits (internal and/or SANAS), including raising of and resolution of non-conformances, participation in EQA. Tutorials – interns attend a series of departmental tutorials where they actively participate on a Q&A basis or are given tasks associated with the particular topic
- Mini-project – interns will carry out a research project or validation exercise. MSc and PhD interns are generally exempt from research projects.
- Interns actively participate in and present at the weekly journal club, attend monthly research forum at the NICD, academic days etc. Where possible and depending on the timing, opportunities for local conference attendance will be provided (e.g. FIDSSA) and interns are encouraged to submit an abstract

Centre for Tuberculosis (CTB)

- Sputa or other extra-pulmonary samples, culture isolates (liquid & solid media) – sample registration, preparation and processing
- Microscopy and staining techniques for Auramine and Ziehl Nielsen (ZN) Stain – smear preparation, staining and microscopic examination of sputa and culture isolates (morphology)
- TB Culture MGIT 960 – decontamination and processing. MGIT 960 operation and result interpretation.
- TB Culture Middlebrook 7H10/11 & Lowenstein Jensen
- MGIT MTB complex identification – perform and interpret rapid chromatographic immunoassay for qualitative detection of MTB complex antigen
- MGIT 960 Drug Susceptibility Testing (DST) – preparation of dilutions for MTB isolates, inoculation of drugs (1^{st}, 2^{nd} and new and repurposed drugs) and MTB isolates, Epicenter and MGIT 960 result interpretation
- Phenotypic Minimum Inhibitory Concentration testing
- Perform Molecular assays for genotypic drug resistance predication and species identifications
- Sequencing applications

Assignments/Assessments:

A written assessment will be performed according to rules and regulations stipulated by the HPCSA at the end of the rotation at the Centre for Tuberculosis. Ongoing assessment will consist of a group topic review, journal presentation and evaluation report of the intern scientist by their direct supervisor. The report will be based on the interim portfolio being collated by the intern (see below) as well as an evaluation of his/her general laboratory demeanour including:

- Attention to good laboratory practice
- Participation in academic activities
- Laboratory expertise acquired
- Personal interaction with other staff members
- Research work

- Presentation skills
- Interns assigned to the Centre for Tuberculosis are expected to complete mini-project/s and submit a report

The evaluation report will be discussed in full with the scientist and relevant feedback given during a contact session. Opportunities for improvement will be discussed and noted.

Centre for Healthcare-Associated Infections, Antimicrobial Resistance and Mycoses (CHARM)

The Centre for Healthcare-Associated Infections, Antimicrobial Resistance and Mycoses (CHARM) hosts two national reference laboratories and is supported by an epidemiology section. The Centre aims to prevent and monitor changes in infectious micro-organisms causing Healthcare-associated Infections and Mycoses through the following functions:

- Strategic information obtained through surveillance and research of antimicrobial-resistant bacterial and fungal pathogens and providing feedback to the Department of Health and other relevant stakeholders
- Conduct surveillance and public health research for mycoses and Healthcare-associated Infections
- Use surveillance data to support the development of standard treatment guidelines for certain infectious diseases and to evaluate relevant public health programmes
- Improve access to essential medicines and diagnostics including identification of emerging pathogens
- Diagnostic laboratory services for identification, susceptibility testing and genotyping of bacteria and fungi
- Provides specialist advice during outbreak situations and offers laboratory support for outbreak response
- Training for clinical, laboratory and public health personnel to ensure optimal diagnosis and control of diseases
- Provides Proficiency testing schemes (PTS) in a form of External Quality Assessments (EQA)
- Serve as a repository of reference bacterial, fungal and mycobacterial strains

Microbiology laboratory techniques/tests offered:

- Phenotypic, mass spectrometric and sequence-based identification of unknown bacteria and fungi
- Antimicrobial susceptibility testing of bacteria, yeasts and moulds
- Molecular methods for diagnostics, surveillance and research on the micro-organisms relevant to the Centre's functions which include:
  - DNA extraction (manual)
  - Conventional and real-time PCR assays
  - Genotyping: Pulsed field Gel Electrophoresis analysis of Healthcare-associated pathogens
  - Sanger sequencing
  - Whole genome sequencing
  - Bioinformatic analysis

Assignments/Assessments:

- Routine microbiological testing (including molecular) – this will be ongoing as interns will be included in the staff rotation so will perform the tests routinely throughout the duration of the internship. They will perform tests under supervision until competent and all results will be authorised by senior staff
- Interns will be introduced to the laboratory quality assurance system and will be expected to maintain the systems in place including equipment maintenance, document control, training and competency, CA/PA etc
- Participation in all teaching activities
- Mini-research project – interns will carry out two research projects (one for each reference laboratory). Research projects should culminate in a short report (1-2 page summary) or preparation of a manuscript for publication in a peer-reviewed journal

- Presentation: Interns will actively participate in the monthly journal club (including presenting), monthly research forum, academic days etc
- Interns will meet with their principle trainer (Principal medical scientist) on a regular basis to discuss progress.

Centre for Emerging Zoonotic and Parasitic Diseases (CEZPD)

The Centre for Emerging Zoonotic and Parasitic Diseases (CEZPD) renders diagnostic expertise and investigatory capacity on highly dangerous bacterial and viral pathogens associated with zoonotic disease in South Africa and on the African continent. The CEZPD aims to function as a resource for knowledge and expertise to the South African government, the SADC countries and the African continent, in order to assist in the planning of relevant policies and programs and to harness innovation in science and technology to support surveillance, detection and outbreak response systems. In observing this goal, the CEZPD supports South Africa's commitment to the International Health Regulations.

Microbiology laboratory techniques/tests offered:

- Routine diagnostic methods [staining, microscopy, culturing, basic biochemical tests] for the identification of important parasites (e.g. *Plasmodium, Schistosoma, Ascaris, Taenia* etc.) and high consequence zoonotic bacteria (e.g. *Bacillus anthracis, Yersinia pestis, Brucella* spp., *Clostridium botulinum* etc)
- Molecular methods for diagnosis, surveillance and research on the organisms relevant to the Centre's functions which may include:
- DNA extraction (manual and automated)
- Conventional and real-time PCR
- RFLP, MVLA, DNA sequencing, phylogenetic analysis, genotyping
- Serological assays for diagnosis, surveillance and research on the organisms related to the Centre's functions which may include EIA, IFA, and agglutination assays
- An overview of Electron Microscopy procedures
- An overview of malaria mosquito vector rearing and the identification of medically important vectors

Assignments/Assessments:

- Phenotypic – this is ongoing as interns will be included in the staff rotation so will perform the tests routinely throughout the duration of the internship (all results will be authorised by senior staff). Interns will also participate in processing of samples for proficiency testing schemes
- Molecular/genotypic – this is ongoing as interns will be included in the staff rotation so will perform the tests routinely throughout the duration of the internship (all results will be authorised by senior staff). Interns will raise non-conformances as appropriate/necessary
- Tutorials – interns will attend a series of departmental tutorials where they will be actively participating on a Q&A basis or be given tasks associated with the particular topic
- Mini-project – interns will carry out a research project
- Interns will actively participate in the monthly journal club (including presenting), bi-monthly research forum, academic days, etc

Division of Biosafety and Biosecurity (DBB)

The Division of Biosafety and Biosecurity serves as a centralized resource for the NICD's biorisk management activities. It is responsible for ensuring institutional biosafety and biosecurity through effective risk mitigation using international industry best practices. Specific functions of the DBB include; management of institutional laboratory facilities at optimal efficiency, safety, comfort and containment, ensuring laboratories are compliant with national and international legislative requirements and safety standards and best practices,

provide advice and guidance to laboratories on biorisk management assessments as well as for the implementation and enhancement of mitigation strategies for reducing biological risks, provide training in biosafety and biosecurity in national and international arenas, engagement with international biosafety and biosecurity leaders and ensure the institution remains abreast of the latest developments in the field.

Biorisk management:

- Contribute to the development and implementation of NICD's biosafety and biosecurity policies and procedures according to national and international rules, regulations and best practices
- Coordinate and support biorisk management related activities at the NICD, for example: develop and perform biorisk assessments and audits, promote a shared culture of responsibility, reduce dual use risks, mitigate biological proliferation and deliberate use threats, and ensure safe transfer of biological agents, biorisk management training and practices, and incident response management

Biocontainment engineering:

- Ensure all containment facilities are operating within optimal established parameters through routine daily assessments and checklists
- Understand, maintain and guide repair of specialized biosafety and biosecurity engineering controls including HVAC systems, effluent waste management, chiller systems, pressure systems, building management systems, and access control, as well as biological safety cabinets and pressure suits

Assignments/Assessments:

- Lectures: Biorisk management (assessments, mitigation and performance indicators), dual use research of concern, codes of conduct and responsible science, bioethics of research, IATA shipping of dangerous infectious substances, engineering controls and PPE, safe laboratory practices
- Practical demonstrations: Interns will shadow engineering staff as they perform daily checklists in order to obtain a visual understanding of the engineering controls of a containment facility. Interns are also receiving practical training on working in a BSC, donning and doffing PPE and proper hand washing techniques (GLP)
- Class debate: a dual use dilemma scenario is prepared for the class, participants are allowed time to research and prepare arguments for or against and then have a scored debate on the scenario.
- Assignments: interns are required to write an opinion piece (with references) on what it means to be a responsible scientist and responsibility over research outcomes, and are required to perform a risk assessment of their intern research projects. Both are marked and evaluated.
- Test: IATA shipping training requires a test to be written and passed (pass mark: 70%)

Description of the overall NICD training program

Each intern medical scientist will complete a 2-year training program. The training program will comprise 18 months in a NICD host centre and a 6-month rotation through the other centres/divisions/departments at the NICD and NHLS (listed in the table below).

We have capacity to train two to three interns per NICD centre.

Summary of the NICD training program

18 months	Host centre at NICD	• CHIVSTI, NICD • CED, NICD • CRDM, NICD • CTB, NICD • CHARM, NICD • CEZPD, NICD
6 months	Rotation per other NICD centres (2-3 weeks), NICD divisions (2-4 days), and NLHS microbiology laboratories (1-2 weeks; by arrangement if feasible)	• CHIVSTI, NICD • CED, NICD • CRDM, NICD • CTB, NICD • CHARM, NICD • CEZPD, NICD • CVI, NICD • Division of Biosafety and Biosecurity, NICD • Division of Public Health Surveillance and Response, NICD • NHLS clinical microbiology laboratories

Outline of the interns training during the 18 month's term at their NICD host centre

The following general principles will be covered:

- Good Laboratory Practice: Regular training is conducted for all staff. Laboratory divisions conducting patient testing have SANAS accreditation for ISO 15189. This will include exposure to: laboratory management, quality assurance activities of the department, role of standard operating procedures and adherence to these, documentation such as quality manual, safety manual etc. This will involve an orientation program and ongoing bench exposure.
- Safety Training – regular training provided for all staff. The safety representative in the laboratory will be responsible for the training.
- General Laboratory techniques: centrifugation, pipetting, sample preparation, chain of custody, laboratory information system, sample storage, etc.

Training will ensure that the intern emerges with expert knowledge in a particular field, able to troubleshoot as well as use initiative to instigate new work in a particular area. During this time, they will be expected to spend at least 50% of their time on routine work done by the laboratory. Research projects they are doing (including the possibility of a Masters project) should fit within the remaining 50% of time.

Each centre will offer at least two modules to the intern scientist during the 18-month period. Intern scientists will be expected during this time to become proficient in running the routine assays carried out by their unit. They will become expert in the clinical indications for the assays, other testing available for related conditions, requirements and pitfalls of the assays, instrument maintenance and troubleshooting. They will be expected to attend the academic teaching available in the centre and available through the NICD. These would include:

- Monthly NICD Scientific Meetings (interns should be given an opportunity to present at least once during their internship)
- Weekly/monthly journal club in the host centre
- Special lectures and *ad hoc* lectures (invited speakers)

- University research days – interns are encouraged to present at least once
- Conference attendance/presentation – interns are encouraged to attend and present data at one national conference (if funding is available)

There is also a selection of optional courses from which to choose including:

- All CEU courses offered by NICD/NHLS
- Research-related courses offered by collaborating universities

Outline of the interns training during their 6 month's term of rotation through other centres/divisions/departments at the NICD and NHLS

The intern will be exposed to the theory and techniques spanning the tests offered by the laboratory. The aim is to give an overview of tests available, equipment and expertise available, an introduction to the pathology tested in the various units, and to stimulate the interest of the intern. The intern will be expected to understand the principals involved in the techniques. They will not however be expected to have performed all the techniques mentioned, nor to be able to run all of the tests without supervision. Rather the aim is to learn which tests are available and for which patients they would be applicable.

Assessment

Assessment will be performed according to rules and regulations stipulated by the HPCSA i.e. submission of a portfolio of evidence. Details for the portfolio are outlined in the national curriculum guidelines.

Requirements for internal assessment of the candidate are outlined below.

Ongoing assessment

Ongoing assessment will consist of an evaluation report of the intern scientist by the supervisor or unit/section head at the end of each rotation completed (i.e. at the end of each rotation, and during the 18-month host stay). The report will be based on the interim portfolio being collated by the intern (see below) as well as an evaluation of his/her general laboratory demeanour including:

- Laboratory expertise acquired
- Attention to good laboratory practice
- Participation in academic activities

The evaluation report will be discussed in full with the scientist during an interview and relevant feedback given. Opportunities for improvement will be discussed and noted. A hard copy of the report will be placed in the intern's portfolio.

Final portfolio

For registration in the discipline of Microbiology, the portfolio should comprise:

1. Logbook of tests performed or witnessed i.e. level of competency must be indicated
2. List of presentations (departmental/conference/research day/journal club/etc.) with title, date and forum presented – this must be signed off by supervisor or senior staff to ensure proof that this activity was undertaken

3. Minimum of one project demonstrating capability in the scientific method and computer literacy. This should have the form of a research paper i.e. including introduction, methods, results, discussion, conclusion and references, or an instrument/test validation report (including background, intra-run precision, inter-run precision, accuracy and references)
4. Evaluation reports from head of relevant units at the end of each block, summarising training in their respective departments
5. Log of any complaints received or corrective actions undertaken with regards to errors in specimen processing or communication
6. Additional training e.g. workshops/presentations/lectures/tutorials attended
7. Assessments (oral/written/ongoing)

Competencies

The following are the generic competencies expected from all intern medical scientists on completion of internship.

Technical Competencies

1. Understanding of the principles associated with a range of techniques employed in the various microbiology specialities
2. Knowledge of the standards of practice expected from these techniques used
3. Experience of performing techniques in diagnosis/surveillance by understanding and following of SOPs
4. The ability to solve problems that might arise during the routine application of techniques (troubleshooting)
5. Understanding of the principles of quality control and quality assurance
6. Experience of the use of quality control and quality assurance techniques including restorative action when performance deteriorates
7. A critical ability to review the results and determine the significance of quality control and assessment information for relevant analytical procedures
8. An understanding of the hazards (environmental, biological, chemical, radioisotopic) associated with the practice of microbiology and the appropriate controlling legislation and procedures of risk assessment.

Scientific Competencies

1. Understanding the science of microbiology in the context of medicine and clinical practice
2. Experience in searching for knowledge, critical appraisal of information and integration into the knowledge base of microbiology
3. Ability to apply knowledge to problems associated with the routine provision and development of the service
4. Ability to identify the clinical decision which the test/intervention will inform
5. Ability to make judgements on the effectiveness of procedures performed
6. Understand the principles of the techniques and methods employed in microbiology
7. Able to advise on appropriate choice of investigation and sample preparation
8. Must be familiar with information on technical developments and emerging technologies in microbiology
9. An understanding of sensitivity, specificity, positive and negative predictive values of an assay and how these are influenced by prevalence of a disease

Research and Development Competencies

1. Ability to read and critically appraise the literature
2. Ability to develop the aims and objectives associated with a project
3. Ability to develop an experimental protocol and to meet the aims and objectives in a way that provides

reliable and robust data
4. Ability to perform the required experimental work ability to produce and present the results (including statistical analysis)
5. Ability to critically appraise results in the light of existing knowledge and the hypothesis developed and to formulate further research questions
6. Ability to present data and provide a critical appraisal to an audience of peers – both spoken and written
7. Develop research skills and expertise sufficient to support supervised and collaborative research
8. An awareness of the current extent of knowledge in microbiology and an ability to employ appropriate information tools to search for, consolidate and critically examine information
9. Participation in local research meetings and supervised and collaborative research initiatives, leading to in-house reports (e.g. validation reports), publications or a postgraduate degree
10. Self-endeavour (e.g. literature awareness) under the tutelage of an appropriate specialist

Communication Competencies

1. Ability to assess a situation and act accordingly when representing the specialty
2. Ability to respond to enquiries regarding the service provided when dealing with clinical colleagues
3. Ability to communicate with patients, carers and relatives, the public and other healthcare professionals as appropriate
4. Ability to communicate the outcome of problem solving and research and development activities
5. Evidence of presentation of scientific material at meetings and in the literature
6. Must be able to use modern communication devices
7. Must understand basic management techniques and be aware of topical management issues

Problem Solving Competencies

1. Ability to assess a situation which may pose a problem
2. Ability to determine the nature and severity of the problem
3. Ability call upon the required knowledge and experience to deal with the problem
4. Initiate resolution of the problem
5. Demonstrate personal initiative
6. Must be able to interpret internal quality control and external quality assurance data
7. Must be able to recognise when a test or procedure is not within adequate performance limits
8. Must be able to recognise the consequences of inadequate performance of individual tests or procedures
9. Must be able to identify and appropriate solution to the problem and propose an effective and timely solution, including any requirement for clinical follow-up

Management Competencies

1. Understanding of the legal and ethical boundaries of scientific research
2. Ability to recognise the limits of personal practice and when to seek advice
3. Ability to manage personal workload and prioritize tasks appropriately
4. Understanding the principles of clinical governance including importance of confidentiality, informed consent and data security
5. The ability to contribute effectively to work undertaken as part of a multi-disciplinary team
6. Understanding of the need for career-long, self-directed learning and the importance of continuing professional development
7. Understanding of the need for, and ability to establish and maintain a safe practice environment
8. Understanding of the structure and organization of the department

Ethics and Values Competencies

1. Apply and maintain appropriate professional ethics, values attitudes and behaviour.
2. Use science and technology effectively and critically, showing responsibility towards the environment and health of others
3. Understand and apply ethics in both human and animal research
4. Understand and comply with the laws of copyright protection, confidentiality and ownership of intellectual property
5. Take responsibility within own limits of competence and recognise the need for lifelong learning with an awareness of personal and knowledge limitations
6. Demonstrate an ability to work as a team and to show respect for colleagues and other health care professionals and the ability to foster a positive collaborative relationship with others

References

Acts:

Occupational Health and Safety Act, https://www.gov.za/documents/occupational-health-and-safety-act
Compensation for Occupational Injuries and Diseases Act, https://www.saica.co.za/Technical/LegalandGovernance/Legislation/COIDA/tabid/3039/language/en-US/Default.aspx
National Health Act, http://section27.org.za/wp-content/uploads/2019/07/Stevenson-National-Health-Act-Guide-2019-1.pdf
Labour Relations Act especially the aspects regarding HIV/AIDS and the Human Tissue Act.
http://www.health.gov.za/index.php/2014-03-17-09-09-38/legislation/joomla-split-menu/category/84-2012r%3Fdownload%3D138:regulations-relating-to-categories-of-hospitals-r185-2012

HPCSA Regulations:

REGULATIONS DEFINING THE SCOPE OF THE PROFESSION OF MEDICAL SCIENCE
http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/legislations/regulations/mdb/regulations/regulations_gnr_579_2009.pdf
REGULATIONS RELATING TO THE QUALIFICATIONS FOR REGISTRATION OF MEDICAL SCIENTISTS
http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/legislations/regulations/mdb/regulations/regulations_gnr_581_2009.pdf
REGULATIONS RELATING TO THE REGISTRATION OF INTERNS IN MEDICAL SCIENCE
http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/legislations/regulations/mdb/regulations/regulations_gnr_578_2009.pdf
REGULATIONS RELATING TO THE REGISTRATION OF STUDENTS IN MEDICAL SCIENCE,
http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/legislations/regulations/mdb/regulations/regulations_gnr_580_2009.pdf
REGULATIONS RELATING TO THE REGISTRATION OF CERTAIN CATEGORIES OF MEDICAL SCIENTISTS
http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/legislations/regulations/mdb/regulations/regulations_gnr_52_97.pdf

Registration:

http://www.hpcsa.co.za/ (registration forms may change, please use the most recent update)

Ethics and medico-legal aspects:

HPCSA Guidelines on Ethical Rules (version available from the HPCSA website – Booklets 1 to 11)
https://www.hpcsa.co.za/Uploads/Professional_Practice/Ethics_Booklet.pdf
The general guidelines for health researchers and Biotechnology research in South African dealing with patients and patient samples (version available from the HPCSA website – Booklets 13 and 14).
https://www.hpcsa.co.za/Uploads/Professional_Practice/Ethics_Booklet.pdf
NHLS SOP GPL2773, Minimizing transcription errors, compliance checks….
NHLS SOP POLH0009, NHLS code of conduct
NHLS SOP CHE0599, GLP in a molecular laboratory
NHLS SOP IMM0201, GLP for immunology
NHLS SOP GPQ0061, Confidentiality in the NHLS

Safety and Quality Management:

NHLS Safety Manual, NHLS POLS0001
Occupational Health Safety Programme, NHLS POLS0002
Health and Safety Policies, NHLS POLS0003
Safety Procedures, NHLS POLS0004
Potential Work Hazards, NHLS POLS0005
NHLS safety manual – hazardous biological agents, NHLS POLS0006
Safety and Waste Management forms, NHLS POLS0009
NHLS safety health and environment (SHE) policy, NHLS POLS0010
Part 2 - ISO 15189:2012 “Medical laboratories - Requirements for quality and competence”
https://www.westgard.com/iso-15189-2012-requirements-1.htm