Appendix A: Sub-specialist training programme in Paediatric Infectious Diseases at Red Cross Children's Hospital and the School of Child and Adolescent Health, University of Cape Town

Aim

To produce competent paediatric Infectious Diseases sub-specialists with expertise in clinical infectious diseases, microbiology, virology, infectious diseases epidemiology, tropical public health and ID research methodology.

Specific objectives

1. To provide training in clinical infectious diseases for paediatricians, microbiologists and virologists
2. To provide microbiology, virology and immunology laboratory training for clinical infectious diseases registrars through the establishment of a joint training forum with the Department of Clinical Laboratory Sciences at the University of Cape Town
3. To provide training in communicable diseases epidemiology and tropical public health
4. To develop collaborative training initiatives in paediatric infectious diseases with centres of excellence throughout Africa

Clinical responsibilities

In accordance with the HPCSA guidelines each ID registrar is expected to complete 18 months of training in clinical infectious diseases. This training will take place within the Paediatric Infectious Diseases Unit at Red Cross Children’s Hospital.

Clinical responsibilities at Red Cross Children’s Hospital will include:

1. Outpatient

Management of children with specialised infectious diseases and immunology problems who attend the Infectious Diseases Clinic on Monday mornings, together with one of the sub-specialists

Management of children with HIV-infection, particularly those on antiretroviral therapy and attend weekly HIV clinics at Red Cross Children’s Hospital

Together with other senior staff in the Paediatric Infectious Diseases Unit provide onsite & telephonic consultation to other paediatric antiretroviral treatment sites in the Western Cape

Together with the ID sub-specialists provide ID consultation support to level 2 hospitals e.g. New Somerset Hospital, Victoria Hospital

2. Inpatient

Together with the ID sub-specialists, provide an ID consultation service to the entire hospital, including support for HIV-infected & HIV-TB co-infected children, sick children with tuberculosis or drug resistant tuberculosis (including INH mono-resistant, MDR-, and XDR-TB), those with malaria, and provide antimicrobial and infection control advice
Together with the ID sub-specialists conduct a problem / teaching ward round every week during which the management of patients with problems relating to Infectious Diseases and antimicrobial therapy including issues relating to HIV infection and antiretroviral therapy are addressed.

(3) Ad hoc & telephonic consultation

Provide initial consultation on all urgent internal ID queries and external telephonic queries during working hours

(4) Infection control

Attend and contribute to meetings and activities convened by the hospital infection control committee

(5) After hours & weekends

In accordance with the practice in the School of Child and Adolescent Health (SCAH), the ID registrar will fulfil senior registrar duties in the emergency unit of the hospital or the neonatal service attached to SCAH. These duties provide additional experience in a wide range of ID emergencies. Weekend cover is performed in ward B1.

Together with the sub-specialists, the ID registrar will at times provide an after-hours Infectious Diseases consultation service to SCAH

**Educational / research objectives**

During the 2 year attachment the ID Registrar should participate in all educational activities convened by the Paediatric Infectious Diseases Unit at Red Cross Children’s Hospital including:

- (1) Infectious Diseases ward rounds
- (2) Weekly microbiology blood culture meetings
- (3) HIV and immunology case review meetings
- (4) Infectious Diseases Journal clubs

ID registrars are encouraged to attend other ID academic meetings & courses, in particular, those hosted by the Institute of Infectious Diseases and Molecular Medicine (IIDMM), University of Cape Town, the Infectious Diseases Society of Southern Africa (IDSSA), the Federation of Infectious Diseases Societies of Southern Africa and the SA HIV Clinicians Society.

In accordance with the CMSA sub-specialist training guidelines, ID registrars are expected to maintain a portfolio documenting clinical cases managed and their laboratory experience. Details of each case in the portfolio should include the name, date of birth, date of entry, diagnosis, and specific comments relating to the learning experience of the case.

Opportunities to develop presentation skills exist, for example on ward rounds, and during clinical meetings conducted by the paediatric infectious diseases unit and the School of Child and Adolescent Health. In addition, ID registrars should participate in undergraduate and postgraduate teaching.

Regular feedback sessions (at least at 3-monthly intervals) should be conducted by the sub-specialists attached to the unit.
ID registrars attached to SCAH are expected to complete an M Phil dissertation. This gives them an opportunity to develop research and writing skills. Regular meetings between the ID registrar and the project supervisors (ID sub-specialists) will be held to direct the development and completion of the research project.

ID registrars are expected to complete the Colleges of Medicine of South Africa examination for the post-specialisation certificate in the sub-speciality Infectious Diseases [Cert ID (SA)] during their 2-year ID attachment. This will permit sub-specialist registration with the HPCSA. The list of topics included at the end of this document may be used to guide preparation for this examination.

**Laboratory training**

Microbiology and virology training will take place in the routine NHLS microbiology and virology laboratories of the Divisions of Medical Microbiology and Virology, University of Cape Town. Dr A Whitelaw and Dr S Oliver (microbiologists) direct the microbiology training, and Dr D Hardie (virologist) directs the virology training. Laboratory training will take place over 6 months (i.e. 4 months in routine microbiology, including 1 week in immunology, and 2 months in virology), in accordance with the HPCSA guidelines.

**I. Goal of laboratory training**

To develop a basic knowledge of the diagnostic role of the microbiology and virology laboratories in order to interface with the laboratory, collect appropriate specimens and interpret laboratory reports.

**II. Guidelines for microbiology laboratory training**

Basic principles of specimen processing, including:
(a) What constitutes a good specimen?
(b) Which specimens should not be processed?
(c) How and why certain specimens are inoculated onto certain media.
(d) Basic microscopy (performing and reading)
   i. Wet preps (urines, parasites)
   ii. Gram stains
   iii. Iodine preps on stools
   iv. Ziehl Neelsen
   v. Auramine stains
(e) Incubation conditions and why different conditions are chosen.

Basic follow up of cultures
(a) When to follow up organisms from culture
(b) Principles of working with organisms (pure culture, single colonies, etc.)
(c) Basic principles of how organisms are identified in the lab (*this need not be done in detail*)
(d) Principles behind the formulation of break points
(e) Antibiotic sensitivity testing, particularly the pros and cons of each test:
   i. Disc diffusion
   ii. Etest MIC
   iii. Broth dilution MIC
   iv. Cut-off plates
   v. Automated sensitivity testing methods
Special circumstances

**Blood cultures**
- Different media, automated systems, bottles etc
- Phoning out Gram results and following up culture results (*this gives very good clinical interaction and is a valuable learning exercise*)

**Mycobacteria**
- Microscopy (see above)
- Principles of TB culture, decontamination, processing etc
- Identification of mycobacteria (biochemical and DNA based)
- Laboratory Safety
- Principles of drug sensitivity testing (phenotypic and genotypic)

**Fungi**
- Type of specimens appropriate for fungal culture
- Microscopy (some detail on different fungal stains)
- Principles of specimen processing
- Principles of fungal identification
- Sensitivity testing of yeasts

**Molecular work**
- Principles of PCR
- Basic differences between different PCR assays (real-time, block based, quantitative, qualitative, nested, reverse-transcriptase)
  - Some practical experience in doing PCR and possibly other molecular tests
- When to offer molecular diagnostic tests

**Serology**
- Understanding of the basic serological tests used, in particular indirect immunofluorescence, ELISA, agglutination/precipitation techniques/etc. Performance and interpretation of syphilis serology

**Other**
- Laboratory safety
- Accreditation
- Quality control – internal and external
- Cost effectiveness
- Continuing education
- Clinical liaison
- Infection Control

### III. The diagnostic virology laboratory: Training for the ID specialist

**Background knowledge**
The candidate should acquaint him/herself with the
1. Pathogenesis of viral disease
2. Basic cellular biology
3. Basic immunology
4. Pharmacology of antiviral medicines
5. Principles of good laboratory practice

**Main Objectives**
1. Develop a practical knowledge of appropriate specimen collection
2. Obtain a basic understanding of the methods of viral diagnosis
3. Become acquainted with the repertoire of tests available in a diagnostic virology laboratory and the appropriate usage for a particular clinical condition.
4. Understand the limitations of the most important virological tests
5. Develop the ability to judge the clinical significance of virological laboratory tests with consideration to the clinical picture and other special investigations (laboratory and other)

1. Develop a practical knowledge of appropriate specimen collection with respect to:
   a) The timing of specimen collection (e.g. within first 24 hours of symptoms)
   b) The nature of the appropriate specimen and appropriate site for collection
   c) Collection device and specimen container
   d) Transport of specimens

2. Obtain a basic understanding of the methods of viral diagnosis
   a) Direct detection
      Methods used for direct detection of virus infection
      Immunofluorescence
      Enzyme immunoassay
      Nucleic acid detection: probe hybridization, PCR-amplification, other methods of amplification, quantitative assays (viral load)
      Electron microscopy
   b) Virus isolation
      The different culture systems: laboratory animals, embryonated chicken eggs, cell-lines
      Cell-lines: continuous and primary
      Specimen processing before culture inoculation
      Methods for detection of virus infection in culture
   c) Serology
      Rapid assays: principles and limitations
      Neutralizations assays
      Principle and practical use
      Immunoglobulin class specific assays
      IgM assays: Enzyme immuno assays
      Methods to avoid the effect of rheumatoid factor
      IgG assays
      Avidity assays
      Automated serological assays
      Principle of competitive assays

3. Learn the repertoire of tests available in a diagnostic virology laboratory and appropriate usage for a particular clinical condition.
   Candidate’s practical knowledge should include the following
   Turn-around time of different tests
   Viruses that are easily cultured
   Available rapid tests
   Available immunofluorescence tests for direct diagnosis
   Available EIA tests
   Applications of molecular testing
   Relationship between sensitivity, specificity and positive/negative predictive value of laboratory assays in different clinical scenarios

4. Understand the limitations of the most important virological tests
Factors that influence the sensitivity of PCR and viral load assays including specimen volume, presence of inhibitors, virus variability and assay design.
Causes of false positive and false negative serological assays:
  Pre-analytical (clinical)
  Analytical
  Post analytical

5. Develop the ability to judge the clinical significance of virological laboratory tests with consideration to the clinical picture and other special investigations (laboratory and other)
Be able to determine the clinical significance of virus cultures/ serological results and qualitative and quantitative nucleic acid tests in order to differentiate between the following clinical scenarios:
  Acute virus infection
  Immunity to virus disease
  Chronic asymptomatic and latent infection
  Re-infection or reactivation of virus disease
  Asymptomatic virus excretion
  Virological therapy failure

List of clinical topics

This is not an exhaustive list but covers the most important clinical topics. This list may be used to guide preparation for the Colleges of Medicine of South Africa examination for the post-specialisation certificate in the sub-speciality Infectious Diseases [Cert ID (SA)].

1. Immunology
   a. Development of the immune system from fetus to adulthood
   b. Innate and acquired immunity
   c. Primary and secondary immunodeficiencies
   d. Investigating the child with recurrent infection
   e. Immune responses in specific infections: HIV, TB, viral infections, etc

2. Congenital Infections
   a. Classic TORCHS infections
   b. Uncommon: TB, Varicella-zoster, etc

3. HIV/AIDS
   a. The virus
   b. Pathogenesis
   c. Diagnosis and interpretation of laboratory assays
   d. Disease spectrum
   e. TB/HIV co-infection
   f. Management / treatment issues
   g. Opportunistic infections
   h. Prevention, including vaccination and PMTCT interventions

4. Tuberculosis
   a. Pathogenesis
   b. Disease spectrum
   c. Epidemiology and molecular epidemiology
   d. Diagnosis (specimens, microscopy, culture, PCR, immune, other)
5. Neonatal infections

6. Immunisation
   a. EPI/disease eradication and elimination
   b. EPI and non-EPI vaccines
   c. Vaccine adverse events
   d. Vaccine development: vaccine types, immunological responses, phase I to IV trials
   e. Immunisation for immunocompromised individuals
   f. Immunisation of travelers

7. Nosocomial infections & infection control measures
   a. Nosocomial infection: definitions, surveillance
   b. Hospital infection control policy and practice
   c. Antibiotic policy and practice
   d. Sterilisation and disinfection
   e. Waste disposal
   f. Prevention of transmission of communicable disease in hospital (eg TB, meningococcus, varicella, measles etc)

8. Exanthems of childhood and common skin infections

9. Fever of unknown origin (clinical approach)
   a. Include discussion on periodic syndromes
   b. Include diseases that may mimic infections in children: malignancy, toxins, auto-immune

10. Malaria
    a. Pathogenesis
    b. Spectrum of disease
    c. Diagnosis (microscopy, antigen tests etc)
    d. Management including newer therapeutic options
    e. Control and prevention, including prophylaxis regimens
    f. HIV/Malaria co-infection
    g. Malaria in pregnancy and neonatal period

11. Selective parasitic infections
    a. Schistosomiasis
    b. Cystercerosis
    c. Toxoplasmosis
    d. Helminthic infections
    e. Hydatid disease

12. Gastrointestinal infections
    a. Rotavirus diarrhoea
    b. Cholera
    c. Giardiasis
    d. Amebiasis
    e. Viral hepatitis

13. Selective other infections
a. Viral haemorrhagic fevers (Marburg fever, Ebola viral infection, Crimean-Congo haemorrhagic fever, etc)
b. Prion diseases
c. Typhoid fever
d. Brucellosis
e. Bordetella pertussis
f. Rickettsial infection
g. Leptospirosis
h. Herpes viral infections
i. Candidial infections
j. Mycoplasma and chlamydial infections
k. Measles
l. Rubella
m. Diphtheria
n. Tetanus
o. Rheumatic fever
p. Osteomyelitis and septic arthritis
q. Meningitis
r. Septicaemia
s. Urinary tract infections
t. Pneumonia

14. Antimicrobial therapy
   a. Mechanisms of action of antibiotics
   b. Mechanisms of resistance
   c. Pharmacokinetics characteristics of antibiotics
   d. Interpretation of MIC results
   e. Managing antibiotic resistant infections
   f. Antibiotics for immunocompromised children
   g. Anti-TB drugs
   h. Antivirals including antiretrovirals
   i. Antifungals

15. Other treatment modalities in infections
   a. Pro- and pre-biotics
   b. Immunoglobulins
   c. Bone marrow transplantation
   d. Cytokine therapy
   e. Exchange transfusion
   f. Immunomodulators

16. 'Para-infectious' diseases
   a. Necrotising enterocolitis
   b. Reye syndrome
   c. Kawasaki syndrome
   d. Guillain-Barre syndrome
   e. Chronic fatigue syndrome / Myalgic encephalopathy

17. Infections in ICU & oncology service

18. Infection in immunocompromised children

19. Infections in travellers, include preventative measures

20. Sexually transmitted diseases in children and adolescents
21. Current issues / emerging infectious diseases, e.g.
   a. Influenza immunisation
   b. SARS / Swine influenza
   c. Avian Influenza
   d. Poliomyelitis eradication
   e. Potential bioterror agents

22. Public health principles applicable to infectious diseases
   a. Include detailed discussion on outbreak investigation
   b. Notifiable diseases
   c. Tropical public health
   d. Environmental control issues, including surveillance

23. Research methods & epidemiology applicable to infectious diseases
   a. Protocol design
   b. Descriptive statistics
   c. Inferential statistics

24. Laboratory topics
   a. Routine laboratory investigations: principles and applications
   b. Antimicrobial resistance testing: methodologies and results interpretation
   c. Advanced methodologies for detecting infectious agents

References

The College of Paediatricians of South Africa. Regulations for admission to the examination for the post-specialisation sub-speciality certificate in infectious diseases, Cert ID(SA), November 2010