

UEMS BOARD COMMISSION OF CLINICAL MICROBIOLOGY CORE TRAINING PROGRAMME FOR CLINICAL MICROBIOLOGY

INTRODUCTION

GENERAL AIM

To produce trained clinical microbiologists who can provide a specialist opinion in the discipline and who should have developed the appropriate management skills to lead a department, if required. The trained medical microbiologist should be competent to:

1. *give advice as a physician on the diagnosis, treatment and prevention of microbial and parasitic diseases.*
2. *provide a scientific basis for laboratory diagnosis and management; to set protocols and to maintain standards within the laboratory.*
3. *undertake the management responsibilities required of the director of a clinical microbiology laboratory.*
4. *take charge of infection control and prevention in hospitals*
5. *propose hospital policies on the control of antibiotic, antiviral, antimycotic and antiparasitic usage.*
6. *collaborate with national surveillance organisations and public health authorities and provide services for these organisations*
7. *participate in education and training programs for medical microbiologists, infection control doctors, other medical doctors and experts in the field of microbial diseases. There may also be a role in public education, where relevant and feasible.*
8. *undertake research and development in the field of clinical microbiology and infectious diseases.*

These eight areas of competence include two (namely 4 and 5) in which additional courses and/or formal training may be required by law in some European countries. Points 7 and 8 in the main apply to academic clinical microbiologists.

OBJECTIVES

Over a minimum 5-year period the trainee should acquire or develop:

- a) Good clinical care skills
 - (i) History, examination, investigations, treatment (therapeutics) and communication (verbal and written).
 - (ii) Management of infectious diseases.
 - (iii) Time management and decision-making.
- b) Specialised factual knowledge of the natural history of infectious diseases.
- c) Interpretative skills so that a clinically useful opinion can be derived from laboratory data. Emphasis should be made on the importance of clinical training and multidisciplinary care.
- d) Technical knowledge, gained from familiarity with laboratory technology, so that methodology appropriate to a clinical problem can be chosen and so that quality control and quality assurance procedures can be implemented.
- e) Research and development experience.

Original thought and critical assessment of published work are important to allow the trainee to contribute in a team, and individually, to the development of the service.
- f) The life-long habits of reading, literature-searches, consultation with colleagues, attendance at scientific meetings and the presentation of scientific work as part of continuing professional development (CPD).
- g) Data management skills to evaluate information derived from the population served and from the technical procedures applied in the laboratory. These skills should include familiarity with IT and the use of spreadsheets, databases and statistical packages etc.

h) Management skills.

The trainee must gain experience, under supervision, in developing departmental policies and future strategies and must develop the leadership skills necessary to implement them. The trainee should acquire a basic knowledge of healthcare economics.

i) Presentation skills:

The trainee should become familiar with the preparation and delivery of oral presentations and written scientific reports. They should also author at least one scientific publication in a national or international medical journal during their training period.

j) Familiarity with all aspects of health and safety requirements for laboratories.

k) The communication skills required for the practice of microbiology. These include both informal verbal skills and formal skills such as at committee work and written work encompassing strategy documents, reports, letters etc

l) An understanding of audit, leadership, governance and team working which underpin microbiology practice.

m) Moral based competencies.

- (i) Professional behaviour.
- (ii) Ethics and legal issues.
- (iii) Patient education and disease prevention.

n) Teaching methods and skills.

SUPERVISION AND REVIEW OF PROGRESS IN TRAINING

Trainees are required to keep a training record detailing their training experience. This will be inspected on a regular basis by their Educational Supervisor, i.e. the consultant in charge of training. Trainees should retain documentation of attendance at local, national and international meetings. Meeting with trainers should be documented and a logbook retained, unless filed electronically. Trainees will be regularly informed of their progress and, in addition, trainees must be encouraged and given every opportunity to discuss any deficiencies in the training programme. The Educational Supervisor should discuss the trainee's progress with each consultant (trainer) with whom a trainee spends a period of one month or more. Trainees should agree a training programme with their supervisor soon after appointment.

The trainee should have supportive appraisal twice a year:

- a) an informal meeting involving the Educational Supervisor and trainee, should be held a minimum of every six (?THREE) months and the record of training should be signed by the Educational Supervisor;
- b) an assessment by a panel approved by the Postgraduate Dean and/or a national board or committee for the registration of medical specialists on completion of each year's training or similar. Any reports or appraisals prepared during the year should be available to the trainee.

Educational Supervisors would be expected to have substantial experience in the speciality, to have demonstrated an interest in training, to have appropriate teaching resources, to be involved in appropriate regional training committees, to be involved in annual reviews and to liaise closely with the national board or committee for the registration of medical specialists.

CORE TRAINING PROGRAMMES:

This document sets out a curriculum for medical microbiologists which covers the scientific base of clinical microbiology, as well as applied aspects, including related fields such as infectious disease and communicable disease control. Some elements of medical microbiology training is common to the training of consultants in communicable disease control and infectious diseases.

AIMS OF TRAINING

The core training programme aims to provide the trainee with both the theoretical foundation and the practical, technical, clinical and managerial skills necessary for the independent specialist practice of medical microbiology in a clinical environment and for the advancement of the subject. Although some information relating to the appropriate clinical experience is listed in section 11, it must be appreciated that laboratory work and clinical experience must be closely integrated; therefore laboratory associated clinical duties are an essential component of the training programme.

SUPERVISION

Programmes based on this curriculum should be appropriate to the needs and previous experience of the trainee and should set out educational objectives against which the trainee's progress can be assessed. The trainee should have an educational supervisor at each site of any rotation. The training programme should identify how specific areas of training, not covered by the departments involved, will be obtained (communicable diseases/epidemiology, public health microbiology) together with any courses deemed necessary.

A CORE TRAINING PROGRAMME: CLINICAL MICROBIOLOGY

1. Scientific basis of clinical microbiology

Trainees should have an understanding of the principles of the following, together with how they may be applied to clinical and research problems:

- a) microbial structure, physiology, and genetics;
- b) microbial taxonomy, classification and typing methods;
- c) host defence mechanisms, the immune system and immunity to infection and immunodeficiency;
- d) microbial pathogenicity and genetic susceptibility to pathogens and diseases;
- e) epidemiology of infectious diseases - their surveillance and control;
- f) antimicrobial agents, their mode of action and mechanisms of microbial resistance.

2. Laboratory safety

Prior to any "hands on" experience of laboratory work, the trainee should be instructed in basic safety requirements including correct laboratory dress and laboratory hygiene. Instruction should also be given on the immediate handling and disposal of specimens and contaminated articles (e.g. inoculating loops, pipettes) at the laboratory bench, the dangers of aerosols and the procedure for dealing with spillages.

At the end of formal training, the microbiologist should be familiar with:

- a) the principles of standard precautions, hazard groups and containment levels.
- b) local procedures for the safe transport of specimens or cultures and also with national and international postal and packaging regulations for such material;
- c) current requirements and recommendations of the National Advisory Committee on safety in microbiological laboratories.
- d) the principles and operation of microbiological safety cabinets and the procedures for their decontamination and monitoring of air flow.

3. Sterilisation and Disinfection

At the end of formal training, the microbiologist should understand the principles and uses of sterilisation and disinfection procedures for the preparation of media and instruments and for microbiological waste disposal. Trainees should be familiar with methods of monitoring and be capable of formulating a policy on the use of sterilisation and disinfection in the laboratory, hospital or community and the role of environmental cleaning and decontamination. They should also be aware of emerging technologies and their applications

4. Handling of specimens

At the end of formal training, the microbiologist should:

- a) be aware, for each specimen type, of the optimal methods for collection, transport (including transport media), storage, reception, identification and documentation, including the requirements for high-risk specimens.

The trainee should develop a sense of the continuity of identification of specimens from collection, through culture and further testing to the issuing of a final report. He or she needs to be aware of critical points in processing where this continuity may fail and be able to minimise the risk of this.

- b) be able to assess degrees of urgency for the processing of specimens, including the provision for an out of hours service and the communication of preliminary results as applicable;
- c) be able to decide upon further testing or processing of a specimen as appropriate;
- d) be aware of existing reference facilities and their appropriate use.
- e) understand the evidence base behind Standards of Practice (SOPs).

5. Microscopy

At the end of formal training, the microbiologist should:

- a) understand the principles of light, fluorescent and electron microscopy and be able to set up a light microscope.
- b) be able to perform routine staining techniques including fluorescent dyes;
- c) be familiar with the appearance of stained preparations and be able to recognise artefacts and their possible origin.

6. Culture methods

At the end of formal training, the microbiologist should:

- a) have a basic understanding of the diversity of microbial metabolism;
- b) be aware of the wide range of selective, enrichment and inhibitory media available for general and specialised use and be able to choose relevant media in common use in medical and environmental laboratories;
- c) be familiar with physical growth requirements of micro-organisms including atmosphere and optimal temperature and have an appreciation of the growth kinetics of both solid phase and broth cultures. It is important in this context to know those micro-organisms and clinical situations in which detectable growth may require prolonged incubation;
- d) be familiar with the preparation of media in common use and have an understanding of internal quality control of such preparations;
- e) be able to process all common specimens, recognise potential pathogens from a mixture of colonies on culture plates, separate such colonies in order to achieve the pure growth necessary for further work.
- f) be familiar with the principles and methods of environmental culture.

7. Further processing of cultures

At the end of formal training, the microbiologist should:

- a) be able to perform tests leading to the identification of all common pathogens including the use of commercially produced kits (eg. kits for enzyme assays) and rapid diagnostic kits, ELISA, latex agglutination, etc;
- b) understand the principles of identification media and be able to use them appropriately;
- c) be familiar with and understand the principles behind the use of chromogenic agars
- d) understand the principles and methods of molecular identification and epidemiologic typing applied to diagnosis, outbreak investigation and epidemiological surveillance.
- e) be aware of available reference facilities for further identification including serotyping and all other typing schemes, both phenotypic and genotypic;

8. Antimicrobial investigations

At the end of formal training, the microbiologist should:

- a) have a thorough understanding and knowledge of the range of therapies available for infectious disease, the clinical indications for their use and their side effect profile.
- b) be fully cognisant of the classification of antimicrobial agents and their modes of action.
- c) be able to ~~test~~ determine the antibiotic susceptibilities of an isolate using the common techniques.
- d) be able to perform minimum inhibitory concentrations (MICs) and interpret using nationally or internationally approved breakpoints.
- e) be familiar with the strengths and weaknesses of automated susceptibility test methods.

- f) have an understanding of the pharmacodynamics, pharmacokinetics and the therapeutic and toxic effects of antimicrobial drugs and be able to advise on appropriate dosage regimens.
- g) understand the principles of interpretative reading of antibiograms and the use of expert system software for that purpose.
- h) be familiar with clinically relevant natural and acquired resistance phenotypes of common bacterial pathogens, viruses, parasites and yeasts.
- i) be familiar with the epidemiology of antimicrobial resistance at global and local level and of its clinical and financial implications as regards susceptibility testing, choice of therapy and control of hospital infection.

9. Molecular microbiology and emerging technologies

At the end of formal training, the microbiologist should:

- a) have a basic understanding and have gained experience of molecular biology technology (e.g., DNA/RNA preparation, hybridisation, nucleic acid amplification techniques (NAT));
- b) be aware of automated, and rapid techniques available to clinical microbiology;
- c) be able to evaluate critically the need for emerging techniques within the laboratory, including cost effectiveness and effects on staffing levels and working practices.
- d) be aware of the potential role of point of care testing.

10. Data handling

At the end of formal training, the microbiologist should:

- a) have a basic understanding of information technology and in particular, computerised data handling. He or she should have an appreciation of the advantages and disadvantages of such systems and a basic understanding of the need for data protection;
- b) be aware of available technologies for data broadcasting.
- c) be aware of the developing issues prompted by computerised management of data in terms of confidentiality, data archiving, and report validation (electronic signature).
- d) be familiar with the fundamental aspects of computing- databases, spreadsheets, wordprocessing, internet and how these are used on a day to day basis.

11. Clinical experience

At the end of formal training, the microbiologist should:

- a) have gained experience of liaison with clinical colleagues through regular ward visits and participation in collaborative clinical activities. In particular, a close relationship is required with high dependency units (eg ICU, NICU) and specialist units (e.g. haematology, paediatrics, transplantation etc.) where available;
- b) have gained experience of liaison with general practitioners;
- c) have participated in on-call rotas (including weekends) with consultant cover and have acquired decision making skills and be capable of prioritisation.
- d) have participated in postgraduate educational meetings such as Grand Rounds and lunchtime case presentations;
- e) be able to provide informed advice on vaccination and immunisation with all products normally available in the EU.
- f) ideally to have undergone some clinical training in infectious diseases.
- g) Have a thorough understanding of the assessment, diagnosis, management and follow-up of the following:
 - Urinary tract infection.
 - Respiratory tract infection.

- Gastrointestinal infection.
- Skin, soft tissue, bone and joint infection.
- Post-operative infection.
- Encephalitis/Meningitis.
- Hepatitis-
- Patients with skin rashes and their contacts (pregnant and non pregnant).
- Infections in pregnancy in both mother and foetus.
- Infections in the immunocompromised.
- Infection in travellers.
- Genitourinary infection, sexually transmitted infections (STIs).
- HIV infection.
- Infections which constitute medical emergencies.
- Occupational associated infection.
- Food and water borne infection.
- Hospital acquired infection.
- Infective endocarditis.
- Systemic infections including blood stream infections (bacteraemia), vascular graft infections etc.
- Device associated infections.
- Prion diseases.

12. Infection control in hospital and community

At the end of formal training, the microbiologist should:

- a) have had first-hand experience of local infection control problems, including outbreaks of infection and their management;
- b) be familiar with the workings of infection control meetings including local and regional infection control committees;
- c) be aware of those areas of hospital and community health that require infection control policies;
- d) have worked closely with the infection control nurse both in day to day duties and in the education of those involved with infection control issues;
- e) have participated in visits to clinical and non-clinical areas to advise on infection control. These should include kitchen inspections, especially those conducted by environmental health officers, operating theatres and Central Sterilisation Services Departments (CSSDs). Relationships should be developed with key personnel in the CSSD, pharmacy and laundry;
- f) have an understanding of the principles of patient isolation and their application;
- g) be familiar with any documentation relevant to infection control at local, national and super-national level and to have a knowledge of existing working party recommendations (eg MRSA, *Shigella*, *Clostridium difficile*, norovirus, avian influenza and SARS);
- h) gained some experience of public health microbiology with secondment if necessary to a Public Health Laboratory;
- i) have had experience of communicable disease control in the community by working with Environmental Health Officers.
- j) become familiar with the physical and chemical agents used in hospital infection control.
- k) Understand the principles of notification and epidemiologic surveillance of infectious diseases and antimicrobial resistance and be aware of legal requirements for reporting communicable disease cases to public health authorities.

- l) be aware of issues related to bioterrorism.

13. Antimicrobial usage

At the end of formal training, a microbiologist should have knowledge of:

- a) empiric, directed and prophylactic antimicrobial use.
- b) the means of prevention of emergence of resistance
- c) surveillance of antimicrobial resistance

14. Virology

At the end of formal training, a microbiologist should have knowledge of:

- a) basic diagnostic and screening virology methodology;
- b) interpretation of results, both for clinical and infection control purposes;
- c) virology policies in relation to health care workers, pregnancy, transplantation and immunisation;
- d) when to refer to or request specialist virological expertise.
- e) use of anti-viral agents.

A minimum period of six months in total should be spent in a virology laboratory. In the Netherlands, the training in virology is one year.

15. Mycology

At the end of formal training, a microbiologist should have knowledge of:

- a) basic diagnostic mycology methodology;
- b) interpretation of results, both for clinical and infection control purposes;
- c) superficial and deep seated fungal infection
- d) special problems associated with the immunocompromised host
- e) anti-fungal agents and treatment strategies

A spent in a specialised mycology laboratory during training would be desirable.

16. Parasitology

At the end of formal training, a microbiologist should have knowledge of:

- a) basic diagnostic parasitology methodology;
- b) interpretation of results, both for clinical and infection control purposes;
- c) epidemiology and clinical features of endemic and imported parasitic infection
- d) special problems associated with the immunocompromised host
- e) anti-parasitic drugs and treatment strategies

A spent in a specialised parasitology laboratory during training would be desirable.

17. Results reporting

At the end of formal training, the microbiologist should:

- a) be able to report laboratory results interpretively to ensure the patient is appropriately treated.
- b) be aware of the role of the laboratory report in antibiotic stewardship and infection control initiatives.
- c) be able to liaise effectively with wards and primary care based doctors.

18. Quality control

At the end of formal training, the microbiologist should:

- a) have an understanding of internal and external quality control and quality assurance;
- b) have had experience of the regular processing of specimens, distributed by an organisation for external quality control.
- c) have an understanding of the existing external quality control schemes and the processing of data by these schemes.

19. Audit and clinical governance

At the end of formal training, the microbiologist should:

- a) have an understanding of the principles of audit.
- b) have participated in microbiological audit both in the laboratory and the clinical setting.
- c) understand the importance of clinical governance.
- d) be aware of regional, national and international practice guidelines.

20. Accreditation

At the end of formal training, the microbiologist should be aware of requirements of continuing professional development and be informed of any existing laboratory accreditation schemes and of the process whereby accreditation is conferred.

21. Management

At the end of formal training, the microbiologist should have achieved a basic knowledge of important aspects of laboratory management including budget control, personnel management, staff appraisal, team working, negotiation skills, strategic planning, preparation of a business plan, contracting processes, service level agreements, departmental and directorate budgeting etc. He/she should also understand the fundamentals of financial management in health-care facilities and the principles of medico-economic evaluation of laboratory tests. Ideally attendance at interview panels should be achieved as part of training. The trainees should be encouraged to attend appropriate management courses in which the programme will be sustained by professional managers. Trainees may, as "colleagues", be permitted to sit in on departmental, directorate and other local committee meetings as observers. The aims and objectives of this should be to provide them with some experience of committee procedures, aspects of confidentiality, decision making at a local level and the importance of maintaining good inter-personal relationships

UEMS Section of Medical Biopathology, Commission of Clinical Microbiology, incorporating comments of the Executive Committee of the European Society of Clinical Microbiology and Infectious Diseases.

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