

Recommended core curriculum for a specialist training program in neurology

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1. Entry to program

Entry is only for medical doctors and therefore will depend on national criteria for fully registered physicians, usually following general medical training. Some countries require a specific period (typically 2 years) of general medical training before entry is allowed to specialist training programs.

2. Duration of training

2.1. The recommended duration of training is 60 months.

2.2. A minimum period of 36 months should comprise clinical neurology and this may include child neurology, intensive care, emergency room neurology, neurorehabilitation, neurosurgery and psychiatry. Some countries, for instance Germany, require a specified, compulsory period in psychiatry.

2.3. Specified sub-specialist training will be given part time or full time in (a) neurophysiology, (b) neuropathology, and (c) neuroimaging.

2.4. Optional, but recommended, sub-specialist training includes neurophysiology, neurosonology, neuroimaging, neuro-ophthalmology, neuro-otology, neuropathology, neurochemistry, neurorehabilitation, neuropsychology, neuroimmunology and neurological aspects of internal medicine, pregnancy and intensive care.

2.5. Specific educational courses, up to 200 h of duration, to cover areas such as neuroanatomy, neurochemistry, neuropharmacology, neuroimmunology, neurogenetics, law and administration.

2.6. It is highly desirable that the training includes neurological research. Most trainees do this and it allows them to develop competence in correct scientific methods, data interpretation, medical statistics and the evaluation and production of medical publications.

3. Training sequence

3.1. The training sequence is not compulsory but it is desirable that clinical neurology be given priority.

3.2. Most trainees will train in more than one institution and it should be possible and be encouraged to do some of the training in another country.

4. Training objectives

The overall aim of a well-designed training program is to produce a good, competent general neurologist with the necessary skills and ability to correctly assess, investigate and treat patients with illnesses across the broad spectrum of neurological disease. These skills will be acquired by:

4.1. Systematic study of the underlying anatomy, physiology and chemistry of the nervous system.

4.2. Understanding and correctly eliciting neurological symptoms and physical signs and correctly applying such information in reaching correct diagnosis.

4.3. Understanding the correct use of specific neuro-radiological, neurophysiological and other ancillary investigative procedures in neurology.

4.4. The correct scientifically based treatment of neurological disorders.

4.5. The application of these skills at ward, outpatient, emergency room and intensive care unit levels.

4.6. A well-trained specialist should also be able to communicate skilfully, ethically and sympathetically with patients and their families, interact properly with colleagues and other healthcare professionals and administer competently within the healthcare delivery system.

5. Specific skill and knowledge objectives

5.1. Leading symptoms and major syndromes

Headache, pain, cognitive function, sleep, altered consciousness and dementia; cranial nerves, hemisphere, cerebellar and spinal disease; CSF and its disorders; movement disorders; autonomic function; uro-neurology; cerebrovascular disease; neuromuscular disease; demyelinating disease; paroxysmal disorders.

Neuro-endocrinology; intoxications; deficiencies; neurological infections; tropical neurology; neuro-oncology; Neurotraumatology.

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5.2. Neurophysiology

5.2.1. Basic concepts, technical problems, limitations and normal findings at different ages.

5.2.2. EEG recording and interpretation, video EEG Telemetry, polysomnography and multiple sleep latency. Depth recording and cortical mapping.

5.2.3. Nerve conduction tests, thermal thresholds.

5.2.4. Electromyography and SFEMG and other tests of neuromuscular integrity.

5.2.5. Evoked potentials.

5.2.6. Magnetic stimulation.

5.2.7. Retinal function.

5.3. Imaging

5.3.1. Basic principles, techniques and limitations in neuroradiology.

5.3.2. Indications, cost, value and risks of different investigations.

5.3.3. Radiological and vascular anatomy.

5.3.4. CT, MRI, SPECT and PET scanning.

5.3.5. Digital, MR and CT angiography.

5.3.6. Extra and transcranial Doppler/Duplex.

5.3.7. Interventional neuroradiology.

5.4. Neuropathology

5.4.1. Gross and microscopic pathology.

5.4.2. Staining methods and techniques including immunocytochemistry.

5.4.3. Electron microscopy.

5.4.4. Major pathological abnormalities affecting the brain, spine, peripheral nerves and muscle including congenital, inflammatory, infective, prion, neoplastic, vascular and degenerative disorders.

5.4.5. Indications for and limitations of different techniques and the correct interpretation of information obtained from biopsy, surgical and autopsy material.

5.4.6. Brain fixation and cutting.

5.4.7. Forensic neuropathology.

5.5. Paediatric neurology

5.5.1. Trainees should acquire a sufficient understanding of normal and abnormal child development to enable them to interpret the childhood history and investigations that are important in patients seen in adult life.

5.5.2. They should know sufficiently about the broad disease groups that continue from childhood into adult life to provide safe neurological care for young adults.

5.5.3. Knowledge objectives include

- Normal child development – gross and fine motor, language, cognition and behaviour.
- Common types of cerebral palsy, antecedents, presentation and management.
- The common epilepsy syndromes and non-epileptic paroxysmal disorders of childhood in terms of their presentation, diagnosis and management.
- The ability to separate benign and malignant syndromes and recognize their common cognitive and behavioural co-morbidities.
- The common neuromuscular diseases, their presentation, diagnosis and management.
- A broad knowledge of the progressive degenerative diseases of childhood with particular emphasis on those that are treatable.
- A knowledge of the common behavioural phenotypes that co-exist with early brain disease, including autistic spectrum disorder, attention deficit, hyperactivity, obsessive compulsive, developmental coordination and conduct disorders.
- An understanding of the family psychological responses to neurological illness in childhood.

5.6. Psychiatry

5.6.1. Trainees should acquire skills in conducting a psychiatric interview and evaluating psychiatric symptomatology.

5.6.2. They should be able to recognize the common psychiatric disorders acute and chronic, especially those related to alcohol abuse, dementia, epilepsy and confusional states.

5.6.3. They should have a detailed understanding of somatization disorders, including hysteria.

5.6.4. They should acquire skill in the use of the common psychoactive drugs, their indications, contra-indications, use and side effects.

5.6 a. Neuropsychology

Trainees should develop basic clinical skills in assessment of cognitive function. They should understand the methodology of detailed neuropsychological assessment techniques and their interpretation. They should have the knowledge of the common neuropsychological syndromes including dementia and its subtypes, focal deficits in cognitive function and cerebral disconnection syndromes.

5.7. Neurosurgery

5.7.1. Trainees will require skills in recognizing neurosurgically treatable pathology, and the indications and limitations of such treatment.

5.7.2. They should understand the acute management of head and spinal injuries, subdural and other intracranial hematomas, subarachnoid hemorrhage, cerebral abscess, cerebral tumor and acutely raised intracranial pressure.

5.7.3. They should be able to manage the acute neuro-medical problems that can arise following neurosurgery.

5.7.4. They should be familiar with the management of acute and chronic spinal compression.

5.7.5. Trainees should be familiar with the correct indications for and harvesting of central and peripheral nervous system biopsies.

5.8. Neurological sub-specialist areas

5.8.1. Neuro-ophthalmology: Correct examination of the visual system including acuity, fields, pupils and eye movements. Recognition of retinal, orbital, anterior visual pathway and higher cortical visual problems. The management of visual failure and eye movement disorders. The use and interpretation of common neuro-ophthalmological investigations.

5.8.2. Neuro-otology: Mechanisms of hearing and balance and the appropriate tests for their evaluation. Assessment and treatment of the dizzy patient.

5.8.3. Neurogenetics: An understanding of the principles of neurogenetics, its techniques and terminology. The common hereditary disorders including Huntington's disease, hereditary ataxias, neuropathies, Parkinson syndromes and dementias; neurofibromatosis and other neurocutaneous conditions; mitochondrial disorders and inheritance; gene therapy; genetic counselling.

5.8.4. Neuropharmacology: Principles of clinical neuropharmacology; the main drugs used to treat neurological disorders, their uses, pharmacokinetics and interactions; neurotransmitters.

5.8.5. Neuroimmunology: Basic immunology; the neurology of connective tissue disorders; antiphospholipid syndromes; sarcoidosis; the use of steroids, immunosuppressants, immunoglobulin, interferons and plasmapheresis.

5.8.6. Neurochemistry: Training in performing and interpreting investigative techniques on the spinal fluid and other substances relevant to the nervous system.

5.9. The neurology of intensive care

5.9.1. Trainees should understand and acquire the basic skills used in the diagnosis, monitoring and management of patients in intensive care units.

5.9.2. They should have a basic knowledge of intensive care and its application to neurology. This includes airway maintenance, respiration, swallowing, aspiration and cardiovascular support.

5.9.3. They should appreciate the nutritional requirement in intensive care units and potential problems such as Wernicke syndrome and critical care neuropathy.

5.9.4. They should know the special psychological needs and problems of patients in intensive care.

5.9.5. They should be able to skilfully and sympathetically deal with questions of brain death, organ donation and communication with relatives.

5.10. Infectious disease

Trainees should have knowledge and skills to diagnose and manage patients with diseases of the central and peripheral nervous system caused by infectious diseases. They should have particular experience of acute and chronic meningitis, cerebral abscess and subdural empyema, encephalitis, HIV, syphilis, Lyme disease, poliomyelitis and tropical infections.

5.11. Internal medicine

5.11.1. Trainees should develop facility in dealing with patients in the setting of an acute general hospital.

5.11.2. They should be able to treat the specific neurological complications of medical and systemic disease diseases.

5.11.3. They should understand and be able to treat specific problems that arise in women in relation to pregnancy and contraception and also how these states impact on neurological diseases and treatments.

5.12. General skills

5.12.1. Trainees will need a broad range of communication and presentation skills.

5.12.2. They will need to know how to deal with difficult patients and break bad news. They will need to cope with uncertainty and handle complaints.

5.12.3. Training is needed to write meaningful medico-legal reports, grant applications and ethics committee applications. They need to understand budgeting, financial planning and fund raising. They need to handle evidence based medicine, audit and continuing medical education (CME/CPD).

6. Training assessment

This varies from country to country but will for the most part be continuous and under the supervision of a specialist tutor. Teaching and learning methods include – Self directed learning (textbooks, journals, internet). – Apprenticeship.

- Formal postgraduate courses.
- Attendance at approved conferences and scientific meetings.

Assessment must be continuous and will include log book records, regular interviews and written assessments. There will normally be a detailed global assessment at the end of the 60 months. A final exit examination applies in some countries but is not obligatory.

Comments and acknowledgements

The Education Committee of the EFNS, after publishing the Survey of the current situation of postgraduate neurological training in Europe (1) decided to develop core curriculum for the specialist training program in Neurology. This work was jointly done with the section of neurology of the European Monospecialist section (UEMS) (<http://www.uems.org/neuro>). The core curriculum for neurology should provide guidelines for the national curricula and should be accepted by all the members. It is organized to cover the following topics: 1) entry to the program, 2) duration of training 3) training sequence, 4) training objectives, 5) specific skill and knowledge objectives and 6) training assessment. The core curriculum is meant to be flexible enough to allow adaptation to the different curricula already organized in each country, which have some differences, depending on the organization of the teaching and the national medical practice.

This work has required reflection and adaptation of the various proposals received, and it was a lengthy process, since many of the proposals were received within wide intervals of time. For this curriculum we received important contributions from Zdenek Ambler, Alexandre Bisdorff, JY Delattre, Nils Erik Gilhus Wolfgang Grisold, Friedhelm Jungmann Brian Neville, Jos Th J Tans, Marianne de Visser Charles Mark Wiles, Ian Wilkinson. Roderik Galvin has carefully prepared this final version. This curriculum is not a rigid structure. It is a working tool that will certainly undergo evolution. With time, practical experience, and the development of science and medical practice, neurological training in its form and contents will surely change, as well.

We hope this will be a contribution towards a uniform neurological training in Europe.

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