



The Royal College of Pathologists

Pathology: the science behind the cure

Curriculum and assessment system for specialty training in Diagnostic Neuropathology

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1. Preface

The position of Diagnostic Neuropathology as a specialty is distinguished by the fact that it recruits from other specialties. Generally, doctors do not come across Diagnostic Neuropathology during core medical training or core surgical training. They discover Diagnostic Neuropathology as a career option when they are some way into Histopathology training or training in Neurology/Neurosurgery. Trainees in Neurology and Neurosurgery especially encounter neuropathologists in practice within the context of a multidisciplinary clinical neuroscience service.

Training in *Diagnostic Neuropathology* should be regarded as higher specialty training. The new training programme is un-coupled from any single core training programme; therefore not 'run-through'. We propose competitive entry at ST3. Logically, three routes of entry are available, which envisage a trainee leaving (resigning from) a specialty training programme (*Histopathology*, *Neurology* or *Neurosurgery*) having successfully applied for a place on a *Diagnostic Neuropathology* training programme. They would be moving from specialty training in *Histopathology* (having completed ST2) or in *Neurology/Neurosurgery* (having completed ST3) to higher specialty training in *Diagnostic Neuropathology*. Whatever their provenance, the new trainee in *Diagnostic Neuropathology* will come with one of two sets of knowledge/skills needed for a sound basis for specialisation in Neuropathology: either basic histopathology or basic clinical neuroscience but not both. The current proposal for specialty training in *Diagnostic Neuropathology* will provide for remedial learning and training in the other. We do not stipulate a single required 'core' training; rather we stipulate the competences required of a Neuropathologist and show that trainees from any of the three possible recruiting bases will acquire the same competences after two years in the *Diagnostic Neuropathology* specialty training programme, which is to say that convergence occurs by end of ST4 (ST3 and ST4 could be thought of as the 'consolidation' phase of specialty training) and is followed by a common phase of higher specialty training.

2. Aim of the Programme

The **aim of the training programme** (and assessment system) in *Diagnostic Neuropathology* is to produce individuals who are able:

- a. To provide the NHS with **competent** advice on [1] diagnosis, [2] cause, [3] natural history of the disease, [4] features that may signal a response to treatment, [5] clinic-pathological correlation, and [6] clinico-anatomical correlation, *based on the assessment of tissue* removed from [A] the central nervous system and its coverings, including meninges, bone and adjacent soft tissues, [B] the peripheral nervous system, [C] skeletal muscle, *which meets the needs* [a] of patients, [b] of physicians, surgeons and oncologists engaged in the delivery of clinical neuroscience services, [c] of rheumatologists engaged in the delivery of clinical myology services, and [d] of Coroners (or Procurator Fiscal in Scotland), *and to do so* [i] independently, [ii] safely, [iii] efficiently, [iv] in situations of diagnostic uncertainty, and [v] within the context of the previous medical history, concurrent disease affecting parts of the body other than the nervous system, and/or a history of disease in family members.
- b. To apply their knowledge of the tissue changes in diseases of the nervous system and skeletal muscle, and their skills in handling and interpreting such tissues, to productive engagement with others in applied and clinical neuroscience research, particularly within the context of the NIHR.
- c. To impart knowledge of, and skills in, diagnostic neuropathology to medical students, doctors and nurses training in related specialties (e.g. clinical neurology, neurosurgery, neuroradiology, oncology, histopathology, among others), and biomedical scientists working in the diagnostic neuropathology and related laboratory specialties.
- d. To participate, in their turn, in the training and assessment of specialists in diagnostic neuropathology, after appropriate training as educational supervisors and examiners.

This statement of the aim of the training programme does not include all the skills (because the aim of the programme is to deliver those skills!) required of a consultant neuropathologist but it is an important statement of the essential competences that are expected of an independent practitioner in *Diagnostic Neuropathology* in the NHS. Therefore, trainees and educational providers should regard this section as the 'executive summary' to the detailed *curriculum*, which is appended to this document.

3. Training Programmes and Structure of the Royal College of Pathologists

Delivery of the depth and breadth of diagnostic neuropathology training outlined in the curriculum is the responsibility of the local Postgraduate Deanery. This is likely to be achieved in the short term future through the structures that are already in place for Histopathology, i.e. the Deanery Postgraduate Pathology School, the local Histopathology Specialty Training Committee, where this exists, and a named diagnostic neuropathology Training Programme Director. The Programme Director must ensure that each post or attachment within the programme is approved by the General Medical Council. Heads of Pathology School (HOPS) have a strategic overview of training in the Pathology specialties. They are responsible for ensuring that the delivery of education and training meets the College- and GMC-agreed curriculum and is provided to the standards set by the College and GMC. Future educational governance arrangements for small specialties such as Diagnostic Neuropathology will be determined according to changes in national arrangements that are currently being debated.

Selection will be undertaken twice a year at ST3 level, through a national (UK) recruitment system. In the interest of consistency and to avoid duplication of resources, the Lead Dean for *Histopathology* will oversee selection and admission into the new specialty of *Diagnostic Neuropathology*, and the delivery of training in *Diagnostic Neuropathology*. Similarly, the lead for recruitment in *Histopathology* at the London Deanery will run the recruitment/selection programme for *Diagnostic Neuropathology*. The Head of School for Pathology in London will provide informal advice to the recruitment team in the London Deanery, as required.

The Royal College of Pathologists will appoint a **Lead for Training** in *Diagnostic Neuropathology*. The Lead for Training will sit on the Neuropathology Specialty Advisory Committee (SAC) and will be responsible to the Chair of that Committee and to the College's **Director of Training and Assessment**. One or more Deputy Leads for Training may be appointed, as the SAC deems appropriate and necessary (e.g. a Deputy Lead for Recruitment and Admission to Specialty Training). The admission process will be orchestrated by a core group of specialist selectors, and administered by the Lead for Training, subject to the approval of the Lead Postgraduate Dean. The core specialist selectors will be responsible for maintenance of standards year on year. Further specialist selectors will be involved, usually from programmes with vacancies. A lay person and a deanery administrator will also have a role. All selectors will have appropriate training to enable them to fulfil their role, including ethnicity and diversity training.

Applicants will be invited from doctors in one of two fields, either Clinical Neuroscience, which includes Neurology and Neurosurgery, or Histopathology. Whilst the majority of applicants will have a foundation of Histopathology, the specialty of *Neuropathology* has a history of attracting trainees from Neurology or Neurosurgery. Many have research experience, either in neurosciences or in related areas. We will harness this diversity of experience because of the benefit it brings to clinical neuropathology practice.

4. Entry Requirements for Training in Diagnostic Neuropathology

The minimum requirement for training in *Diagnostic Neuropathology* shall be [1] one year of whole time equivalent training in *Histopathology* and [2] one year of whole time equivalent training in *Clinical Neuroscience* and [3] three years of whole time equivalent training in *Diagnostic Neuropathology* (see figure in Section 5 below). A minimum training period of five years with grounding in *Histopathology* meets European Union Board of Pathology's requirements for training in Pathology. The specialisation element of a minimum of 3 years of Neuropathology with one additional year in one or other clinical neuroscience meets the requirements of the European Confederation of Neuropathological Societies (Euro-CNS) for specialisation in *Neuropathology*.

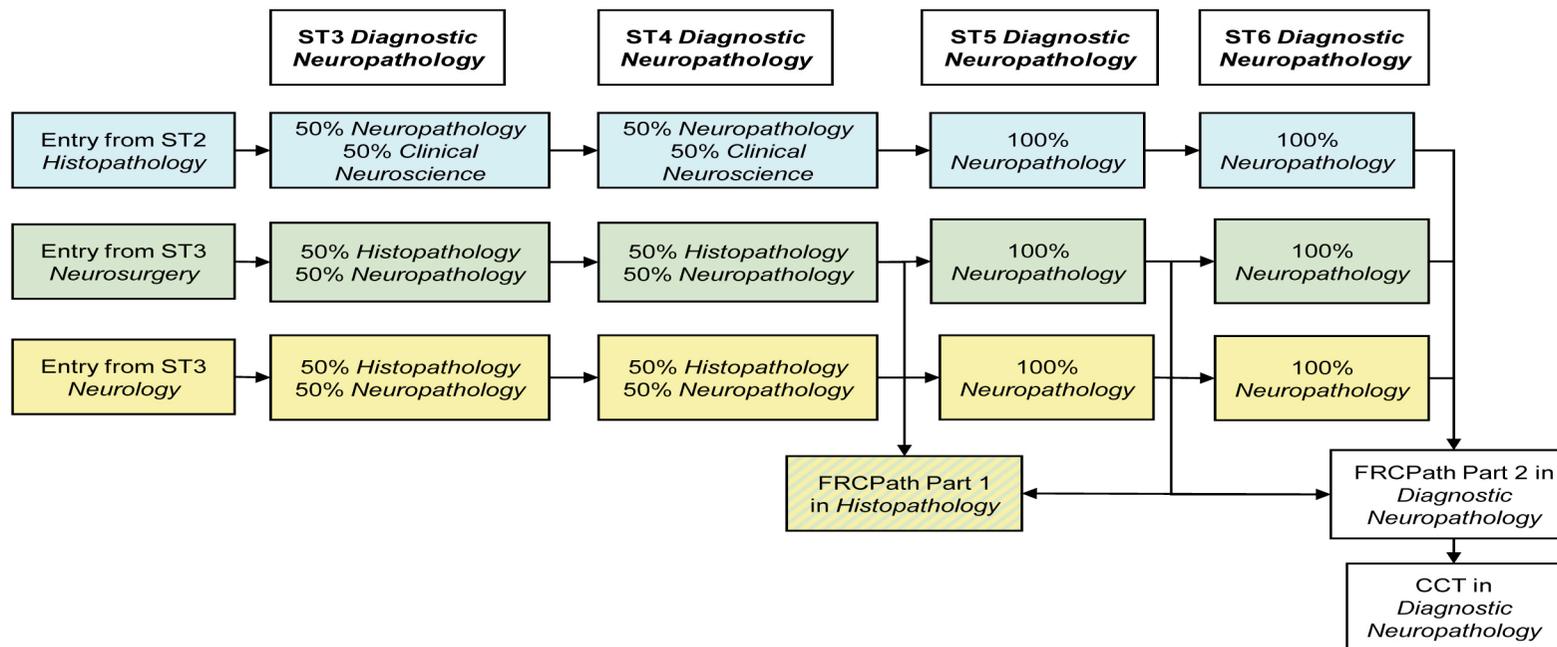
Transitional arrangements for existing subspecialty trainees to be able to transfer to the new curriculum will be made available separately.

5. Point of Entry into Specialty Training

Assuming vacancies and successful applicants, entry into specialty training will be twice yearly, at the beginning of February and August. Entry into specialty training in *Diagnostic Neuropathology* will be at ST3. In common with the clinical neuroscience specialties of *Neurology* and *Neurosurgery*, this point marks a clear commitment to the specialty and declares the aspiration to a consultant post in the specialty on completion of training. A requirement for entry will be satisfactory completion of ST1 and ST2 training in specialties that provide a useful basis for higher specialty training in *Diagnostic Neuropathology*.

Applications from trainees in one of three programmes may be considered for entry to ST3 training in *Diagnostic Neuropathology*:

- [1] Trainees in *Histopathology* who have successfully completed, or expect to complete successfully, ST2 training in *Histopathology*. This implies that applicants from *Histopathology* will be expected to have achieved a satisfactory outcome in their ST2 Annual Review of Competence Progression (ARCP) and to have passed FRCPath Part 1 examination in *Histopathology*.
- [2] Trainees in *Neurology* who have successfully completed two years of core medical training and (at least) one year of specialty training in *Neurology*. This implies that applicants from *Neurology* will be expected to have achieved a satisfactory outcome in their ST3 ARCP and to have passed the MRCP (UK) examination, which will be a requirement for entry into ST3 training in any medical (physicianly) specialty from August 2011.
- [3] Trainees in *Neurosurgery* who have successfully completed, or expect to complete successfully, the *Initial Phase* of run-through training in *Neurosurgery*. This implies that applicants from *Neurosurgery* will be expected to have achieved a satisfactory outcome in their ST3 ARCP and to have passed the MRCS examination (adapted for basic and applied neurosciences, surgical science and clinical neurosurgery).
- [4] Trainees who have entered *Neurosurgery* at ST3 and who have successfully completed, or expect to complete successfully, one year of specialty training in *Neurosurgery*. This implies that applicants from *Neurosurgery* will be expected to have achieved a satisfactory outcome in their ST3 ARCP and to have passed the MRCS examination. At present, entry into Neurosurgery training at ST3 level is possible (although it is likely to be phased out).



It is possible that a trainee in *Neurosurgery* who has successfully completed, or expects to complete successfully, only the first year (ST1) of the *Initial Phase* of run-through training in *Neurosurgery*, may wish to switch to training in *Diagnostic Neuropathology*. In such a case, the trainee should apply for entry into ST1 training in *Histopathology*, complete ST1 and T2 training in *Histopathology* satisfactorily, then enter *Diagnostic Neuropathology* at ST3, which is Entry Route [1] above (blue stream in the figure).

6. Progression Through Training and Converging Competences (see figure in previous section)

Progression from ST3 to ST4 and from ST4 to ST5 will be dependent upon achieving a satisfactory outcome in their ARCP. For entrants into specialty training from *Neurology and Neurosurgery*, progression from ST5 to ST6 will be dependent on success in FRCPATH Part 1 in Histopathology, as well as achieving a satisfactory ARCP outcome. These trainees may attempt this examination after completion of ST3, after 12 months training in *Histopathology*. The FRCPATH Part 2 examination in *Diagnostic Neuropathology* may not be attempted until success in FRCPATH Part 1 in Histopathology and only after satisfactory completion of ST5 training, and subject to the RCPATH's regulations for the FRCPATH Part 2 in *Diagnostic Neuropathology*.

The requirement for FRCPATH Part 1 in *Histopathology* ensures that the trainee's knowledge, skills and behaviour/attitude in *Diagnostic Neuropathology* have a firm foundation on *Histopathology (General pathology and Basic Systemic Pathology)*. This and the requirement for a minimum one year training in *clinical neuroscience* ensure convergence of competences in *Diagnostic Neuropathology*, irrespective of whether entrants into the specialty come from a background in *Histopathology* or *Clinical Neuroscience* (see figure in Section 5).

7. Duration of Training Programme (see figure in previous section)

The duration of training in *Diagnostic Neuropathology* will be not less than four years from the point of entry to the training programme (see page 7).

a. Less than full-time training

'Less than full-time training' is the term used to describe doctors undertaking training on a basis that is less than full-time, normally between five and eight sessions per week. The aim of less than full-time training is to provide opportunities for doctors in the National Health Service (NHS) who are unable to work full time. Doctors can apply for less than full-time training if they can provide evidence that "training on a full-time basis would not be practicable for well-founded individual reasons".

Less than full-time trainees must accept two important principles:

- part-time training shall meet the same requirements (in depth and breadth) as full-time training
- the total duration and quality of part-time training of specialists must be not less than those of a full-time trainee.

In other words, a part-time trainee will have to complete the minimum training time for their specialty *pro rata*.

GMC guidance on approval of less than full-time training states that from 1 December 2007, "deaneries, in conjunction with Royal Colleges/Faculties, will take responsibility for ensuring that all less than full-time training of any kind is undertaken in prospectively approved posts and programmes and that it meets the statutory requirements of the General and Specialist Medical Practice (Education, Training and Qualifications) Order 2003". Prior to beginning their less than full-time training, trainees must inform the Department at The Royal College of Pathologists in order that the Neuropathology SAC can ensure that their less than full-time training programme will comply with the requirements of the CCT. The documentation towards a less than full-time training application will be collected and checked to ensure compliance and a revised provisional CCT date issued. Separate guidance and an application form will be available on the [College website](#) for this purpose.

8. Delivery of Training Programme

a. Training centres

The centres that currently train specialist registrars in *Neuropathology* would be designated as Primary Training Centres for *Diagnostic Neuropathology* when this new specialty is established. Subsequently, the Royal College of Pathologists' Lead for Training (processes subject to approval by the College's Director of Training and Assessment and by the Lead Dean for *Diagnostic Neuropathology*) will encourage competitive bidding for trainees from other neuropathology laboratories. Any new training posts will need prospective approval by the GMC, as per their requirements.

The *Histopathology* component of training for trainees entering the specialty from *Neurology* or *Neurosurgery* should take place in a Histopathology laboratory and should be supervised by Consultant Histopathologists. The *Clinical Neuroscience* component of training for trainees entering the specialty from *Histopathology* should take the form of informal attachment to/attendance at [1] Neurology and Neurosurgery out-patient clinics, [2] Neurology and Neurosurgery ward rounds, [3] Neurology and Neurosurgery multi-disciplinary team meetings, [4] Neurology and Neurosurgery grand rounds and seminars, [5] Neuroradiology imaging clinics and reporting sessions, [6] Clinical neurophysiology clinics. Primary training centres, alone or in partnership with other departments in the same or other hospitals, must demonstrate that they have the facilities and expertise to deliver all these aspects of the training programme.

b. Educational supervisors

Educational Supervisors currently responsible for one or more trainees will retain this designation as Trainers for *Diagnostic Neuropathology* when the new specialty is established. Subsequently, the Royal College of Pathologists' Lead for Training and Lead Dean for *Diagnostic Neuropathology* will encourage competitive bidding for trainees from consultant neuropathologists, based on the range and depth of diagnostic case material coming through their laboratory, on the resources available for trainees, and on the expertise and track record as teacher and trainer.

c. Exchanges – secondment to secondary centres

Even outside the context of formal partnerships in training, a principal training centre should enable the trainee to spend short periods (usually one or two weeks) in National Referral Centres (or other centres with recognised special expertise), such as the National Limb Girdle Muscular Dystrophy Centre, the National CJD Surveillance Unit and one of several UK Brain Banks, allowing for the requirement for prospective GMC approval for all such training attachments.

9. Quality Assurance (GMC Curriculum Standards 5; 7.2; 8.4)

The ARCP process for Diagnostic Neuropathology trainees will be overseen and nationally undertaken by the Lead Postgraduate Dean and the College Lead for Training in *Diagnostic Neuropathology*, with support from Educational Supervisors in the Training Programmes around the UK. Responsibility for administering ultimate ARCP outcomes and undertaking remedial training where necessary would remain with the local postgraduate deaneries.

The Lead Dean will receive copies of end-of-year reports (based on Annual Review of Competence Progression) from all educational supervisors together with an overall commentary by the College's Lead for Training in *Diagnostic Neuropathology*. The report of the Lead for Training will first be submitted for consideration and discussion to the Neuropathology SAC. Membership of the SAC includes a Trainees' Representative and the Chair of the Panel of Examiners in Neuropathology, as well as the Lead and Deputy Lead(s) for Training. The SAC therefore includes the persons responsible for delivering the training programme, for delivering the assessment system and FRCPATH examination, and the trainees' representative.

Although the ARCP process will be nationally led and overseen, the local training programmes will answer to the General Medical Council (as with all other medical specialties) for over-arching quality assessment. College responsibility for curriculum development and updates, together with all other training issues which fall under the College remit will rest with the Neuropathology SAC.

10. Time out of Training

The GMC have provided [guidance](#) on the management of absences from training and their affect on a trainee's Certificate of Completion of Training (CCT) date. The GMC guidance states that, from 1 April 2013, within each 12 month period where a trainee has been absent for a total of 14 days or more (when a trainee would normally be at work), a review to determine if the trainee's CCT date should be extended is triggered. The absence includes all forms of absence such as sickness, maternity, compassionate paid/unpaid leave etc but does not include study or annual leave or prospectively approved Out of Programme Training/ research. The administration of the absence and any extension to training will be undertaken by the relevant deanery in consultation with the relevant College/Faculty where necessary. The GMC support Deaneries implementing this guidance flexibly to reflect the nature of the absence, the timing and the affect of the absence on the individuals' competence. Each trainee's circumstances is to be considered on an individual basis and that any changes to CCT date will reflect the trainee's demonstration of competence.

11. Research

Some trainees may wish to spend a period of time in research after entering *Diagnostic Neuropathology* training as out-of-programme research (OOPR).

a. Research undertaken prior to entry to a *Diagnostic Neuropathology* training programme

Trainees who have undertaken a period of research that includes *clinical work directly relevant to the Diagnostic Neuropathology curriculum* prior to entering a *Diagnostic Neuropathology* training programme can have this period recognised towards an entry on the Specialist Register. However, as the research is unlikely to have been prospectively approved by GMC, their route of entry to the Specialist Register will be through the CESR.

b. Research undertaken whilst within a *Diagnostic Neuropathology* training programme

Trainees who undertake a period of out-of-programme research (OOPR) after entering a *Diagnostic Neuropathology* training programme and obtaining their National Training Number (NTN) can have up to one year accepted by the Neuropathology SAC towards their CCT. In order to be eligible to have this period of research recognised towards the award of the CCT, trainees must have their OOPR approved prospectively by GMC before beginning their research. Prior to beginning the period of research, trainees must agree the OOPR with their deanery and inform the Training Department at The Royal College of Pathologists in order that the *Neuropathology SAC* can ensure that the trainee will comply with the requirements of the CCT programme. The period of research must include clinical work directly relevant to the *Diagnostic Neuropathology* curriculum. The documentation towards a CCT recommendation will be collected by the Training Department at the College, checked to ensure compliance and a revised provisional CCT date issued. It must be ensured that, following deanery agreement and acceptance from the Neuropathology SAC, the GMC prospectively approve the OOPR in order that the period can count towards a CCT. Separate guidance and an application form are available on the [College website](#) for this purpose.

12. Academic Trainees

Trainees who intend to pursue a career in academic or research medicine may undertake specialist training in *Diagnostic Neuropathology*. Such trainees will normally be clinical lecturers and hold an NTN(A). It is expected that such trainees should complete the requirements of the *Diagnostic Neuropathology* curriculum in addition to their academic work. However, the content of their training, while meeting the requirements of the curriculum, will have to take into account their need to develop their research and the provisional CCT date should be amended accordingly. NTN(A) holders in *Diagnostic Neuropathology* should consult the Training Department at the College on an individual basis with regard to the agreement of their provisional CCT date.

13. Overseas Training

a. Overseas training undertaken prior to entry to a *Diagnostic Neuropathology* training programme

Some trainees may have undertaken a period of histopathology or clinical neuroscience training overseas prior to entering a *Diagnostic Neuropathology* training programme in the UK at ST3. Such trainees can have this period recognised towards an entry on the Specialist Register but their route of entry to the Specialist Register will be through the CESR or CESR(CP).

b. Overseas training undertaken during a *Diagnostic Neuropathology* training programme

Some trainees may wish to spend a period of training overseas as out of programme training (OOPT) after entering a *Diagnostic Neuropathology* training programme in the UK. In order to be eligible to have this period of training recognised towards the award of the CCT, trainees must have their OOPT overseas training approved prospectively by GMC before beginning their overseas training. Prior to beginning the period of overseas training, trainees must agree the OOPT with their deanery and inform the Training Department at The Royal College of Pathologists that they will be undertaking overseas training in order that the Neuropathology SAC can ensure that the trainee will comply with the requirements of the CCT programme. The documentation towards a CCT recommendation will be collected by the Training at the College, checked to ensure compliance and a revised provisional CCT date issued. It must be ensured that, following deanery agreement and acceptance from the Neuropathology SAC, the GMC prospectively approve the OOPT in order that the period can count towards a CCT. Separate guidance and an application form will be available on the [College website](#) for this purpose.

14. Curriculum3

- a. The detailed **Curriculum and Assessment system for *Diagnostic Neuropathology*** is at **Appendix 1**, which defines the programme of training in *Diagnostic Neuropathology*. It is formulated to indicate the [1] knowledge, [2] skills and [3] attitudes/behaviours that the trainee will be expected to achieve (Appendix 1: sections 1-3, pages 27-105), and to show how and at what stage the trainee's level of achievement may be measured against defined criteria (Appendix 1: sections 4 and 5, pages 106-121). In large part, the curriculum is written in a clinical problem-led style and integrates the necessary competences in *General Pathology*, in *Basic Systemic Pathology*, and in *Clinical Neuroscience*, with those required of a consultant specialist in *Diagnostic Neuropathology*.
- b. The purpose of this curriculum (GMC Curriculum Standard 1) is to indicate [1] to the trainer, [2] to the trainee, [3] to NHS employers, [4] to users of the diagnostic neuropathology service, and [5] to the public, what knowledge, skills and attitudes/behaviours should be acquired by a trainee before s/he may consider submitting to the FRCPATH examination in *Diagnostic Neuropathology*, which will be the final, high-stakes, component of the Assessment system prior to the CCT application.
- c. The curriculum has the support of [1] the Royal College of Pathologists, including the Histopathology Specialty Advisory Committee, the Neuropathology SAC, the Director of Training and Assessment , and the Director of Examinations and [2], members of the British Neuropathological Society who are currently in practice in the UK, both consultants and trainees,

- d. The separate competences in *General Pathology* and in *Basic Systemic Pathology* that entrants into ST3 *Diagnostic Neuropathology* from *Neurology* and *Neurosurgery* must achieve are shown in **Appendix 1** (pages 123-127), which derives directly from the GMC-approved *Histopathology* curriculum. The trainee would have to achieve all the competences that are listed for Stages A and B training. Therefore, it is important that the trainee's training in Histopathology is supervised by a second educational supervisor, one who is a consultant histopathologist, and that this component of training should take place within a Histopathology laboratory in which *Histopathology* training occurs. The *Neuropathology* trainee will be able to judge the standard that is appropriate for FRCPATH Part I in *Histopathology* through interaction with *Histopathology* trainees at Stage A and Stage B of their training programme.
- e. Similarly, the competences in *Clinical Neuroscience* that entrants into ST3 *Diagnostic Neuropathology* from *Histopathology* must achieve are shown in **Appendix 1** (pages 128-139), which derive from a combination of [1] the GMC-approved *Neurology* curriculum and [2] the GMC-approved *Neurosurgery* curriculum. This appendix will assist ST3 and ST4 trainees in *Diagnostic Neuropathology* to identify the aspects of core training that must be remedied during the first two years of specialty training.
- f. The Curriculum and Assessment System in *Diagnostic Neuropathology* will be systematically revised every three years by a committee composed of the Lead for Training, the Chair of the Panel of Examiners in Diagnostic Neuropathology, the Trainees Representative, the Chair of the Clinical Practice Committee of the British Neuropathological Society (BNS) and the BNS Lead for Professional Standards. Their recommendations will be scrutinized by the College's Neuropathology SAC and then passed to the College's Director for Training and Assessment and the Director of Examinations; thence through College Council to the GMC.

15. Sequence of Learning

Whether applied across the breadth of neuropathological practice or in a modular sense, learning may be thought of in terms of a series of 5 basic steps that parallel the diagnostic process. This is applicable to neuropathological autopsy practice and to neurosurgical biopsy practice, as the following two tables show:

Sequence of Learning for the Neuropathological Autopsy (including Brain Cut)
<p style="text-align: center;">1 - Understand the clinical problem</p> <ul style="list-style-type: none">• Understand the significance of reported neurological symptoms and signs• Requires knowledge of diseases of the nervous system, of functional neuroanatomy and of differential diagnosis
<p style="text-align: center;">2 - Conduct the gross examination</p> <ul style="list-style-type: none">• Perform autopsy and remove appropriate organs/tissues samples, which depends of the acquisition of appropriate technical skills• Requires knowledge of diseases of organs systems that affect the nervous system, knowledge of gross anatomy, knowledge of gross pathology• Requires knowledge of the law governing consent for autopsy, removal and retention of organs and tissue, use of tissue
<p style="text-align: center;">3 - Conduct microscopical examination</p> <ul style="list-style-type: none">• Dependent on the acquisition of skills for tissue sampling, informative use of the light microscope, informative use of other forms of microscopy, e.g. fluorescence microscopy and electron microscopy• Requires knowledge of normal microscopical anatomy, of general pathological processes, of the morphological patterns caused by specific diseases in the context of the general body organs and tissues (not only the nervous and neuromuscular systems), of the tinctorial, histochemical, immunohistochemical and molecular tools available (and how to select them judiciously)
<p style="text-align: center;">4 - Interpret the pathological changes</p> <ul style="list-style-type: none">• Formulate a diagnosis or differential diagnosis and consider the implication of the diagnosis• Requires the ability to correlate clinical, radiological, anatomical and pathological findings; may also require correlation with other laboratory tests (e.g. haematological, chemical and genetic)
<p style="text-align: center;">5 - Demonstrate competence</p> <ul style="list-style-type: none">• Write a report which describes the gross and microscopical pathology, infers a diagnosis or differential diagnosis, and provides the clinician (or other user) with appropriate information and advice• Present case in an evidence-based manner to relevant clinician(s) separately or in the context of a multi-disciplinary team meeting

Sequence of Learning for the Neuropathological Biopsy (including Muscle and Nerve)
1 - Understand the clinical problem
<ul style="list-style-type: none"> • Understand the significance of reported neurological symptoms and signs • Requires knowledge of diseases of the nervous system, of functional neuroanatomy, and of differential diagnosis
2 - Conduct the gross examination
<ul style="list-style-type: none"> • Examine the tissue specimen and sample for processing through to paraffin wax and, if indicated, for snap-freezing and electron microscopy • Requires knowledge of diseases of the central nervous system and its coverings, of peripheral nerves and of skeletal muscle • Requires knowledge of the differential diagnosis • Requires knowledge of the law governing consent for removal and retention of tissue, and of use of tissue • Dependent on the acquisition of skills for tissue sampling
3 - Conduct microscopical examination
<ul style="list-style-type: none"> • Dependent on the acquisition of skills for, and on informative use of, the transmitted light microscope and other forms of microscopy e.g. fluorescence microscopy and electron microscopy • Requires knowledge of normal microscopical anatomy, of general pathological processes, of the morphological patterns caused by specific diseases of the central nervous system and its coverings and of diseases of the neuromuscular system • Requires knowledge of the tinctorial, histochemical, immunohistochemical and molecular tools available and skill in select from these judiciously
4 - Interpret the pathological changes
<ul style="list-style-type: none"> • Formulate a diagnosis or differential diagnosis and consider the implication of the diagnosis • Requires the ability to correlate clinical, radiological, anatomical and pathological findings; may also require correlation with other laboratory tests (e.g. haematological, chemical and genetic)
5 - Demonstrate competence
<ul style="list-style-type: none"> • Write a report which describes the gross and microscopical pathology, infers a diagnosis or differential diagnosis, and provides the clinician (or other user) with appropriate information and advice • Present case in an evidence-based manner to relevant clinician(s) separately or in the context of a multi-disciplinary team meeting

These models serve as the basis for the design of a scheme of workplace-based (WPBA) assessments. Each of the five stages of learning will have a WPBA assessment designed to determine if the trainee has acquired the knowledge, skills and attitudes/behaviours required for the particular stage. 'Blue-printing' assessments (Appendix 1: sections 4 and 5, following page 140) onto these five-stage models ensures a sequence of assessment components that add unique information and build on previous assessment(s) – **GMC Curriculum Standard 2**

a. The Neuropathological Biopsy 5-stage model may be placed into a modular context too, so that the five progressive stages of learning of the second table could be applied in context of:

- i. Neurosurgical biopsy practice
- ii. Skeletal muscle pathology
- iii. Peripheral nerve pathology

The model may be adapted for training in cytological examination of cerebrospinal fluid samples.

b. The Neuropathological Autopsy 5-stage model may also be separated into three distinct assessable streams:

- i. Adult autopsy practice
- ii. Paediatric autopsy practice
- iii. The Coroner's autopsy

c. Methods for workplace-based assessments (**GMC Curriculum Standard 8**) may take the form of:

- i. Systematic observation of clinical practice
- ii. Direct observational procedure

iii. Judgements of multiple assessors

d. Simulation of clinical situations may be assessed by:

- i. Case review, including autopsy and biopsy reports
- ii. Case-based discussion
- iii. Oral presentations
- iv. multi-source feedback
- v. User feedback survey
- vi. Audit projects
- vii. Critical incident review

e. The specific method of WPBA assessment will be up to the trainee and educational supervisor, but must comply with **mandatory requirement 8.3**, which states:

- i. *That the WPBA-derived evidence must come from different sources*
- ii. *That the evidence must be judged against pre-determined published criteria, where available*
- iii. *That the weight placed on different sources of evidence must be determined by a blueprint and by the quality of the evidence*
- iv. *That the synthesis of the evidence and the process of judging it must be made explicit*

Trainees and educational supervisors will make use of the web-based resource for workplace-based assessment that has been established by the RCPATH. The RCPATH will train educational supervisors and provide guidance to trainees.

16. Model of Learning(GMC Curriculum Standard 6)

- a. A useful model of learning may be based on the two tables in the previous section. Whilst the curriculum sets out the specialty-specific content (as well as the general and professional content) to be ‘mastered’ by the trainee (**GMC Curriculum Standard 3**), the standard also requires that “the recommendations on the **sequencing of learning and experience** should be provided”. Also, **mandatory requirement 3.2** requires the content of the curriculum to be presented in terms of “the **intended outcomes of learning, benchmarked to identifiable stages of training** where appropriate”. A sub-clause to mandatory requirement seeks to explain this as “What the trainee will know, understand, describe, recognise, be aware of and be able to do **at the end of the course**”.
- b. Section 2 (page 5) of this document sets out the competences expected of a trainee **at the end of the training programme**, though these are phrased as ‘Aims of the training programme’. The curriculum indicates the same in detailed and specific terms, using a **clinical problem-led approach**. Curriculum standard 3, and its mandatory requirements, also requires the curriculum to set out a **TIME-LINE OF LEARNING**. Therefore, an example of such a time-line is provided here as guidance for those trainees/education providers that seek it:

	Know, describe and recognise:	Understand and be aware of:	Be able to do:
End of Year 1 / ST3	<ul style="list-style-type: none"> • General pathology • Gross and microscopical anatomy of general body organs and tissues • Gross and microscopical anatomy of the developed brain and spinal cord • Gross and microscopical anatomy of the developing brain and spinal cord • Principles of neurology • Principles of neurosurgery • Principles of neuroimaging 	<ul style="list-style-type: none"> • Principles and use of histochemical techniques • Principles and use of immuno-histochemical techniques • Clinical context of the diagnostic dilemma • The law regulating the removal, retention and use of human tissue • Functional neuroanatomy • Clinico-anatomical correlation • Diseases of the nervous system 	<ul style="list-style-type: none"> • Conduct a general autopsy • Conduct cut-up and sampling of biopsy specimens • Dissect a formalin-fixed brain • Remove the brain (not spinal cord) and general organs from a body at autopsy • Use a light microscope • Interpret HandE-stained sections • Diagnose basic pathological processes in a variety of diseased organs and tissues • Diagnose typical examples of common neuropathological disorders • Draft autopsy and biopsy reports

	Know, describe and recognise:	Understand and be aware of:	Be able to do:
End of Year 2 / ST4	<ul style="list-style-type: none"> • Basic gross and microscopical pathology of major organs • Basic gross and microscopical neuropathology • Tumours of the nervous system and its coverings • Hypoxic and ischaemic injury of the CNS • CNS infection • Demyelinating diseases 	<ul style="list-style-type: none"> • Principles and use of molecular pathology techniques • Principles of neurological differential diagnosis 	<ul style="list-style-type: none"> • Conduct a neuropathological autopsy, including removal of the spinal cord and dorsal root ganglia • Self-assessment and audit • Improved accuracy in drafts of autopsy and biopsy reports • Present straightforward cases at multi-disciplinary meetings
End of Year 3 / ST5	<ul style="list-style-type: none"> • Paediatric and developmental neuropathology • Lysosomal, peroxisomal and mitochondrial disorders • Traumatic neuropathology • Diseases of peripheral nerve • Diseases of skeletal muscle • Extended knowledge of systemic pathology 	<ul style="list-style-type: none"> • Principles and application of electron microscopy 	<ul style="list-style-type: none"> • Extend neuropathological autopsy to include removal of vertebral arteries, autonomic nerves • Improve the accuracy of drafts of autopsy and biopsy reports • Begin to draft reports on intra-operative biopsy specimens • Present cases that have some degree of diagnostic uncertainty at multi-disciplinary meetings • Demonstrate knowledge of <i>General and basic systemic pathology</i> by success in FRCPath Part 1 examination in <i>Histopathology</i>

	Know, describe and recognise:	Understand and be aware of:	Be able to do:
End of Year 4 / ST6	<ul style="list-style-type: none"> • Neurodegenerative diseases • Prion diseases • Pathology of epilepsy • Principles of diagnostic (non-neuro) cytopathology • Principles of laboratory management • Medical law and ethics relevant to neuropathological practice 	<ul style="list-style-type: none"> • The cellular and molecular basis of diseases of the nervous system and of skeletal muscle 	<ul style="list-style-type: none"> • Extend neuropathological autopsy to include removal of the brachial and lumbar plexuses • Improve the accuracy of intra-operative biopsies • Improve the accuracy of drafts of autopsy and biopsy reports • Demonstrate competence by success in FRCPATH Part 2 examination in <i>Diagnostic Neuropathology</i>
End of Year 5 / ST7	<ul style="list-style-type: none"> • Advanced knowledge of gross and microscopical neuropathology 		<ul style="list-style-type: none"> • CCT in <i>Diagnostic Neuropathology</i>

- c. This time-line table has drawbacks. It is valuable to state the knowledge, skills and attitudes/behaviours that should have been achieved at 6 months and at 12 months, in order to confirm suitability of the trainee to progress within the training programme. However, after 12 months the requirement should be less dogmatic. There should be evidence of increasing and expanding knowledge, skills and attitudes/behaviours (i.e. in depth and in breadth), such that the trainee is able to undertake more steps in the Sequence of Learning (see tables in section 9) with fewer errors year by year, particularly with cases of increasing complexity and greater diagnostic uncertainty, eventually working up and reporting cases without immediate supervision. Trainees, in agreement with their educational supervisors, should be free to decide which blocks of knowledge to acquire in any particular training year.
- d. Subject to the agreement of the relevant Deanery, of the educational supervisor and of the Trust, the trainee should be able to undertake a period of out-of-training research experience if the opportunity arises.

17. The Assessment System (GMC Curriculum Standard 2)

a. Purpose of the assessment system

The purpose of The Royal College of Pathologists' assessment system in histopathology and its subspecialties is:

- i. To confirm suitability of choice at an early stage of training in *Diagnostic Neuropathology*.
- ii. To indicate the capability and potential of a trainee through tests of applied knowledge and skill relevant to the *Diagnostic Neuropathology*.
- iii. To enable the trainee to collect all necessary evidence for the ARCP; this assesses readiness to progress from one year of training to another.
- iv. To support trainees to progress at their own pace by measuring a trainee's capacity to achieve competences in *Diagnostic Neuropathology*.
- v. To promote and encourage learning and to provide feedback to the trainee about progress and learning needs.
- vi. To provide evidence for the award of the CCT.
- vii. To assure the public that the trainee is ready for and capable of unsupervised professional practice.

b. Components of the assessment system

The components are:

- i. A series of compulsory workplace-based assessments within specialty training, which are low-stakes assessments, intended to **drive learning** (the acquisition of knowledge, skills and behaviours), to discover inadequacies in this process and to assist in **planning and adjusting the training programme** (Appendix 1 sections 4 and 5).
- ii. **FRCPATH Part 1 examination in Histopathology**, which is intended to assess whether or not the trainee has achieved basic knowledge and competence in general and systemic (other than the nervous system) pathology.
- iii. **FRCPATH Part 2 examination in Diagnostic Neuropathology** intended to assess whether or not the trainee has achieved a standard that fulfils the aim of the programme, as stated in Section 2a (page 5) for **all** modules of the curriculum. Success in this examination is a central requirement before the trainee can apply for a CCT in Diagnostic Neuropathology. The trainee's portfolio will also be assessed by the College during an application for **CCT in Diagnostic Neuropathology**, and an appropriate recommendation made to the GMC.

18. Workplace-Based Assessment (GMC Curriculum Standard 2)

Trainees will be expected to undertake workplace-based assessment throughout their training in diagnostic neuropathology. In general, workplace-based assessments are designed to be formative in nature; as such they are best suited to determine educational progress in different contexts. To this end, it is strongly recommended that workplace-based assessment be carried out regularly throughout training to assess and document a trainee's progress. However, a minimum number of "satisfactory" workplace-based assessments should be completed during each stage of training. These will include:

- Case-based discussion (CbD) – minimum of 6 each year of training
- Directly observed practical skills (DOPS) – minimum of 6 each year of training
- Evaluation of clinical events (ECE) – minimum of 6 each year of training
- Multi-source feedback (MSF) – one at the end of the first year of training and another every other year thereafter. – this describes histopathology but needs to be better tailored to diagnostic neuropathology.

19. Medical Leadership Competency Framework

The Royal College of Pathologists supports the integration of the NHS Institute for Innovation and Improvement Medical Leadership Competency Framework into our specialty training curricula. The details of this framework and the competencies contained therein can be found [here](#). A proportion of the workplace-based assessments undertaken annually by *Diagnostic Neuropathology* trainees should assess competencies included within this framework. Training in these areas of generic practice should be included in the annual training plan for each trainee.

20. Audit, Patient Safety and Service Improvement

The Royal College of Pathologists supports the integration of training in these areas into our specialty training curricula. A proportion of the workplace-based assessments undertaken annually by *Diagnostic Neuropathology* trainees should assess training in, knowledge of and/or projects undertaken in these areas. Training in these areas of generic practice should be included in the annual training plan for each trainee.

21. FRCPath Part 2 Examination in *Neuropathology*

The FRCPath Part 2 examination in *Neuropathology* is a 'high stakes' examination taken at the end of the period of specialist training. Imperatives include the assurance of high reliability and high validity. The FRCPath Part 2 examination in *Neuropathology* examination is designed to test:

- Factual knowledge
- Technical skills
- Pattern recognition
- Selection of further tests (test selection)
- Clinico-anatomical correlation
- Clinico-pathological correlation
- These parameters imprint (blueprint) onto the components of the FRCPath *Neuropathology* examination:

	Factual knowledge	Technical skills	Pattern recognition	Test selection	Clinico-anatomical correlation	Clinico-pathological correlation
Autopsy		✓				✓
Brain-cutting		✓		✓		
Brain slices	✓				✓	✓
Surgical biopsies	✓		✓	✓		✓
Intra-operative diagnosis			✓			
Autopsy brain microscopical pathology	✓		✓		✓	✓
Muscle and/or Nerve biopsy	✓		✓			
Oral Examination	✓					

The candidate's judgement, problem-solving ability and professional attitude are other aspects that are assessed over the examination as a whole; but they do not form part of the key construct at component level.

22. Blueprinting Curriculum and Assessment System onto Principles of Good Medical Practice

A blueprint has been produced that shows the main components of the curriculum and assessment system in *Diagnostic Neuropathology* relate to the GMC's principles of Good Medical Practice which can be found on the College website.

23. Criteria for Award of CCT

- a. Evidence of satisfactory completion of the Diagnostic Neuropathology curriculum and the minimum training period.
- b. Satisfactory outcomes in the requisite number of workplace-based assessments (including multi-source feedback).
- c. A pass in FRCPATH Part 1 examination in Histopathology.
- d. A pass in the FRCPATH Part 2 examination in Diagnostic Neuropathology.
- e. Acquisition of Annual Review of Competence Progression (ARCP) Outcome 6.

24. Validation of the Training Programme

- a. The method and process of selection for entry into specialty training will be validated by review of the trainees' performance at the first 'Annual Review of Competence Progression' after admission.
- b. The training programme will be validated by candidates' success rate in the FRCPATH Part 2 examination in Diagnostic Neuropathology.

25. Managing Curriculum Implementation

The curriculum outlines the minimum requirements for delivery of training in *Diagnostic Neuropathology* in a regional training programme. It guides educational supervisors as to what is required to deliver the curriculum and guides trainees in the learning and assessment methods required for satisfactory completion of training.

It is the responsibility of the local Educational Supervisor and their Deanery/Postgraduate School, with the assistance of the regional STC and supported by the College Lead for Training in *Diagnostic Neuropathology*, to ensure that the programme delivers the depth and breadth of specialty training outlined in the *Diagnostic Neuropathology* curriculum. The College Lead for Training and Lead Dean will ensure that each post or attachment within the programme is approved by the GMC. Heads of Pathology School (HOPS) have a strategic overview of training in the Pathology specialties. They are responsible for ensuring that the delivery of education and training meets the College- and GMC-agreed curriculum and is provided to the standards set by the College and the GMC.

It is the responsibility of the GMC and Deaneries to quality assure training programmes to ensure training programmes across the UK are able to deliver a balanced programme of training.

It is the responsibility of the educational/clinical supervisor of a particular post or attachment within a programme to ensure that the training delivered in their post meets the requirements of the relevant section(s) of the curriculum. The educational supervisor must undertake regular educational appraisal with their trainee, at the beginning, middle and end of a section of training, to ensure structured and goal-oriented delivery of training.

Trainees must [register](#) with The Royal College of Pathologists on appointment to a *Diagnostic Neuropathology* training programme. It is the trainee's responsibility to familiarise themselves with the curriculum and assessment requirements both for the satisfactory completion of each stage of training and the award of the CCT or CESR(CP). They must be familiar with all aspects of the assessment system; workplace-based assessment including multi-source feedback, the Year 1 Histopathology Assessment and the FRCPath examination. It is the trainee's responsibility to ensure that s/he apply in good time for any assessments and examinations that demand an application. Trainees must also make appropriate use of the [LEPT](#) system and e-learning.

26. Curriculum Review and Updating

The curriculum will be evaluated and monitored by The Royal College of Pathologists as part of continuous feedback from STCs, Programme Directors, Regional Specialty Advisors, trainers and trainees.

The curriculum will be formally reviewed in the first instance by the College's *Diagnostic Neuropathology* SAC within 2 years of publication. In reviewing the curriculum, opinions will be sought from the College's SAC on Histopathology, its related subspecialty sub-committees, the Trainees Advisory Committee, the Lay Advisory Committee and its Fellows and Registered Trainees.

Any significant changes to the curriculum will need the approval of The Royal College of Pathologists' Council and the GMC.

27. Equality and Diversity

Extract from The Royal College of Pathologists' *Diversity and equality policy and approach* (December 2006). A full copy of the policy is available on the [College website](#).

The Royal College of Pathologists is committed to the principle of diversity and equality in employment, membership, academic activities, examinations and training. As part of this commitment we are concerned to inspire and support all those who work with us directly and indirectly.

Integral to our approach is the emphasis we place on our belief that everyone should be treated in a fair, open and honest manner. Our approach is a comprehensive one and reflects all areas of diversity, recognising the value of each individual. We aim to ensure that no one is treated less favourably than another on the grounds of sex, race, age, sexual orientation, gender reassignment, disability, pregnancy & maternity, religion and belief and marriage and civil partnership. Our intention is to reflect not only the letter but also the spirit of equality legislation.

Our policy will take account of current equality legislation and good practice as outlined in the Equality Act 2010 which supersedes/includes all previous legislation.

The Training Department collects information about the gender and ethnicity of trainees as part of their registration with the College. This information is recorded by the College and statistics published on an annual basis in the annual report. Further information about the monitoring activities of the College trainees, candidates and Fellows are available in the College policy.

28. Conclusion and Acknowledgements

The structure and content of the training programme, curriculum and assessment system in *Diagnostic Neuropathology*, which are contained in this document and appendices, have been developed through consultation [1] with all practising consultant neuropathologists in the UK and all current trainees (specialist registrars) in Neuropathology, [2] with representatives of UK consultant neurologists, consultant neuro-oncologists and consultant neurosurgeons, [3] with representatives of consultant histopathologists, consultant paediatric pathologists and consultant forensic pathologists, [4] with trainees, and [5] with representatives of some patient groups, such as the Motor Neuron Disease Association. Strategic Health Authorities were consulted as part of the 'stage one application' process.

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APPENDIX 1: CURRICULUM AND ASSESSMENT SYSTEM FOR SPECIALTY TRAINING IN DIAGNOSTIC NEUROPATHOLOGY

INTRODUCTION

1.1. Aims and Objectives

1.1.1. Aim

The aim of the College in devising this *Curriculum and Assessment System in Diagnostic Neuropathology* is to ensure that all trainees, trainers, educational supervisors and education providers in *Diagnostic Neuropathology* are aware of the knowledge, skills and attitudes necessary for a career in *Diagnostic Neuropathology* within the NHS.

1.1.2. Objective

The objectives of this Curriculum are to ensure that training is provided, and competence achieved, in the following essential areas of neuropathological practice in the context of Specialty Registrar appointments in *Diagnostic Neuropathology* of 4 to 5 years duration.

The key elements to be achieved in a training programme are as follows:

1.1.2.1. *Diagnostic and interpretative skills in anatomic and microscopic pathology to the standards expected of a consultant:*

- **Competence** in all aspects of surgical and autopsy pathology, including gross description, dissection of specimens and histological diagnosis and reporting
- **Proficiency** in the major sub-speciality of neuropathology, including paediatric neuropathology and forensic/medico-legal neuropathology

1.1.2.2. *Lifelong learning habits and data acquisition/interpretation:*

- To develop lifelong learning habits in reading, information gathering, consultation with colleagues and attendance at scientific meetings as part of continuing professional development
- To understand research and development methods and to be involved in research projects which should lead to scientific presentations and publication
- To be able to critically assess published scientific data.

1.1.2.3. *Understanding of basic scientific principles:*

- Acquiring adequate levels of factual knowledge in normal anatomy, histology and basic science underlying pathological processes,

modern laboratory techniques

- Understanding the limitations of human interpretation of images and data and also those of new technologies.

1.1.2.4. Familiarity with routine laboratory techniques and health and safety issues:

- Requirements of and implementation of health and safety legislation
- Rational use of special stains to achieve diagnostic benefit
- Appropriate use of special techniques (e.g. Cytogenetics, molecular diagnostics, EM etc).

1.1.2.5. Understanding of information technology:

- Laboratory data entry and retrieval systems
- Ability to search electronic databases
- Use of the World Wide Web as a learning and communication resource
- Understanding of the Data Protection Act and requirements for patient confidentiality.

1.1.2.6. Laboratory management and communication expertise:

- To understand the organisation and structure of a histopathology/neuropathology laboratory including staffing and financial issues
- To understand the concepts of good laboratory practice, and criteria for laboratory accreditation and how to implement these
- To develop management and communication skills, including the planning and implementation of policies which require leadership skills
- To understand the importance of audit and the ability to audit their personal and departmental activities
- To develop the ability to evaluate and audit existing and new tests, techniques and services
- To gain experience in planning and implementation of departmental policies and rotas
- To develop an ability to work as part of a team including close liaison with clinicians
- To be able to present pathological data to clinicians and other health care workers in an effective manner.

1.1.2.7. Responsibility for maintaining and developing standards of professional practice:

- To understand the importance of clinical governance and delivery of high quality standards in histopathology and neuropathology
- To understand the concept of clinical risk management and procedures designed to minimise risks
- To understand the importance of patient consent to the use of data or biomaterials for ethically approved research and for teaching.

1.2. Training Programme

The specialty registrar (StR) is expected to spend at least four years in supervised training (ST3-ST6). A trainee entering specialty training from either ST3 Neurology or ST3 Neurosurgery has to become competent in basic diagnostic histopathology and acquire proficiency in the sub-

specialty of neuropathology. The trainee is expected to spend considerable time (a minimum of twelve months) attached to non-neuropathology parts of the histopathology rota during the first two years of training, leading to the Part I FRCPATH examination in Histopathology. Then, the third and fourth years of training will focus on neuropathology. A trainee entering specialty training from ST2 Histopathology has to become knowledgeable in basic neuroscience and in the principles of clinical neurology and neurosurgery. These trainees should spend 12 months out of the first two years of training acquiring this knowledge (and associated skills) either in the neuropathology laboratory (such as learning neuroanatomy through brain dissection) or attached to clinical departments, including Neurology, Neurosurgery, Neuroradiology and Clinical Neurophysiology.

In Section 3 of this Curriculum, the trainee is provided with some guidance on how to acquire knowledge of General Pathology, Basic Systemic Histopathology and Neuropathology by the inclusion of selected current textbook titles. For the benefit of trainees entering specialty training from ST2 Histopathology, a selection of titles in Neuroanatomy, Neurology, Neurosurgery and Neuroradiology is provided at the end of the document (page 115).

The usual four-year period of StR training is traditionally based on the apprenticeship model, where the trainee learns basic technical skills (surgical cut-up, brain cutting, general and special autopsy techniques, preparation of wet smears and, in some centres, how to perform open or needle muscle biopsies) to support the diagnostic service. Thus the trainee is involved early and directly with current cases, both surgical biopsies and autopsies. There is less reliance on study of archived material early in training, since the trainee can expect to encounter most examples of neuropathology over the course of training.

Focused study of archived material is likely to become a significant element in training in the third and fourth years of training. This activity is driven by the imminent Part 2 FRCPATH examination in Diagnostic Neuropathology and it seeks to provide the trainee with experience of rare neuropathological disorders, which are likely to be found in one or two specialist centres in the UK or elsewhere.

The specialty registrar should attend scientific meetings of the British Neuropathological Society, the Wye College Symposia, educational programmes of the European Confederation of Neuropathological Societies (EuroCNS), and other national and international meetings.

The training programme should be flexible in order to facilitate audit projects, clinical or scientific research projects and modular credentialing.

The assessment system includes; [a] workplace-based assessments, [b] the annual review of competence progression (ARCP), [c] the Part 1 FRCPATH examination in Histopathology, [d] the Part 2 FRCPATH examination in Diagnostic Neuropathology.

1.3. Overview of Knowledge and Skills

See Section 4 for *Assessment of Knowledge* and Section 5 for *Assessment of Skills*. Section 1.4

1.3.1. The skills, knowledge and competencies expected of a consultant neuropathologist are implicit in the structure of the Part 2

examination for FRCPath diploma in *Diagnostic Neuropathology*. There are 6 components to the FRCPath examination in *Diagnostic Neuropathology*:

- Autopsy
- Brain cut (dissection, macroscopical examination and sampling for histology)
- Brain slices (macroscopical examination of archived brain tissue)
- Long cases, including muscle biopsy
- Neurosurgical biopsies, including muscle and nerve
- Intra-operative diagnosis using wet smears and/or frozen sections, and
- Cerebrospinal fluid cytology

Candidates may be examined also on aspects of:

- Ocular pathology
- Skin
- Bone and soft tissue pathology

1.3.2. Examiners require evidence of competence in the following areas:

1.3.2.1. *Knowledge*

- Full spectrum of systemic gross pathology
- Expert knowledge of external and internal gross anatomy of the brain, including:
 - Blood supply
 - Afferent and efferent projection pathways of major cortical areas and subcortical, brainstem and cerebellar nuclei
- Gross pathology of the spinal cord and its coverings, including the vertebral column
- Clinical-anatomical correlation
- Sampling protocols according to clinical problem
- Surgical neuropathology
 - Use of HandE-stained sections to provide:
 - Reasonably narrow differential diagnosis
 - Distinguish between a reactive process and neoplasm
 - Distinguish between a tumour that is benign (low grade) or malignant (high grade)
- Judicious use of immunohistochemical preparations to assist neuropathological differential diagnosis
- Judicious use of electron microscopy, in situ hybridization and other molecular biology techniques to assist neuropathological differential diagnosis

1.3.2.2. *Skills*

- Perform general body autopsy (guidelines)
- Examination of skull and intracranial contents, including dural venous sinuses, pituitary gland, cranial nerves, middle ear cavities and sinuses of the skull

- Examination and dissection of the arterial circle of Willis
- Removal of the brain
- Examination of the spine and removal of spinal cord and dorsal root ganglia
- Exposure and removal of cervical, brachial and lumbar plexuses
- Examination of carotid sheath, including sympathetic and vagal ganglia
- Removal of thoracic sympathetic chain
- Sampling of muscles supplied by motor cranial nerves
- Exposure and removal of the vertebral artery along its entire course
- Dissection, examination and sampling of the fixed brain (in coronal and/or horizontal plane) and spinal cord
- Observational skills (must not miss macroscopical neuropathology)
- Diagnostic interpretation of neurosurgical biopsies
- Diagnostic interpretation of cytological preparations of cerebrospinal fluid
- Diagnostic interpretation of skeletal muscle biopsies
- Diagnostic interpretation of peripheral nerve biopsies
- Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case.
- Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed.
- Ability to make you understood to lay persons and to professionals at all levels.

1.4. Overview of Training Programme

The upper part of the matrix shows the SKILLS that should be acquired progressively over the 4-year period of the training programme. The lower part of the matrix shows the KNOWLEDGE that should be acquired progressively over the same period. The time spent on textbook (journal review) study and on examination of archive material decreases as the time spent acquiring skills and participating in *current* workload increases through the period of training.

First Year	Second Year	Third Year	Fourth Year
Neuropathology autopsy techniques Brain cut (adult cases) Neurosurgical cut-up	Neuropathology autopsy techniques Brain cut (adult cases) Neurosurgical cut-up CSF cytology Responsibility for current autopsy cases	Neuropathology autopsy techniques Brain cut (adult and paediatric cases) Neurosurgical cut-up CSF cytology Reporting current autopsy cases Reporting current neurosurgical biopsies Reporting current CSF cytology Intra-operative smear preparations	Neuropathology autopsy techniques Brain cut (adult and paediatric cases) Neurosurgical cut-up CSF cytology Reporting current autopsy cases Reporting current neurosurgical biopsies Reporting current CSF cytology Intra-operative smear preparations Muscle biopsies Peripheral nerve biopsies Forensic neuropathology
<ul style="list-style-type: none"> • Neuroanatomy • General neuropathology <ul style="list-style-type: none"> • Cellular pathology of the central nervous system • Raised intracranial pressure, oedema and hydrocephalus • Hypoxia and vascular disease • Clinical neurology and principles of neurosurgery • Principles of neuro-imaging • Clinico-anatomical correlation • Developmental anatomy 	Nutritional, metabolic and toxic disorders Lysosomal, peroxisomal and mitochondrial disorders Trauma and Epilepsy Infections of the CNS Neurodegenerative disease & prion disorders Demyelinating disorders Tumours of the nervous system	Developmental neuropathology Paediatric neuropathology Skeletal muscle pathology Peripheral nerve pathology Forensic neuropathology Differential diagnosis in neuropathology	CPA (UK) Ltd Standards for Clinical Pathology Laboratories Laboratory Management

2. GENERAL OBJECTIVES IN MORBID ANATOMY WITHIN THE CONTEXT OF THE NHS

Taken (with minor modifications) from RCPATH Histopathology Curriculum & Assessment system (2010), compiled by Dr Adrian Bateman & David Bailey

2.1. Good Clinical Care

Subject	Knowledge	Skills	Attitudes
Basic knowledge	<ul style="list-style-type: none"> • Possess sufficient general clinical knowledge including major changes in trends of diagnosis and treatment. • Possess sufficient knowledge of normal anatomy, physiology and pathophysiology. 	Develop the ability to solve complex clinical and research, when applicable] problems by applying sound knowledge of basic principles without the requirement always to rely on 'pattern matching'.	Understand importance of integration of clinical and pathological data for accurate diagnosis.
Surgical cut-up	Understand principles of specimen dissection, macroscopic description and block selection in neoplastic and non-neoplastic disease.	Possess sufficient manual dexterity to perform dissection safely and accurately, without damage to tissues.	<ul style="list-style-type: none"> • Understand importance of accuracy and requirement for attention to detail during specimen description and block selection. • Understands importance of ensuring that request form and specimen identification is accurate and the requirement to identify and resolve any errors or discordance.
Laboratory processes	Understand the principles of laboratory processing within surgical pathology and cytopathology.	One week's or equivalent experience of laboratory processing including section cutting at the start of training.	Respect the work of the technical staff in preparing slides for viewing.
Surgical reporting	<ul style="list-style-type: none"> • Understand the principles of microscopy. • Knowledge of the microscopic features of the range of normality within tissues 	<ul style="list-style-type: none"> • Be able to set up a microscope with ergonomic safety and operate it effectively. • Be able to recognise the 	<ul style="list-style-type: none"> • Understand requirement for attention to detail during surgical reporting and the need for correlation with the

	as well as the major common pathological processes and patterns of disease.	microscopic features of tissue structure in normality and disease	clinical situation. <ul style="list-style-type: none"> • Demonstrate an understanding of the importance of surgical pathology to clinicians and patients [e.g. timeliness and accuracy of reporting]. •
Special techniques	<ul style="list-style-type: none"> • Understand principles of 'special' histochemical and immunohistochemical methods. • Understand principles of common molecular pathology techniques. Understand principles of electron microscopy. 	<ul style="list-style-type: none"> • Know when to resort to special techniques. • Be able to recognise histological features of histochemical and immunohistochemical stains in normal & diseased tissues. 	Understand cost-benefit issues when considering the use of additional techniques.
Fundamentals of molecular biology	<ul style="list-style-type: none"> • Understanding of the origins and consequences of germ-line variation and somatic mutations, including DNA methylation and gene expression changes • Knowledge of basic molecular databases • Knowledge of how histological samples are taken prepared and of how nucleic acids are extracted from them • The principles of the most up-to-date molecular methods • Knowledge of molecular tests currently performed on histological samples, including the limitations of those tests, and of tests which are anticipated in the near future 	<ul style="list-style-type: none"> • Ability to understand origins of, and justifications for, molecular tests • Ability to retrieve relevant data from public sources • Ability to undertake the appropriate sample collection, retrieval and preparation for the common molecular tests, whether performed on extracted nucleic acid or in situ • Knowledge of sequencing, PCR, microarrays (DNA and RNA), in situ hybridisation, mutation detection • Ability to assess the demand for molecular tests and the modes of supply 	<ul style="list-style-type: none"> • Ability to understand and explain the underlying principles of molecular genetics and molecular pathology • Appreciation of state of knowledge and how to update that knowledge • Ability to relate histological sample types and availability to the molecular analyses which might be performed on them • Appreciation of the available technologies • Appreciation of how molecular methods can contribute to patient care and could do so in the future
Autopsies	<ul style="list-style-type: none"> • A wide knowledge of the pathological basis of disease and the 	<ul style="list-style-type: none"> • Be able to obtain consent for autopsies and for further 	<ul style="list-style-type: none"> • A desire to learn about common disease processes

	<p>macroscopic/microscopic pathology of various types of death.</p> <ul style="list-style-type: none"> • Possess knowledge of anatomy, macroscopic features of major disease processes and common tissue dissection techniques relevant to autopsy practice. • Know the main side effects of common treatments & the major complications of most surgical procedures. • Have some understanding of the training undertaken by anatomical pathology technologists (APTs) and the role that they can appropriately play within all aspects of the mortuary function. • Have an understanding of the use of clinical information and the health record in autopsy examination. • Be conversant with current policy in relation to consent for autopsies and for tissue or organ retention. • Be conversant with current policy in relation to tissue or organ donation. • Understand the legal basis of consent to autopsy examination and the circumstances in which consent is not required. • Be aware of the value of the autopsy as a teaching aid. 	<p>investigation of tissue or whole organs.</p> <ul style="list-style-type: none"> • Demonstrate manual dexterity sufficient to perform autopsies safely and to demonstrate the major abnormalities. • Acquire the ability to demonstrate findings to clinicians and medical students, with clear clinicopathological correlation. • Liaise with the APTs to maximise the autopsy learning opportunities • Be able to interrogate the clinical and laboratory records and understand the utility and limitations associated with various types of investigation including imaging, microbiology and biochemistry. • Be able to identify issues to be addressed by the autopsy examination. • Appropriate teaching skills 	<p>through the autopsy</p> <ul style="list-style-type: none"> • Understand issues of autopsy consent, tissue/organ retention and coroners/procurator fiscal practice. • Demonstrate an understanding of the importance of autopsy findings to clinicians and relatives. • Be able to give explanation to families of the reasons for, and if requested, details of the investigations required by an autopsy examination. • Understand issues of autopsy consent, tissue/organ retention and Coroners'/Procurator Fiscals' practice. • Be aware of religious and cultural sensitivities relating to autopsy. • Be able to liaise with clinical colleagues in order to obtain clinical information prior to autopsy. • Be able identify and address the questions and issues raised by the death. • Be conversant with current clinical practice. • Welcome clinicians and other appropriate visitors to the mortuary to share knowledge. • Be able to explain to families
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			<p>when tissue or organs may need to be sent away for expert review and options for funeral, disposal etc.</p> <ul style="list-style-type: none"> • Be prepared to teach at every opportunity
2.2. Personal Organization and Efficiency			
Subject	Knowledge	Skills	Attitudes
Overall clinical judgement	<ul style="list-style-type: none"> • Possess sufficient clinical and pathology knowledge to enable integration of clinical data and pathological features. • Be aware of the extent of one's own limitations and know when to ask for advice. 	Correct interpretation of pathological features in the context of available clinical information.	<ul style="list-style-type: none"> • Understand the quantity and quality of clinical information required for accurate diagnosis in most situations. • Consult and admit mistakes
Written records	<ul style="list-style-type: none"> • Possess knowledge of the appropriate content of reports. • Understand the principles of diagnostic coding and report archiving. • Recognise the problems faced by people for whom English is not a first language. • Recognise the problems faced by people with educational and/or physical disabilities. • Know the relevance of data protection pertaining to patient confidentiality. 	Produce accurate reports with clear conclusions and other written correspondence.	<ul style="list-style-type: none"> • Appreciate the importance of timely dictation, cost-effective use of medical secretaries & the growing use of electronic communication. • Be aware of the need for prompt and accurate communication with clinicians. • Show courtesy towards medical secretaries and clerical staff.
Time management	<ul style="list-style-type: none"> • Understand which tasks take priority. • Understand the importance of 	<ul style="list-style-type: none"> • Start with the most important tasks. • Recognise when falling behind and 	<ul style="list-style-type: none"> • Have realistic expectations of tasks to be completed by self and others.

	punctuality.	re-prioritise or call for help. • Develop timekeeping skills.	• Be willing to consult and work as part of a team.
Decision making	Demonstrate in practice the clinical priorities for investigation and management.	Analyse and manage clinical problems effectively.	• Be flexible and willing to change in the light of changing conditions. • Be willing to ask for help.
Life-long learning	<ul style="list-style-type: none"> • Demonstrate the importance of continuing professional development. • Understand the concepts of appraisal and assessment. 	<ul style="list-style-type: none"> • Recognise and use learning opportunities. • Use the potential of study leave to keep one up to date. Able to maintain a portfolio. • Maintain a professional portfolio • Monitor own performance through audit and feedback. 	<ul style="list-style-type: none"> • Be self-motivated and eager to learn. • Show willingness to learn from colleagues and to accept feedback. • Demonstrate a positive attitude to appraisal.
Good use of information technology.	<ul style="list-style-type: none"> • Understand use of email, internet, fax and the telephone • Apply the principles of how to retrieve and utilize data recorded in clinical systems. • Apply the principles of literature searching using medical databases. • Demonstrate an understanding of the range of possible uses for clinical data and information and appreciate the dangers and benefits of aggregating clinical data. • Correctly apply the principles of healthcare-related coding systems e.g. diagnostic coding within neuropathology reports. • Apply the principles of video-conferencing and tele-pathology – including recognition of the strengths and pitfalls of these systems. 	<ul style="list-style-type: none"> • Demonstrate competent use of database, word processing and statistics programmes. • Find, access and evaluate websites and health-related databases (including literature searches). • Apply the principles of confidentiality in the context of IT. • Use data encryption and passwords appropriately. • Use digital imaging devices effectively and manage image resolution and colour-space. • Use video-conferencing and tele-pathology equipment when necessary. • Use coding systems effectively. 	<ul style="list-style-type: none"> • Be prepared to use IT tools within a diagnostic and, where relevant, research setting e.g. video-conferencing and tele-pathology systems. • Be aware of ethical issues that might arise during the use of IT tools such as patient databases. • Demonstrate an understanding of the importance of accurate diagnostic coding. • Keep up-to-date with new developments within IT that are pertinent to histopathology. • Be prepared to invest time and effort in learning new IT skills as appropriate to one's

	<ul style="list-style-type: none"> Define the main features, responsibilities and liabilities in the UK and Europe pertaining to confidentiality. 		role.
2.3. Teamwork and Communication			
Subject	Knowledge	Skills	Attitudes
Clinical teams	<ul style="list-style-type: none"> Understand how a team works. Understand the roles and responsibilities of team members, especially within the department and within multidisciplinary teams. Know the roles and responsibilities of team members. Know how a team works effectively. Know the roles of other clinical specialties and their limitations. 	<ul style="list-style-type: none"> Be able to communicate effectively. Seek advice if unsure. Recognise when input from another specialty is required for individual patients. Be able to work effectively with other health care professionals, including demonstration of material at MDT meetings. Respect skills and contribution of colleagues. Recognise own limitations. Delegate, show leadership and supervise safely. 	<ul style="list-style-type: none"> Show respect for others opinions. Be conscientious and work co-operatively. Respect colleagues, including non-medical professionals and recognise good advice. Recognise own limitations.
Communication with colleagues	Know how to communicate with other members of the pathology department, other departments and clinical teams.	<ul style="list-style-type: none"> Use appropriate language. Select an appropriate communication method. 	Be prompt and respond courteously and fairly.

Complaints	<ul style="list-style-type: none"> • Awareness of the local complaints procedures. • Have an awareness of systems of independent review. 	<ul style="list-style-type: none"> • Anticipate potential problems. • Manage dissatisfied colleagues. 	<ul style="list-style-type: none"> • Act with honesty and sensitivity and promptly. • Be prepared to accept responsibility.
2.4. Maintaining Trust			
Subject	Knowledge	Skills	Attitudes
Continuity of care	Understand the relevance of continuity of care.	<ul style="list-style-type: none"> • Ensure satisfactory completion of reasonable tasks at the end of the day. • Make adequate arrangements to cover leave. 	Recognise the importance of punctuality and attention to detail.
Recognise own limitations	Know the extent of one's own limitations and know when to ask for advice.		Be willing to consult and to admit mistakes.
Stress	<ul style="list-style-type: none"> • Know the effects of stress. • Have knowledge of support facilities for doctors. 	Develop appropriate coping mechanisms for stress and ability to seek help if appropriate.	Recognise the manifestations of stress on self and others.
Relevance of outside bodies	Have an understanding of the relevance to professional life of: <ul style="list-style-type: none"> • The Royal Colleges • General Medical Council • Postgraduate Dean • Defence unions • British Medical Association • Specialist Societies 	Recognise situations when appropriate to involve these bodies/individuals.	Be open to constructive criticism. Accept professional regulation.
Personal health	<ul style="list-style-type: none"> • Know of occupational health services. • Know of one's responsibilities to the public. 	Recognise when personal health takes priority over work pressures and to be able to take the necessary time off.	Recognise personal health as an important issue.

Informed consent	<ul style="list-style-type: none"> Know the process for gaining informed consent. Understand the principles of consent issues as relating to Cellular Pathology clinical practice and research. 	Demonstrate appropriate use of written material.	Respect for patients' and relatives' points of view and wishes.
Confidentiality	<ul style="list-style-type: none"> Be aware of relevant strategies to ensure confidentiality. Be aware of situations when confidentiality might be broken. 	Use and share all information appropriately.	Respect the right to confidentiality.
Legal issues	<ul style="list-style-type: none"> Understand the legal issues relating to surgical pathology and cytopathology reporting. Know the legal responsibilities of completing death certificates. Understand the legal framework of the Coronial/Procurator Fiscal system, including the types of deaths that should be referred to the Coroner/Procurator Fiscal. 	Liaison with the Coroner/Procurator Fiscal.	Act with compassion at all times.
2.5. <u>Teaching and Research</u>			
Subject	Knowledge	Skills	Attitudes
To have the skills, attitudes and practices of a competent teacher	<ul style="list-style-type: none"> Know how to identify adult learning principles and needs. Know the structure of a teaching activity. Know varied teaching strategies. Know the principles of teaching evaluation. 	<ul style="list-style-type: none"> Facilitate the learning process [e.g. identify learning outcomes, construct educational objectives, communicate effectively with the learners, use appropriate teaching resources, give constructive and effective feedback]. 	<ul style="list-style-type: none"> Demonstrate a willingness and enthusiasm to teach. Show respect for the learner. Demonstrate a professional attitude towards teaching.
To be able to plan and analyse a	<ul style="list-style-type: none"> Know the principles of performing a research study. 	<ul style="list-style-type: none"> Undertake systematic critical review of scientific literature. 	<ul style="list-style-type: none"> Demonstrate curiosity and a critical spirit of enquiry.

research project.	<ul style="list-style-type: none"> • Know how to use appropriate statistical methods. • Know the principles of research ethics and the structure and function of local research ethics committees. • Understanding of the principles of research funding and how to obtain it. 	<ul style="list-style-type: none"> • Ability to frame questions to be answered by a research project. • Develop protocols and methods for research. • Be able to use databases. • Be able to accurately analyse data. • Be able to write a scientific paper. • Have good written and verbal presentation skills. • Be able to participate as part of a team involved in a research project or two case reports by the end of training • Be able to demonstrate their role in its publication or presentation. 	<ul style="list-style-type: none"> • Ensure patient confidentiality. • Demonstrate knowledge of the importance of ethical approval and patient consent for clinical research.
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2.6. Clinical Governance

Subject	Knowledge	Skills	Attitudes
The organisational framework for Clinical Governance and its application in practice.	<ul style="list-style-type: none"> • Demonstrate an understanding of these important aspects of clinical governance: <ul style="list-style-type: none"> • medical and clinical audit • research and development • integrated care pathways • evidence-based practice • clinical effectiveness • clinical risk systems • the procedures and the effective action when things go wrong in one's own practice or that of others • complaints procedures • risk assessments • Explain the benefits a patient might reasonably expect from clinical 	<ul style="list-style-type: none"> • Be an active participant in clinical governance. • Undertake medical and clinical audit. • Be actively involved in audit cycles. • Be active in research and development. • Critically appraise medical data research. • Practise evidence-based medicine. • Aim for clinical effectiveness (best practice) at all times. • Educate self, colleagues and other healthcare professionals. • Deal with complaints in a focused and constructive manner. 	<ul style="list-style-type: none"> • Make the care of your patient your first concern. • Respect patients' privacy, dignity and confidentiality. • Be prepared to learn from mistakes, errors and complaints. • Recognise the importance of teamwork. • Share best practice with others.

	governance.	<ul style="list-style-type: none"> Learn from complaints. 	
Risk management	<ul style="list-style-type: none"> Demonstrate appropriate knowledge of such matters as health and safety policy, policies on needle stick injuries, note keeping, communications and staffing numbers. Demonstrate appropriate knowledge of risk management issues pertinent to laboratory processing. Demonstrate appropriate knowledge of risk assessment, perception and relative risk. Be familiar with the complications and side effects of treatments and investigations. 	<ul style="list-style-type: none"> Confidently and authoritatively discuss relevant risks with patients and to obtain informed consent. Balance risks and benefits with patients. 	<ul style="list-style-type: none"> Respect and accept patients' views and choices Be truthful and admit error to patients, relatives and colleagues
Evidence	<ul style="list-style-type: none"> Demonstrate an understanding of the principles of evidence-based medicine. Demonstrate an understanding of types of clinical trial. Demonstrate an understanding of types of evidence. 	<ul style="list-style-type: none"> Critically appraise evidence. Be competent in the use of databases, libraries and the internet. Discuss the relevance of evidence with individual patients or their families. 	Display a keenness to use evidence in the support of patient care and own decisions therein.
Clinical Audit	<ul style="list-style-type: none"> Competently use the audit cycle, data sources and data confidentiality. Understand the principles of internal and external quality assurance. 	<ul style="list-style-type: none"> Be involved in ongoing audit. Initiate and complete at least one clinical audit project per year. 	Consider the relevance of audit to benefit patient care and individual performance [i.e. to clinical governance].
Appraisal and Assessment	<ul style="list-style-type: none"> Understand the concepts of appraisal and assessment. Understand how to conduct an appraisal interview or assessment. 	<ul style="list-style-type: none"> Able to maintain an appraisal portfolio. Develop the ability to undertake an effective appraisal or assessment. 	<ul style="list-style-type: none"> Demonstrate a positive attitude to appraisal. Be aware of equality and diversity issues as they relate to appraisal.

Guidelines	Compare the advantages and disadvantages of guidelines.	<ul style="list-style-type: none"> • Demonstrate the ability to utilise guidelines. • Be able to contribute to the evolution of guidelines. 	<ul style="list-style-type: none"> • Show regard for individual patient needs when using guidelines. • Show willingness to use guidelines as appropriate.
2.7. Structure of the NHS and relationships to other bodies			
Subject	Knowledge	Skills	Attitudes
Structure of the NHS and the principles of management, including charge management	<ul style="list-style-type: none"> • Describe the structure of the NHS, primary care groups and hospital Trusts. • Describe the local Trust's management structure (including chief executives, medical directors, clinical directors and the pathology laboratory). • Explain finance issues in general in the NHS, especially budgetary management and commissioning. • Explain the importance of a health service for the population. 	<ul style="list-style-type: none"> • Demonstrate developing skills in managing change and managing people. • Demonstrate developing interviewing techniques including those required for performance reviews. • Build a business plan. • Utilise one's position in the NHS to best effect. 	<ul style="list-style-type: none"> • Show an awareness of equity in healthcare access and delivery. • Demonstrate an understanding of the importance of a health service for the population. • Show respect for others, ensuring equal opportunities.
Relevance of outside, but related, bodies	<ul style="list-style-type: none"> • Demonstrate a knowledge and understanding of the role and relevance to professional life of: <ul style="list-style-type: none"> • The Medical Royal Colleges • General Medical Council (GMC) • Postgraduate Dean and deaneries • Clinical Pathology Accreditation (UK) Ltd and other accreditation bodies • defence unions • British Medical Association (BMA) • Specialist societies. • Demonstrate knowledge of central 	Recognise situations when it would be appropriate to involve these bodies and individuals.	<ul style="list-style-type: none"> • Be open to constructive criticism. • Accept professional regulation.

	government health regulatory agencies (e.g. National Institute for Health and Clinical Excellence [NICE], Healthcare Commission [HCC], NHS Quality Improvement Scotland, National Patient Safety Agency [NPSA]).		
Media awareness	Explain the importance of media awareness and public communications training and where to obtain it.	Recognise situations when it may be appropriate to implement such training and/or seek further advice from the Trust.	<ul style="list-style-type: none"> Act professionally. Be willing to ask for help.
Planning	<ul style="list-style-type: none"> Demonstrate knowledge of the structure, financing, and operation of the NHS and its constituent organisations. Demonstrate knowledge of ethical and equality aspects relating to management and leadership e.g. approaches to use of resources/ Demonstrate knowledge of rationing; approaches to involving the public and patients in decision making. Demonstrate knowledge of business management principles: priority setting and basic understanding of how to produce a business plan. Demonstrate knowledge of the requirements of running of a department, unit or practice relevant to the specialty. 	<ul style="list-style-type: none"> Develop and implement protocols and guidelines Analyse feedback and comments and integrate them into plans for the service. 	Demonstrate an awareness of equity in healthcare access and delivery.
Managing resources	<ul style="list-style-type: none"> Demonstrate an effective knowledge of efficient use of clinical resources in order to provide care. Demonstrate an effective knowledge of commissioning, funding and contracting 	<ul style="list-style-type: none"> Demonstrate the ability to use clinical audit with the purpose of highlighting resources required. Demonstrate the ability to manage time and resources effectively in 	<ul style="list-style-type: none"> Show a commitment to the proper use of public money and take action when resources are not used efficiently or effectively

	<p>arrangements relevant to the specialty.</p> <ul style="list-style-type: none"> • Demonstrate an effective knowledge of how financial pressures experienced by the specialty department and organisation are managed. 	<p>terms of delivering services to patients.</p>	<ul style="list-style-type: none"> • Demonstrate awareness that in addition to patient specific clinical records, clinical staff also have responsibilities for other records (e.g. research)
Managing people	<ul style="list-style-type: none"> • Demonstrate knowledge of relevant legislation (e.g. Equality and Diversity, Health and Safety, Employment Law) and local Human Resource policies. • Demonstrate knowledge of the duties, rights and responsibilities of an employer, and of a co- worker (e.g. looking after occupational safety of fellow staff). • Demonstrate knowledge of individual performance review purpose, techniques and processes, including difference between appraisal, assessment and revalidation. 	<ul style="list-style-type: none"> • Demonstrate the ability to prepare rotas; delegate; organise and lead teams. • Demonstrate the ability to contribute to the recruitment and selection of staff. • Demonstrate the ability to contribute to staff development and training, including mentoring, supervision and appraisal. 	<ul style="list-style-type: none"> • Demonstrate a willingness to supervise the work of less experienced colleagues. • Demonstrate a commitment to good communication whilst also inspiring confidence and trust.
Managing performance	<p>Demonstrate knowledge of:</p> <ul style="list-style-type: none"> • Organisational performance management techniques and processes. • How complaints arise and how they are managed. 	<p>Demonstrate the ability to:</p> <ul style="list-style-type: none"> • Use and adhere to clinical guidelines and protocols, morbidity and mortality reporting systems, and complaints systems. • Improve services following evaluation / performance management. 	<ul style="list-style-type: none"> • Respond constructively to the outcome of reviews, assessments or appraisals of performance. • Demonstrate an understanding the needs and priorities of non-clinical staff.

Identifying the context for change	<p>Summarise:</p> <ul style="list-style-type: none"> • The responsibilities of the various Executive Board members and Clinical Directors or leaders. • The function and responsibilities of national bodies such as DH, HCC, NICE, NPSA, NCAS; Royal Colleges and Faculties, specialty specific bodies, representative bodies; regulatory bodies; educational and training organisations. 	<ul style="list-style-type: none"> • Discuss the local, national and UK health priorities and how they impact on the delivery of health care relevant to the specialty. • Identify trends, future options and strategy relevant to the specialty and delivering patient services. 	<ul style="list-style-type: none"> • Comply with national guidelines that influence healthcare provision. • Willingly articulate strategic ideas and use effective influencing skills.
Applying knowledge and evidence	<p>Demonstrate knowledge of:</p> <ul style="list-style-type: none"> • Patient outcome reporting systems within the specialty, and the organisation and how these relate to national programmes. • Research methods and how to evaluate scientific publications including the use and limitations of different methodologies for collecting data. 	<p>Demonstrate the ability to:</p> <ul style="list-style-type: none"> • Compare and benchmark healthcare services. • Use a broad range of scientific and policy publications relating to delivering healthcare services. 	Evaluate issues and potential solutions before acting
Making decisions	<p>Demonstrate knowledge of:</p> <ul style="list-style-type: none"> • How decisions are made by individuals, teams and the organisation. • Effective communication strategies within organisations. 	<p>Demonstrate the ability to:</p> <ul style="list-style-type: none"> • Prepare properly for meetings - reading agendas, understanding minutes, action points and doing background research on agenda items. • Work collegially and collaboratively with a wide range of people outside the immediate clinical setting. 	<p>Demonstrate:</p> <ul style="list-style-type: none"> • An appreciation of the importance of involving the public and communities in developing health services. • Willingness to participate in decision making processes beyond the immediate clinical care setting.

Evaluating impact	<p>Demonstrate an understanding of:</p> <ul style="list-style-type: none"> • Impact mapping of service change. • Barriers to change. • Qualitative methods to gather the experience of patients and carers. 	<p>Demonstrate the ability to:</p> <ul style="list-style-type: none"> • Evaluate outcomes and re-assess the solutions through research, audit and quality assurance activities. • Understand the wider impact of implementing change in healthcare provision and the potential for opportunity costs. 	<ul style="list-style-type: none"> • Demonstrate a commitment to implementing proven improvements in clinical practice and services. • Obtain the evidence base before declaring effectiveness of changes. • Adopt attitudes and behaviours that assist dissemination of good practice.
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3. SPECIFIC OBJECTIVES IN NEUROPATHOLOGY

3.1 Neurosurgical Biopsy

Objective	Subject matter	Teaching / Learning method
<p>Diagnosis of a mass lesion or lytic lesion in bones of skull or vertebrae</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Myeloma • Lymphoma • Metastases • Giant cell tumour of bone • Langerhans' Cell Histiocytosis • Chordoma • Chondrosarcoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Preparation and interpretation of CT and MR-guided bone needle biopsy • Ability to communicate the diagnosis clearly • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Awareness of the need to comment on the extent of excision of the lesion, 	<p>Textbook:</p> <ul style="list-style-type: none"> • Robbins and Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto and Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

	<p>when appropriate.</p> <ul style="list-style-type: none"> Participation in multi-disciplinary meeting or other clinicopathological meeting 	
<p>Diagnosis of a mass lesion arising from the meningeal coverings of the brain or spinal cord</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> Meningioma Lymphoma Metastases Gliosarcoma Melanoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> Age Gender predisposition Anatomical site Natural history Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> Preparation and interpretation of intra-operative biopsy Preparation and interpretation of neurosurgical biopsy Ability to communicate the diagnosis clearly Ability to advise on the likely biological behaviour of the lesion Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> Awareness of need to communicate the diagnosis promptly Awareness of the need to comment on the extent of excision of the lesion, when appropriate. Participation in multi-disciplinary meeting or other clinicopathological meeting Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. 	<p>Textbooks:</p> <ul style="list-style-type: none"> WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler and Cavanee) Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Diagnosis of a mass lesion in the region of the sella</p>	<p>(1) Knowledge Microscopical features of:</p>	<p>Textbooks:</p> <ul style="list-style-type: none"> Greenfield's

<p>turcica</p>	<ul style="list-style-type: none"> • Hypophysitis • Sarcoidosis • Infarction • Pituitary adenoma • Craniopharyngioma • Pilocytic astrocytoma • Meningioma • Lymphoma • Germ cell tumours • Granular cell tumour of the neurohypophysis • Spindle cell oncocytoma of the adenohypophysis <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Ability to communicate the diagnosis clearly • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Awareness of the need to comment on the extent of excision of the lesion, when appropriate. • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Neuropathology, 8th edition (Ed: Love, Louis and Ellison)</p> <ul style="list-style-type: none"> • Neuropathology, 2nd edition (Ellison and Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler and Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Diagnosis of a mass lesion in the region of the pineal gland</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Pineocytoma 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th

	<ul style="list-style-type: none"> • Pineal parenchymal tumour of intermediate differentiation • Pineoblastoma • Papillary tumour of the pineal region • Atypical teratoid / rhabdoid tumour • Germ cell tumours <ul style="list-style-type: none"> ➢ Germinoma ➢ Teratoma: mature, immature, malignant ➢ Yolk sac tumour ➢ Embryonal carcinoma ➢ Choriocarcinoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Dissection, preparation and examination of neurosurgical lobectomy • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Abscess, infarction, demyelination and tumour ➢ Primary brain tumour and metastases ➢ Glioma and lymphoma ➢ Low and high-grade glioma • Ability to apply WHO classification to a tumour • Ability to accurately grade glioma or lymphoma • Ability to communicate the diagnosis clearly • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly 	<p>edition (Ed: Love, Louis & Ellison)</p> <ul style="list-style-type: none"> • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
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	<ul style="list-style-type: none"> • Awareness of the need to comment on the extent of excision of the lesion, when appropriate. • Participation in multi-disciplinary meeting or other clinicopathological meeting 	
<p>Diagnosis of a mass lesion within the brain or spinal cord</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Abscess, infarction, demyelination and tumour • Primary brain tumour and metastases • Glioma and lymphoma • Low and high-grade glioma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Dissection, preparation and examination of neurosurgical lobectomy • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Abscess, infarction, demyelination and tumour ➢ Primary brain tumour and metastases ➢ Glioma and lymphoma ➢ Low and high-grade glioma • Ability to apply WHO classification to a tumour • Ability to accurately grade glioma or lymphoma • Ability to communicate the diagnosis clearly • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<ul style="list-style-type: none"> • Awareness of the need to comment on the extent of excision of the lesion, when appropriate. • Participation in multi-disciplinary meeting or other clinicopathological meeting 	Visit to Specialist Centre
Diagnosis of a mass lesion arising from nerve root or from the trunk of a cranial or peripheral nerve	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Schwannoma • Neurofibroma • Perineurioma • Malignant peripheral nerve sheath tumour (MPNST) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Schwannoma ➢ Neurofibroma ➢ Perineurioma ➢ Malignant peripheral nerve sheath tumour (MPNST) • Ability to apply WHO classification to a tumour • Ability to communicate the diagnosis clearly • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Awareness of the need to comment on the extent of excision of the lesion, when appropriate. 	<p>Textbooks:</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

	<ul style="list-style-type: none"> • Participation in multi-disciplinary meeting or other clinicopathological meeting 	
<p>Diagnosis of a lesion causing intractable temporal lobe epilepsy</p>	<p>(1) Knowledge Microscopical features of the lesions associated with symptomatic epilepsy</p> <ul style="list-style-type: none"> • Cerebral malformations • Cortical dysplasia • Vascular malformations • Infections and non-infective inflammatory conditions • Neoplasms • Mesial temporal sclerosis <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of intra-operative biopsy • Preparation and interpretation of neurosurgical biopsy • Dissection, preparation and examination of neurosurgical lobectomy • Ability to determine specific nature of a structural lesion causing epilepsy • Ability to distinguish between infective and non-infective inflammatory lesions causing epilepsy • Ability to identify mesial temporal sclerosis • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Awareness of the need to comment on the extent of excision of the lesion, when appropriate. • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

<p>Diagnosis of a case of dementia</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • CADASIL • Cranial (giant cell) arteritis • Meningeal carcinomatosis • Paraneoplastic encephalitides • Chronic inflammation of meninges • Prion disease • AIDS and opportunistic infection • Metabolic disease (leukodystrophy, lysosomal storage disease, mitochondrial disease, peroxisomal disorders etc) • Neurodegenerative disease <ul style="list-style-type: none"> ➢ Alzheimer's disease ➢ Dementia with Lewy bodies ➢ Frontotemporal lobar degenerations ➢ Corticobasal degeneration ➢ Progressive supranuclear palsy ➢ Other (argyrophilic grain dementia, etc.) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurosurgical biopsy (meningeal, cerebral cortex and white matter biopsy) • Skin biopsy (CADASIL – electron microscopy) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p>	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Lewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Consider possibility of accessing archived material at:</p> <ul style="list-style-type: none"> • One of the UK brain banks for neurodegenerative disease • National CJD Surveillance Unit
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	<ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Awareness of need to communicate concern to Clinical Neurosciences Service Unit Director in unexpected case of prion disease • Participation in multi-disciplinary meeting or other clinicopathological meeting 	
Diagnosis of focal or diffuse cerebral white matter abnormality	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Non-infective inflammatory disease • Infections • Demyelination • Metabolic disease • Neoplastic disease • Vascular / ischaemic disease <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurosurgical biopsy (meningeal, cerebral cortex and white matter biopsy) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
Diagnosis of focal or diffuse, meningeal or cerebral lesions in immunosuppressed patient	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Opportunistic infections • Lymphoma and other malignancies 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis

	<ul style="list-style-type: none"> • CNS changes of AIDS • Other inflammatory / metabolic / neoplastic / ischaemic process <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurosurgical biopsy (meningeal, cerebral cortex and white matter biopsy) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>& Ellison)</p> <ul style="list-style-type: none"> • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of headache (in absence of mass lesion)</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • Cranial (giant cell) arteritis • Meningeal carcinomatosis 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd

	<ul style="list-style-type: none"> • Chronic inflammatory disorders of meninges • Diffusely infiltrative glial tumour <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Temporal artery biopsy (cranial arteritis?) • Neurosurgical biopsy (chronic meningitis, meningeal carcinomatosis, meningocerebral vasculitis?) • Skeletal muscle biopsy (sarcoidosis, vasculitis?) • Peripheral nerve biopsy (vasculitis?) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>edition (Ellison & Love)</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironside, Moss, Louis, Lowe, Weller) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Atlas of Peripheral Nerve Pathology (King) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
Investigation of strokes (cerebral infarction or	<p>(1) Knowledge Microscopical features of:</p>	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's

<p>haemorrhage)</p>	<ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • Vascular malformation • CADASIL • Mitochondrial cytopathy (MELAS) • Haemorrhage into neoplasm <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Skin biopsy (CADASIL – electron microscopy, vasculitis?) • Skeletal muscle biopsy (mitochondrial cytopathy, vasculitis?) • Peripheral nerve biopsy (vasculitis?) • Neurosurgical biopsy (meninges and/or wall of haematoma or edge of infarct) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Neuropathology, 8th edition (Ed: Love, Louis & Ellison)</p> <ul style="list-style-type: none"> • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Atlas of Peripheral Nerve Pathology (King) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
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3.2 Intra-operative biopsy diagnosis using smear and/or frozen section technique

Objective	Subject matter	Teaching / Learning method
<p>Diagnosis of a mass lesion or lytic lesion in bones of skull or vertebrae</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Myeloma • Lymphoma • Metastases • Giant cell tumour of bone • Langerhans' Cell Histiocytosis • Chordoma • Chondrosarcoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(1) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin & eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make you understood to lay persons and to professionals at all levels. <p>(2) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. 	<p>Textbooks:</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<ul style="list-style-type: none"> • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	
<p>Diagnosis of a mass lesion arising from the meningeal coverings of the brain or spinal cord</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Meningioma • Lymphoma • Metastases • Gliosarcoma • Melanoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis. 	<p>Textbooks</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler and Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

<p>Diagnosis of a mass lesion in the region of the sella turcica</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Hypophysitis • Sarcoidosis • Infarction • Pituitary adenoma • Craniopharyngioma • Pilocytic astrocytoma • Meningioma • Lymphoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team</p>
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<p>Diagnosis of a mass lesion in the region of the pineal gland</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Pineocytoma • Pineal parenchymal tumour of intermediate differentiation • Pineoblastoma • Papillary tumour of the pineal region • Atypical teratoid / rhabdoid tumour • Germ cell tumours <ul style="list-style-type: none"> ➢ Germinoma ➢ Teratoma: mature, immature, malignant ➢ Yolk sac tumour ➢ Embryonal carcinoma ➢ Choriocarcinoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the 	<p>Textbooks:</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

	<p>neurosurgeon</p> <ul style="list-style-type: none"> • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	
<p>Diagnosis of a mass lesion within the brain or spinal cord</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Abscess, infarction, demyelination and tumour • Primary brain tumour and metastases • Glioma and lymphoma • Low and high-grade glioma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Abscess, infarction, demyelination and tumour ➢ Primary brain tumour and metastases ➢ Glioma and lymphoma ➢ Low and high-grade glioma ➢ Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironside, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Lewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p>

	<p>neurosurgeon</p> <ul style="list-style-type: none"> • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of a mass lesion arising from nerve root or from the trunk of a cranial or peripheral nerve</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Schwannoma • Neurofibroma • Perineurioma • Malignant peripheral nerve sheath tumour (MPNST) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section <ul style="list-style-type: none"> ➢ Ability to distinguish between benign nerve sheath tumour and malignant peripheral nerve sheath tumour (MPNST) ➢ Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. 	<p>Textbooks</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<ul style="list-style-type: none"> Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	
<p>Diagnosis of a lesion causing intractable temporal lobe epilepsy</p>	<p>(1) Knowledge Microscopical features of the lesions associated with symptomatic epilepsy</p> <ul style="list-style-type: none"> Cerebral malformations Cortical dysplasia Vascular malformations Infections and non-infective inflammatory conditions Neoplasms Mesial temporal sclerosis <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> Age Gender predisposition Anatomical site Natural history Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. Preparation of frozen section stained with haematoxylin and eosin. Interpretation of intra-operative wet smear preparation and/or frozen section Ability to determine specific nature of a structural lesion causing epilepsy Ability to distinguish between neoplasm and inflammatory lesions causing epilepsy Ability to identify mesial temporal sclerosis Ability to advise on the likely biological behaviour of the lesion Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> Awareness of need to communicate the diagnosis promptly to the neurosurgeon Awareness of the need to log the 'opinion' given to the surgeon and the 	<p>Textbooks</p> <ul style="list-style-type: none"> Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) Neuropathology, 2nd edition (Ellison & Love) WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) Pathology & Genetics: Developmental Neuropathology (Golden & Harding) Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) Archived material <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<p>date/time of doing so.</p> <ul style="list-style-type: none"> Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	
<p>Diagnosis of a case of dementia</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> Amyloid angiopathy Cerebral vasculitis CADASIL Cranial (giant cell) arteritis Meningeal carcinomatosis Paraneoplastic encephalitides Chronic inflammation of meninges Prion disease AIDS and opportunistic infection Metabolic disease (leukodystrophy, lysosomal storage disease, mitochondrial disease, peroxisomal disorders etc) Neurodegenerative disease <ul style="list-style-type: none"> ➢ Alzheimer's disease ➢ Dementia with Lewy bodies ➢ Frontotemporal lobar degenerations ➢ Corticobasal degeneration ➢ Progressive supranuclear palsy ➢ Other (argyrophilic grain dementia, etc.) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> Age Gender predisposition Anatomical site Natural history Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. Preparation of frozen section stained with haematoxylin and eosin. 	<p>Textbooks</p> <ul style="list-style-type: none"> Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) Neuropathology, 2nd edition (Ellison & Love) Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Consider possibility of accessing archived material at: One of the UK brain banks for neurodegenerative disease National CJD Surveillance Unit</p>

	<ul style="list-style-type: none"> • Interpretation of intra-operative wet smear preparation and/or frozen section <ul style="list-style-type: none"> ➢ Ability to comment on adequacy of biopsy ➢ Ability to identify neoplastic and inflammatory lesions ➢ Ability to select appropriate range of histological techniques for investigation of metabolic and/or neurodegenerative disease • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon, if inflammatory or neoplastic process is identified • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	
<p>Diagnosis of focal or diffuse cerebral white matter abnormality</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Non-infective inflammatory disease • Infections • Demyelination • Leukodystrophies • Metabolic disease • Neoplastic disease • Vascular / ischaemic disease <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Pathology & Genetics: Developmental Neuropathology

	<ul style="list-style-type: none"> • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section <ul style="list-style-type: none"> ➢ Ability to comment on adequacy of biopsy ➢ Ability to identify neoplastic and inflammatory lesions ➢ Ability to select appropriate range of histological techniques for investigation of infectious, metabolic and/or neurodegenerative disease • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon, if infective or neoplastic process is identified • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>(Golden & Harding)</p> <ul style="list-style-type: none"> • Atlas of Peripheral Nerve Pathology (King) • Neuropathology Techniques (Dawson, Neal, Lewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Diagnosis of focal or diffuse, meningeal or cerebral lesions in immunosuppressed patient</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Opportunistic infections • Lymphoma and other malignancies • CNS changes of AIDS • Other inflammatory / metabolic / neoplastic / ischaemic process <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironside, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson,

	<ul style="list-style-type: none"> ➤ Ability to comment on adequacy of biopsy ➤ Ability to identify neoplastic and inflammatory lesions ➤ Ability to select appropriate range of histological techniques for investigation of infectious, metabolic and/or neurodegenerative disease <ul style="list-style-type: none"> • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon, if infective or neoplastic process is identified • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Neal, Llewellyn, Thomas)</p> <ul style="list-style-type: none"> • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Consider visit to Specialist Centre</p>
<p>Diagnosis of headache (in absence of mass lesion)</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • Cranial (giant cell) arteritis • Meningeal carcinomatosis • Chronic inflammatory disorders of meninges • Diffusely infiltrative glial tumour <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology

	<ul style="list-style-type: none"> • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section • Ability to comment on adequacy of biopsy <ul style="list-style-type: none"> ➢ Ability to identify neoplastic and inflammatory lesions ➢ Ability to select appropriate range of histological techniques for investigation of hereditary, infectious, inflammatory, or neoplastic disease ▪ Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon, if infective or neoplastic process is identified • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Techniques (Dawson, Neal, Llewellyn, Thomas)</p> <ul style="list-style-type: none"> • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Investigation of strokes (cerebral infarction or haemorrhage)</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • Vascular malformation • CADASIL • Mitochondrial cytopathy (MELAS) • Haemorrhage into neoplasm <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Neuropathology Techniques (Dawson, Neal, Llewellyn,

	<p>or haematoxylin and eosin.</p> <ul style="list-style-type: none"> • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section <ul style="list-style-type: none"> ➢ Ability to comment on adequacy of biopsy ➢ Ability to identify neoplastic and inflammatory lesions ➢ Ability to select appropriate range of histological techniques for investigation of hereditary, infectious, inflammatory, or neoplastic disease ▪ Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon, if infective or neoplastic process is identified • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Thomas)</p> <ul style="list-style-type: none"> • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
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3.3 Skeletal Muscle Biopsy

Objective	Subject matter	Teaching / Learning method
<p>Diagnosis of muscle weakness, muscle pain or muscle wasting</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Muscle diseases associated with sarcolemmal and extracellular matrix defects • Muscle diseases associated with myonuclear abnormalities • Muscle diseases due to defects of myofibrillar and internal cytoskeletal protein • Muscle diseases associated with defects of ion channels and ion transporters • Developmental disorders of skeletal muscle • Muscle diseases due to defects of catabolic mechanisms • Neuromuscular transmission defects • Myopathies affecting fuel and energy metabolism • Dysimmune and infectious myopathies • Toxic myopathies • Muscle pathology resulting from chronic denervation and disuse 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry) • Neuropathology

	<ul style="list-style-type: none"> • Miscellaneous muscle disorders, including: <ul style="list-style-type: none"> ➢ Repeat expansion myopathies (Myotonic dystrophies) ➢ Large telomeric deletion disease (Facioscapulohumeral dystrophy) ➢ Hereditary inclusion body myopathy ➢ Osteomalacic myopathy ➢ Cancer-related muscle disease ➢ Peripheral neuropathies ➢ Infective, Vasculitic, Carcinomatous, Lymphomatous, Inherited (e.g. Familial Amyloid polyneuropathy, Hereditary Motor and Sensory Neuropathy) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Skeletal muscle biopsy • Peripheral nerve biopsy • Fat and/or rectal biopsy (for amyloid) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Techniques (Dawson, Neal, Llewellyn, Thomas)</p> <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Investigation of strokes (cerebral infarction or haemorrhage)</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Cerebral vasculitis • Mitochondrial cytopathy (MELAS) • Haemorrhage into neoplasm <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Structural and Molecular Basis of Skeletal Muscle

	<ul style="list-style-type: none"> • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Skeletal muscle biopsy (mitochondrial cytopathy, vasculitis?) • Skin biopsy (CADASIL – electron microscopy, vasculitis?) • Peripheral nerve biopsy (vasculitis?) • Neurosurgical biopsy (meninges and/or wall of haematoma or edge of infarct) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting 	<p>Diseases (Karpati)</p> <ul style="list-style-type: none"> • Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
Investigation of progressive ptosis and/or ophthalmoplegia	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Muscular dystrophy (Myotonic dystrophy, Oculopharyngeal muscular dystrophy, Facioscapulohumeral syndrome) • Mitochondrial cytopathy (Kearns-Sayre syndrome) • Myasthenia gravis <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Findings on investigative neurophysiology of conditions listed above 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology 8th edition (Ed: Love, Louis & Ellison) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry)

	<p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Skeletal muscle biopsy (mitochondrial cytopathy; muscular dystrophy including specific features of Myotonic dystrophy and OPMD; spectrum of changes in FSH) • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude Awareness of need to communicate the diagnosis promptly.</p> <ul style="list-style-type: none"> • Retention of appropriate sample(s) for genetic analysis and/or respiratory chain enzyme assays. • Recommendation for genetic analysis and/or respiratory chain enzyme assays when biopsy is suggestive of an inherited disorder. • Participation in multi-disciplinary meeting or other clinicopathological meeting. 	<ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
Investigation of retinitis pigmentosa	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Mitochondrial cytopathy (e.g. Kearns-Sayre syndrome) • Congenital myotubular (centronuclear) myopathy <p>Clinical features of mitochondrial cytopathies:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history <p>(2) Skills</p> <ul style="list-style-type: none"> • Interpretation of skeletal muscle biopsy (mitochondrial cytopathy, myotubular myopathy), including enzyme histochemistry and electron microscopy. • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly. • Retention of appropriate sample(s) for genetic analysis and/or respiratory 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<p>chain enzyme assays.</p> <ul style="list-style-type: none"> • Recommendation for genetic analysis and/or respiratory chain enzyme assays when biopsy is suggestive of an inherited disorder. • Participation in multi-disciplinary meeting or other clinicopathological meeting. 	<p>Visit to Specialist Centre</p>
<p>Investigate cause of arthrogryposis multiplex</p>	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Myelopathic and muscular forms of <i>arthrogryposis multiplex congenita</i> • Congenital muscular dystrophy <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • skeletal muscle biopsy • autopsy changes in spinal cord <p>Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed.</p> <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly. • Retention of appropriate sample(s) for genetic analysis. • Recommendation for genetic analysis when biopsy is suggestive of an inherited disorder. • Participation in multi-disciplinary meeting or other clinicopathological meeting. 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

3.4 Peripheral Nerve Biopsy		
Objective	Subject matter	Teaching / Learning method
Biopsy to investigate peripheral neuropathy	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Demyelinating neuropathy • Axonal neuropathy • Specific features of neuropathy due to: <ul style="list-style-type: none"> ➢ Infective cause ➢ Vasculitis ➢ Carcinomatous or lymphomatous infiltration ➢ Paraneoplastic effect ➢ Inherited mutations (e.g. Familial Amyloid polyneuropathy, Hereditary Motor and Sensory Neuropathy), <p>(2) Skills Interpretation of:</p> <ul style="list-style-type: none"> • Resin sections stained with thionin and acridine orange or methylene blue, azure II and basic fuchsin (trichrome preparation) • Teased nerve fibre preparation • Electron microscopy to assist identification of: <ul style="list-style-type: none"> ➢ Axonal degeneration and regeneration. ➢ Schwann cell abnormalities. ➢ Myelin abnormalities. ➢ Extracellular proteinaceous deposits and basal lamina abnormalities. ➢ Cellular infiltration ➢ Micro-organisms ➢ Perineurial abnormalities. ➢ Abnormalities of endoneurial blood vessels • Histochemistry to identify nature of any abnormal storage material within Schwann cells • Immunohistochemistry <ul style="list-style-type: none"> ➢ To assist morphology, with antibodies against neurofilament proteins, epithelial membrane antigen and S100 protein ➢ To characterise inflammatory cellular infiltrate ➢ To identify immunoglobulin light chain deposition ➢ To identify specific types of inherited amyloidosis 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Atlas of Peripheral Nerve Pathology (King) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>

	<ul style="list-style-type: none"> • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly. • Retention of appropriate sample(s) for genetic analysis and/or respiratory chain enzyme assays. • Recommendation for genetic analysis and/or respiratory chain enzyme assays when biopsy is suggestive of an inherited disorder. • Participation in multi-disciplinary meeting or other clinicopathological meeting. 	
Biopsy to investigate peripheral nerve tumour	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Schwannoma • Neurofibroma • Perineurioma • Malignant peripheral nerve sheath tumour (MPNST) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation of intra-operative wet smear preparation stained with toluidine blue or haematoxylin and eosin. • Preparation of frozen section stained with haematoxylin and eosin. • Interpretation of intra-operative wet smear preparation and/or frozen section <ul style="list-style-type: none"> ➢ Ability to distinguish between benign nerve sheath tumour and malignant peripheral nerve sheath tumour (MPNST) ➢ Ability to advise on the likely biological behaviour of the lesion • Ability to write comprehensive and clear reports for users, indicating the degree of confidence with which an opinion is expressed. 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Atlas of Peripheral Nerve Pathology (King) • Neuropathology • Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p>

	<p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the neurosurgeon • Awareness of the need to log the 'opinion' given to the surgeon and the date/time of doing so. • Awareness of need to audit intra-operative biopsy diagnosis skills against paraffin processed tissue diagnosis 	<p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>3.5 Cerebrospinal Fluid Cytology</p>		
Objective	Subject matter	Teaching / Learning method
<p>Cytological examination of cerebrospinal fluid to detect inflammatory disorders of the CNS and its coverings</p>	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Features of cells normally present within the CSF, including: <ul style="list-style-type: none"> ➢ Lymphocytes and macrophages ➢ Meningothelial cells and cells from the choroids plexus ➢ Ependymal cells and corpora amylacea (in ventricular fluid) ➢ Chondrocytes (in lumbar puncture-derived sample) • Features of leukocytic reaction • Features of micro-organisms <ul style="list-style-type: none"> ➢ Viral cytopathic change: e.g. herpes simplex and cytomegalovirus ➢ Cryptococcus neoformans ➢ Toxoplasma gondii ➢ Hyphae of phycomycete ➢ Bacteria on Gram stain or, in the case of acid fast bacilli, Ziehl Neelsen preparation <p>(2) Skills</p> <p>Ability to:</p> <ul style="list-style-type: none"> • Distinguish between normal appearances, reactive pleocytosis and neoplastic pleocytosis • Identify any micro-organisms • Select judiciously appropriate microbial and immunocytochemical preparations to assist differential diagnosis • To write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed 	<p>Textbooks</p> <ul style="list-style-type: none"> • Cytopathology of the Central Nervous System (Bingner and Johnson) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Neuropathology • Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team</p>

	<p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the clinician. • Awareness of the need to log the 'opinion' given to the clinician and the date/time of doing so. • Awareness of need to audit cytological diagnosis skills against any paraffin processed tissue diagnosis 	<p>Meetings</p>
<p>Cytological examination of cerebrospinal fluid to detect neoplastic disorders of the CNS and its coverings</p>	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Features of neoplastic cells present within the CSF, including: <ul style="list-style-type: none"> ➢ Leukemic blasts ➢ Immunoblasts in malignant lymphoma ➢ Other atypical lymphocytes ➢ Atypical plasma cells of multiple myeloma ➢ Metastatic carcinoma, including ➢ Malignant melanoma ➢ Small cell carcinoma of the lung ➢ Large cell undifferentiated carcinoma ➢ Adenocarcinoma ➢ Squamous cell carcinoma ➢ Malignant neuroblasts of a medulloblastomas or pineoblastoma ➢ Dual population of a pineal germinoma <p>(2) Skills Ability to:</p> <ul style="list-style-type: none"> • Distinguish between reactive pleocytosis and neoplastic pleocytosis • Identify likely histogenesis of neoplastic cells • Select judiciously appropriate immunocytochemical preparations to assist differential diagnosis • To write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly to the clinician. • Awareness of the need to log the 'opinion' given to the clinician and the date/time of doing so. • Awareness of need to audit cytological diagnosis skills against any paraffin processed tissue diagnosis 	<p>Textbooks</p> <ul style="list-style-type: none"> • Cytopathology of the Central Nervous System (Bingner and Johnson) • Smears and Frozen Sections in Surgical Neuropathology: A Manual (Burger) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas)

		<p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
Conduct of Neuropathological Autopsy		
Objective	Subject matter	Teaching / Learning method
<p>Basic neuropathological autopsy</p> <ul style="list-style-type: none"> • To determine cause of death • To determine whether disease injury outside the nervous system contributed to neurological dysfunction • To determine whether disease or injury of the skull or meninges contributed to neurological dysfunction • To identify pathological changes in the brain 	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Gross anatomy of the human body • Basic pathological processes: <ul style="list-style-type: none"> ➤ Inflammation, including abscess and caseation ➤ Granulation tissue and fibrosis ➤ Vascular pathology and infarction ➤ Neoplasia: <ul style="list-style-type: none"> ➤ benign vs. malignant, ➤ primary vs. secondary • Gross pathology of general body organs and systems • Systemic histopathology (microscopical features) • Gross neuroanatomy: <ul style="list-style-type: none"> ➤ Skull ➤ Brain coverings ➤ Vascular supply to the brain ➤ Gross anatomy of the brain ➤ Clinico-anatomical correlates ➤ Gross pathology of the skull, meninges and brain. • Microscopical pathology of the skull, meninges and brain. • Fixation techniques for brain <p>(2) Skills</p> <ul style="list-style-type: none"> • External examination of the body and examination of internal anatomical structures and general body organs to determine the presence and extent of injury or disease outside the nervous system which: 	<p>Textbooks</p> <ul style="list-style-type: none"> • A textbook of autopsy techniques, such as: Handbook of Autopsy Practice (Ludwig) • Carpenter's Human Neuroanatomy, 9th edition (Parent) • Neurological Differential Diagnosis, 2nd edition (Patten) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster)

	<ul style="list-style-type: none"> ➤ May have caused death ➤ May have contributed to neurological dysfunction • Examination of scalp and skull • Removal of brain and meninges • Neuropathological examination of brain and meninges • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act 	<ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Attachment to Specialist Centre</p>
<p>Extended neuropathological autopsy</p> <ul style="list-style-type: none"> • To identify pathological changes in the spinal column or spinal meninges which may have caused dysfunction of spinal cord or nerve roots • To identify pathological changes in: <ul style="list-style-type: none"> ➤ spinal cord ➤ nerve plexuses ➤ autonomic nervous system ➤ peripheral nerves 	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Gross neuroanatomy: <ul style="list-style-type: none"> ➤ Spinal column ➤ Coverings of the spinal cord ➤ Vascular supply to the spinal cord ➤ Gross anatomy of the spinal cord • Anatomy of the peripheral nervous system: <ul style="list-style-type: none"> ➤ Nerve roots ➤ Nerve plexuses ➤ Peripheral nerves ➤ Peripheral ganglia • Clinico-anatomical correlates, including differential diagnosis of nerve root and peripheral nerve lesions • Fixation techniques for spinal cord • Gross pathology of the spinal column, spinal meninges, spinal cord, peripheral nerves and skeletal muscle 	<p>Textbooks</p> <ul style="list-style-type: none"> • Carpenter's Human Neuroanatomy, 9th edition (Parent) • Neurological Differential Diagnosis, 2nd edition (Patten) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri)

<p>➤ skeletal muscle</p>	<ul style="list-style-type: none"> • Microscopical pathology of the spinal column, spinal meninges, spinal cord, peripheral nerves and skeletal muscle. <p>(2) Skills</p> <ul style="list-style-type: none"> • Removal and subsequent examination of spinal cord • Removal and subsequent examination of dorsal root ganglia • Removal and subsequent examination of autonomic ganglia • Removal and subsequent examination of peripheral nerve plexuses • Removal and subsequent examination of peripheral nerve trunks • Removal of skeletal muscle samples • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act 	<ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Attachment to Specialist Centre</p>
<p>Special procedure for autopsy in suspected CJD cases</p>	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • The spectrum of clinical syndromes seen in prion disease (transmissible spongiform encephalopathies) • Guidelines for good practice when performing autopsies on cases in which a diagnosis of transmissible spongiform encephalopathy is suspected, including the handling, processing and storing of tissue in the laboratory. <p>(2) Skills</p> <ul style="list-style-type: none"> • Modification of autopsy in such a way as to ensure minimal contamination of the mortuary and to prevent disease transmission by accidental inoculation • Special considerations in decontamination of the mortuary working surfaces and instruments • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed 	<p>Textbooks</p> <ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) <p>Archived material</p> <p>Current clinical cases</p>

	<p>(3) Attitude</p> <ul style="list-style-type: none"> Awareness of legal obligations under Human Tissue Act 	<p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
Investigation of developmental abnormalities of the nervous system in the fetus, neonate or child	<p>(1) Knowledge</p> <ul style="list-style-type: none"> Of the guidelines set out in the <i>Guidelines For Good Practice: The Perinatal Autopsy</i>, prepared by the British Neuropathological Society Of developmental abnormalities and other pathology in the fetus, neonate or child <p>(2) Skills</p> <ul style="list-style-type: none"> Ability to remove the brain, under water or into a saturated salt solution if it is particularly soft, from a superior approach and collect it intact into formalin. Ability to remove macerated brains within an intact dural sac in the case of stillborn fetuses. Ability to remove the spinal cord within the intact vertebral column in very small fetuses. Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> Awareness of legal obligations under Human Tissue Act 	<p>Textbooks</p> <ul style="list-style-type: none"> Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) Neuropathology, 2nd edition (Ellison & Love) Pathology & Genetics: Developmental Neuropathology (Golden & Harding) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Attachment to Specialist Centre</p>
Assess neurological component of pathology leading to death in the premature infant	<p>(1) Knowledge</p> <ul style="list-style-type: none"> Of the guidelines set out in the <i>Guidelines for Good Practice: the Perinatal Autopsy</i>, prepared by the British Neuropathological Society. Of developmental abnormalities and other pathology in the fetus and neonate, particularly those associated with prematurity. 	<p>Textbooks</p> <ul style="list-style-type: none"> Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) Pathology & Genetics:

	<p>(2) Skills</p> <ul style="list-style-type: none"> • Ability to remove the brain, under water or into a saturated salt solution if it is particularly soft, from a superior approach and collect it intact into formalin. • Ability to remove macerated brains within an intact dural sac in the case of stillborn fetuses. • Ability to remove the spinal cord within the intact vertebral column in very small fetuses. • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act 	<p>Developmental Neuropathology (Golden & Harding)</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Attachment to Specialist Centre</p>
Investigate cause of arthrogryposis multiplex	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • Of myelopathic and muscular forms of arthrogryposis multiplex congenita • Of congenital muscular dystrophy <p>(2) Skills</p> <ul style="list-style-type: none"> • Ability to remove the brain, under water or into a saturated salt solution if it is particularly soft, from a superior approach and collect it intact into formalin. • Ability to remove macerated brains within an intact dural sac in the case of stillborn fetuses. • Ability to remove the spinal cord within the intact vertebral column in very small fetuses. • Ability to sample skeletal muscle, prepare and snap freeze the tissue. • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all 	<p>Textbooks</p> <ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Structural and Molecular Basis of

	<p>levels.</p> <p>(3) Attitude</p> <ul style="list-style-type: none"> Awareness of legal obligations under Human Tissue Act 	<p>Skeletal Muscle Diseases (Karpati)</p> <ul style="list-style-type: none"> Muscle Biopsy: a practical approach 3rd edition (Dubowitz & Sewry) <p>Archived material</p> <p>Current clinical cases Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Assess nervous system in case of sudden infant death syndrome (SIDS)</p>	<p>(1) Knowledge</p> <ul style="list-style-type: none"> Of infective or inflammatory processes in the central nervous system and its coverings Of developmental anomalies of the central nervous system Of the changes resulting from trauma, particularly those which are suspicious of child abuse <p>(2) Skills</p> <ul style="list-style-type: none"> Ability to conduct autopsy examination of skull, vertebral column, meninges, brain and spinal cord (in close collaboration with the paediatric pathologist who performs the general body autopsy) Ability to examine the ocular globes (in close collaboration with the paediatric pathologist who performs the general body autopsy or an ophthalmic pathologist, preferably with specialized medico-legal experience in the field of non-accidental injury) Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. Ability to make oneself understood to lay persons and to professionals at all levels. 	<p>Textbooks</p> <ul style="list-style-type: none"> Forensic Neuropathology (Whitwell) Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) Pathology & Genetics: Developmental Neuropathology (Golden & Harding) Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) Neuropathology, 2nd edition (Ellison & Love) <p>Archived material</p> <p>Current clinical cases</p>

	<p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act 	<p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
<p>Assess by autopsy the evidence for, and nature and severity of, neurological complications arising from medical or nursing care</p>	<p>(1) Knowledge</p> <p>Gross anatomy of the human body</p> <ul style="list-style-type: none"> • Basic pathological processes: <ul style="list-style-type: none"> ➢ Inflammation, including abscess formation ➢ Granulation tissue and fibrosis ➢ Vascular pathology and infarction ➢ Neoplasia: <ul style="list-style-type: none"> • benign vs. malignant, • primary vs. secondary • Gross pathology of general body organs and systems • Systemic histopathology (microscopical features) • Gross neuroanatomy: <ul style="list-style-type: none"> ➢ Skull ➢ Brain coverings ➢ Vascular supply to the brain ➢ Gross anatomy of the brain ➢ Clinico-anatomical correlates • Gross pathology of the skull, meninges and brain. • Microscopical pathology of the skull, meninges and brain. • Fixation techniques for brain <p>(2) Skills</p> <ul style="list-style-type: none"> • External examination of the body and examination of internal anatomical structures and general body organs to determine the presence and extent of injury or disease outside the nervous system which: <ul style="list-style-type: none"> ➢ May have caused death ➢ May have contributed to neurological dysfunction • Examination of scalp and skull • Removal of brain and meninges 	<p>Textbooks</p> <ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>

	<ul style="list-style-type: none"> • Neuropathological examination of brain and meninges • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act • Responsibility to investigate whether pathological changes are consistent with non-accidental injury • Responsibility to assess whether medical and/or nursing care was appropriate and proper • Responsibility to investigate whether death is due to natural causes • To assess whether negligence contributed to death 	Visit to Specialist Centre
Investigate by autopsy the cause and manner of death in a case of head or spinal injury	<p>(1) Knowledge</p> <ul style="list-style-type: none"> • The conduct of an autopsy to assess the nature and extent of traumatic injury, especially to head, neck and spine. • The gross pathology of extradural/epidural, subdural and subarachnoid haemorrhage, and the changes that may date the injury • The gross pathology of the brain and spinal cord (and their coverings) due to direct impact injury and whiplash injury, including: <ul style="list-style-type: none"> ➢ Cortical and gliding contusions ➢ Diffuse axonal injury ➢ Diffuse vascular injury ➢ Cerebral infarction ➢ Other hypoxic-ischaemic lesions ➢ Traumatic dissection of the vertebral and other cranio-cerebral blood vessels • Gross pathology of the brain resulting from raised intracranial pressure • Gross pathology of infection complicating head injury, including meningitis and brain abscess • Gross pathology of medical complications following trauma, including: <ul style="list-style-type: none"> ➢ Fat embolism ➢ Venous thrombosis 	Textbooks <ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Forensic Neuropathology (Whitwell) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri)

	<ul style="list-style-type: none"> ➤ Disseminated intravascular coagulation ➤ Thiamine deficiency ➤ Central pontine myelinolysis <p>(2) Skills</p> <ul style="list-style-type: none"> • External examination of the body and examination of internal anatomical structures and general body organs to determine the presence and extent of injury or disease outside the nervous system which: <ul style="list-style-type: none"> ➤ May have caused death ➤ May have contributed to neurological dysfunction • Examination of scalp and skull • Removal of brain and meninges • Neuropathological examination of brain and meninges • Ability to correlate anatomical and pathological features of the lesion(s) to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of legal obligations under Human Tissue Act • Responsibility to investigate whether pathological changes are consistent with non-accidental injury • Responsibility to assess whether medical and/or nursing care was appropriate and proper • Responsibility to investigate whether natural disease has contributed to the traumatic injury to brain and/or spine • Responsibility to assess whether negligence contributed to death 	<p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit a Specialist Centre</p>
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Neuropathological examination of tissue removed at autopsy

Objective	Subject matter	Teaching / Learning method
Diagnosis of a mass lesion or lytic lesion in bones of skull or vertebrae	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Myeloma 	<p>Textbooks</p> <ul style="list-style-type: none"> • Robbins & Cotran's Pathologic Basis of

	<ul style="list-style-type: none"> • Lymphoma • Metastases • Giant cell tumour of bone • Langerhans' Cell Histiocytosis • Chordoma • Chondrosarcoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>Disease, 8th edition (Kumar, Abbas, Fausto & Aster)</p> <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Attachment to Specialist Centre</p>
<p>Diagnosis of a mass lesion arising from the meningeal coverings of the brain or spinal cord</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Meningioma • Lymphoma • Metastases • Gliosarcoma 	<p>Textbooks</p> <ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler)

	<ul style="list-style-type: none"> • Melanoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>& Cavanaugh)</p> <ul style="list-style-type: none"> • Diagnostic Pathology of Nervous System Tumours (Ironside, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of a mass lesion in the region of the sella turcica</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Hypophysitis • Sarcoidosis • Infarction • Pituitary adenoma • Craniopharyngioma • Pilocytic astrocytoma • Meningioma • Lymphoma 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th

	<p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee)</p> <ul style="list-style-type: none"> • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of a mass lesion in the region of the pineal gland</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Pineocytoma • Pineal parenchymal tumour of intermediate differentiation • Pineoblastoma • Papillary tumour of the pineal region • Atypical teratoid / rhabdoid tumour • Germ cell tumours <ul style="list-style-type: none"> ➢ Germinoma ➢ Teratoma: mature, immature, malignant ➢ Yolk sac tumour 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler

	<ul style="list-style-type: none"> ➤ Embryonal carcinoma ➤ Choriocarcinoma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>& Cavanee)</p> <ul style="list-style-type: none"> • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of a mass lesion within the brain or spinal cord</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Abscess, infarction, demyelination and tumour • Primary brain tumour and metastases • Glioma and lymphoma • Low and high-grade glioma <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th

	<ul style="list-style-type: none"> • Gender predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Abscess, infarction, demyelination and tumour ➢ Primary brain tumour and metastases ➢ Glioma and lymphoma ➢ Low and high-grade glioma • Ability to apply WHO classification to a tumour • Ability to accurately WHO grade to tumour, where relevant • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee)</p> <ul style="list-style-type: none"> • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
Diagnosis of a lesion causing intractable epilepsy	<p>(1) Knowledge</p> <p>Microscopical features of the lesions associated with symptomatic epilepsy</p> <ul style="list-style-type: none"> • Cerebral malformations • Cortical dysplasia • Vascular malformations • Infections and non-infective inflammatory conditions • Neoplasms 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love)

	<ul style="list-style-type: none"> • Mesial temporal sclerosis <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical site • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Dissection, preparation and examination of a cerebral lobe, especially the medial part of the temporal lobe • Ability to determine specific nature of a structural lesion causing epilepsy • Preparation and interpretation of neurohistological sections • Ability to identify mesial temporal sclerosis • Ability to distinguish between: <ul style="list-style-type: none"> ➢ Encephalitis, abscess, infarction, demyelination and tumour ➢ Primary brain tumour and metastases ➢ Glioma and lymphoma • Ability to apply WHO classification to a tumour • Ability to accurately grade tumour, where relevant • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<ul style="list-style-type: none"> • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironside, Moss, Louis, Lowe, Weller) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Specialist Centre: consider possibility of accessing archived material at the Institute of Child Health</p>
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<p>Diagnosis of a case of dementia</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Amyloid angiopathy • Cerebral vasculitis • CADASIL • Cranial (giant cell) arteritis • Meningeal carcinomatosis • Paraneoplastic encephalitides • Chronic inflammation of meninges • Prion disease • AIDS and opportunistic infection • Metabolic disease (leukodystrophy, lysosomal storage disease, mitochondrial disease, peroxisomal disorders etc) • Neurodegenerative disease: <ul style="list-style-type: none"> ➢ Alzheimer's disease ➢ Dementia with Lewy bodies ➢ Frontotemporal lobar degenerations ➢ Corticobasal degeneration ➢ Progressive supranuclear palsy ➢ Other (argyrophilic grain dementia, etc) <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections from selected samples of meninges, brain and spinal cord. • Skin biopsy (CADASIL – electron microscopy) • Ability to relate findings to cause or manner of death • Ability to correlate anatomical distribution of pathology and specific pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the 	<p>Textbooks</p> <ul style="list-style-type: none"> • Carpenter's Human Neuroanatomy, 9th edition (Parent) • Neurological Differential Diagnosis, 2nd edition (Patten) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Consider possibility of accessing archived material at:</p>
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	<p>degree of confidence with which an opinion is expressed</p> <ul style="list-style-type: none"> • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. • Awareness of need to communicate concern to Directors of Clinical Neurosciences Service Unit and Public Health Laboratory Service in unexpected case of prion disease 	<p>One or more brain banks for neurodegenerative disease National CJD Surveillance Unit</p>
<p>Diagnosis of focal or diffuse cerebral white matter abnormality</p>	<p>(1) Knowledge Microscopical features of:</p> <ul style="list-style-type: none"> • Non-infective inflammatory disease • Infections • Demyelination • Metabolic disease • Neoplastic disease • Vascular / ischaemic disease <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p>

	<p>degree of confidence with which an opinion is expressed.</p> <ul style="list-style-type: none"> • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Diagnosis of focal or diffuse, meningeal or cerebral lesions in immunosuppressed patient</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Opportunistic infections • Lymphoma and other malignancies • CNS changes of AIDS • Other inflammatory / metabolic / neoplastic / ischaemic process <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p>	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • WHO Classification of Tumours of the Central Nervous System 4th edition 2007 (Ed: Louis, Oligaki, Wiestler & Cavanee) • Diagnostic Pathology of Nervous System Tumours (Ironsides, Moss, Louis, Lowe, Weller) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto)

	<ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinicopathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>& Aster)</p> <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to HIV brain bank</p>
<p>Diagnosis of progressive abnormality of movement or posture</p>	<p>(1) Knowledge</p> <p>Microscopical features of::</p> <ul style="list-style-type: none"> • Parkinson syndrome: <ul style="list-style-type: none"> ➢ Parkinson's (Lewy body) Disease ➢ Progressive Supranuclear Palsy ➢ Striatonigral Degeneration ➢ Corticobasal degeneration ➢ Familial Frontal Lobe Dementia with Parkinsonism ➢ Wilson Disease ➢ Prion disease (Creutzfeldt-Jakob Disease) • Hemiballismus and hemichorea <ul style="list-style-type: none"> ➢ Stroke, tumour or vascular malformation • Chronic chorea of Huntington type • Athetosis and dystonia <ul style="list-style-type: none"> ➢ Hallervorden-Spatz Disease ➢ Wilson Disease • Cerebellar incoordination and intention tremor <ul style="list-style-type: none"> ➢ Olivopontocerebellar atrophy ➢ Brain tumour ➢ Paraneoplastic syndrome ➢ Prion disease (Creutzfeldt-Jakob Disease) ➢ Friedreich's ataxia and other spinocerebellar degenerations ➢ Cerebellar cortical degeneration <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age 	<p>Textbooks</p> <ul style="list-style-type: none"> • Carpenter's Human Neuroanatomy, 9th edition (Parent) • Neurological Differential Diagnosis, 2nd edition (Patten) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p>

	<ul style="list-style-type: none"> • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinico-pathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>Multidisciplinary Team Meetings</p> <p>Specialist Centre: Access archived material at one of the UK brain banks for neurodegenerative disease</p>
<p>Investigation of strokes (cerebral infarction or haemorrhage)</p>	<p>(1) Knowledge</p> <p>Microscopical features of:</p> <ul style="list-style-type: none"> • Cerebral vasculitis • Mitochondrial cytopathy (MELAS) • Haemorrhage into neoplasm <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Age • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above. <p>(2) Skills</p>	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Structural and Molecular Basis of Skeletal Muscle Diseases (Karpati) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd

	<ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections and sections of skeletal muscle • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinico-pathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>edition (Esiri)</p> <ul style="list-style-type: none"> • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) • Robbins & Cotran's Pathologic Basis of Disease, 8th edition (Kumar, Abbas, Fausto & Aster) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
<p>Investigation of developmental abnormalities and other pathology in the fetus, neonate or child</p>	<p>(1) Knowledge</p> <p>Microscopical features of :</p> <ul style="list-style-type: none"> • Cellular reactions in the developing CNS • Malformations, including: • Toxic and metabolic CNS damage, including: • Kernicterus • Hypoglycaemia • Lysosomal disorders • Peroxisomal disorders • Mitochondrial disorders • Other inborn errors of intermediary metabolism • Hypoxic-ischaemic grey and white matter injury • Perinatal infections of the CNS and its coverings • Neurodegenerative diseases of childhood, including: • Spinal muscular and neurogenic atrophies • The neuroaxonal dystrophies • The leukodystrophies • Alpers' syndrome and Rett's syndrome 	<p>Textbooks</p> <ul style="list-style-type: none"> • Pathology & Genetics: Developmental Neuropathology (Golden & Harding) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Neuropathology Techniques (Dawson, Neal, Llewellyn,

	<ul style="list-style-type: none"> • Arthrogyrosis multiplex congenita • CNS tumours of childhood <p>Clinical features of conditions listed above, including:</p> <ul style="list-style-type: none"> • Genetic predisposition • Anatomical distribution • Natural history • Features on imaging of conditions listed above <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Preparation and interpretation of sections of skeletal muscle and peripheral nerve • Ability to relate findings to cause or manner of death • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case • Judicious selection of fresh or frozen tissue for biochemical and genetic analysis • Judicious selection of tissue samples for EM examination • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to communicate the diagnosis promptly • Participation in multi-disciplinary meeting or other clinico-pathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy. 	<p>Thomas)</p> <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Specialist Centre: access archived material at the Institute of Child Health</p>
Investigation of sudden infant death syndrome	<p>(1) Knowledge</p> <p>Microscopical features of :</p>	<p>Textbooks</p> <ul style="list-style-type: none"> • Pathology & Genetics:

(SIDS)	<ul style="list-style-type: none"> • Cellular reactions in the developing CNS • Malformations • Toxic and metabolic CNS damage, including: • Hypoglycaemia • Hypoxic-ischaemic grey and white matter injury • Perinatal infections of the CNS and its coverings • CNS tumours of childhood <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate any neuropathological findings to cause or manner of death • Judicious selection of fresh or frozen tissue for biochemical and genetic analysis when appropriate • Judicious selection of tissue samples for EM examination when appropriate • Ability to correlate anatomical and pathological features of lesion to the clinical details of the case. • Ability to write clear and comprehensive reports for users, indicating the degree of confidence with which an opinion is expressed. • Ability to make oneself understood to lay persons and to professionals at all levels. <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to liaise with the paediatric pathologist concerned with the case, particularly with regard to the pathological changes found in other organs • Participation in multi-disciplinary meeting or other clinico-pathological meeting • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy 	<p>Developmental Neuropathology (Golden & Harding)</p> <ul style="list-style-type: none"> • Forensic Neuropathology (Whitwell) • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p>
Forensic investigation of suspected child abuse	<p>(1) Knowledge</p> <p>Microscopical features of :</p> <ul style="list-style-type: none"> • Cellular reaction to epidural, subdural and subarachnoid haemorrhage, which may date the injury • Cellular and tissue reactions of the brain to direct impact injury and shaking 	<p>Textbooks</p> <ul style="list-style-type: none"> • Forensic Neuropathology (Whitwell) • Greenfield's

	<p>injury, including:</p> <ul style="list-style-type: none"> • Cortical and gliding contusions • Diffuse axonal injury • Diffuse vascular injury • Cerebral infarction • Other hypoxic-ischaemic lesions • Cellular and tissue reaction of the eye to shaking injury, including: • Retinal haemorrhages • Any non-traumatic lesions found at autopsy <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate any neuropathological findings to external injuries in the case and to the findings in the general autopsy • Ability to evaluate consistency of history of trauma with the severity and extent of traumatic brain and ocular injury • Ability to draw up a formal medico-legal report • Ability to act as an expert witness <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to liaise fully with the paediatric pathologist, the police and the coroner / procurator fiscal, concerned with the case • Awareness of the responsibilities of an expert witness • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy 	<p>Neuropathology, 8th edition (Ed: Love, Louis & Ellison)</p> <ul style="list-style-type: none"> • Neuropathology, 2nd edition (Ellison & Love) • Neuropathology Techniques (Dawson, Neal, Llewellyn, Thomas) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Specialist Centre: consider possibility of accessing archived material at the Institute of Child Health</p>
Investigation traumatic injury to the head or spine	<p>(1) Knowledge</p> <p>Microscopical features of :</p> <ul style="list-style-type: none"> • Cellular reaction to extradural/epidural, subdural and subarachnoid haemorrhage, which may date the injury • Cellular and tissue reactions of the brain to direct impact injury and whiplash injury, including: • Cortical and gliding contusions • Diffuse axonal injury • Diffuse vascular injury • Cerebral infarction 	<p>Textbooks</p> <ul style="list-style-type: none"> • Greenfield's Neuropathology, 8th edition (Ed: Love, Louis & Ellison) • Neuropathology, 2nd edition (Ellison & Love) • Neuropathology Techniques (Dawson, Neal, Llewellyn,

	<ul style="list-style-type: none"> • Other hypoxic-ischaemic lesions • Brain damage secondary to raised intracranial pressure • Any non-traumatic lesions found at autopsy • Infection complicating head injury, including meningitis and brain abscess • Medical complications following trauma, including: <ul style="list-style-type: none"> • Fat embolism • Venous thrombosis • Disseminated intravascular coagulation • Thiamine deficiency • Central pontine myelinolysis <p>(2) Skills</p> <ul style="list-style-type: none"> • Preparation and interpretation of neurohistological sections • Ability to relate neuropathological findings to external injuries in the case and to the findings in the general autopsy • Ability to evaluate consistency of history of trauma with the severity and extent of traumatic brain injury • Ability to distinguish between direct consequences and indirect medical complications of trauma • Ability to draw up a formal medico-legal report • Ability to act as an expert witness <p>(3) Attitude</p> <ul style="list-style-type: none"> • Awareness of need to liaise fully with the general pathologist, the police and the coroner / procurator fiscal, concerned with the case • Awareness of the responsibilities of an expert witness • Awareness of consent issues concerning retention and/or disposal of tissues removed at autopsy 	<p>Thomas)</p> <ul style="list-style-type: none"> • Oppenheimer's Diagnostic Neuropathology: A practical manual, 2nd edition (Esiri) <p>Archived material</p> <p>Current clinical cases</p> <p>Multidisciplinary Team Meetings</p> <p>Visit to Specialist Centre</p>
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4. ASSESSMENT OF KNOWLEDGE IN NEUROPATHOLOGY

Knowledge	Assessment	Evidence of Competence
<p>Knowledge of gross and microscopical pathology of all organ systems, sufficient to:</p> <ul style="list-style-type: none"> • Conduct a general autopsy • Recognize gross pathology externally and in thoracic and abdominal organs • Sample lesions for histology • Interpret the significance of pathological findings in other systems with pathology in the nervous system. 	<p>Year 1 and Year 2 Assessments:</p> <ul style="list-style-type: none"> • Trainee should prepare a series of lectures that deal with the gross pathology and histopathology of the major organ systems (other than the nervous system) for presentation to a mixed audience of medical and technical staff, both senior and trainees, in the laboratory. • Trainee should contribute lectures, previously trialled within the department, to the clinical pathology curriculum for students of medicine, nursing and biomedical science • Case-based discussion (both autopsy and surgical resection specimens) <p>FRCPATH Part 1 examination in Histopathology</p>	<ul style="list-style-type: none"> • Satisfactory lecture without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on case-based discussions • Pass in FRCPATH Part 1 examination in Histopathology

<p>Expert knowledge of external and internal gross anatomy of the brain, including:</p> <ul style="list-style-type: none"> • Blood supply • Afferent and efferent projection pathways of major cortical areas and subcortical, brainstem and cerebellar nuclei 	<p>Year 1 Assessment:</p> <ul style="list-style-type: none"> • Trainee should prepare a series of lectures that deal with the gross pathology of the central and peripheral nervous systems for presentation to a mixed audience of medical and technical staff, both senior and trainees, in the laboratory. • Trainee should contribute lectures, previously trialled within the department, to the clinical pathology curriculum for students of medicine, nursing and biomedical science • Case-based discussion (current and archived autopsy specimens) <p>FRCPPath Part 2 examination in Diagnostic Neuropathology: macroscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on case-based discussions • Pass in FRCPPath Part 2 examination in Diagnostic Neuropathology: macroscopical component
<p>Clinico-anatomical correlation</p> <ul style="list-style-type: none"> • Syndromes associated with cerebral lobes • Disturbances of cognition, including behaviour, language, praxis and memory. • Disturbances of movement • Disturbances of balance and co-ordination • Disturbances of somatic sensation • Visual field defects • Disturbance of conjugate gaze • Cranial nerve syndromes 	<p>Possible methods of assessment in year 1:</p> <ul style="list-style-type: none"> • Trainee could prepare a series of lectures that deal with the clinical neuroanatomy, emphasizing clinico-anatomical correlation, for presentation to a mixed audience of medical and technical staff, both senior and trainees, in the laboratory. • Trainee should contribute to lectures, previously trialled within the department, to the clinical pathology curriculum for students of medicine, nursing and biomedical science, and to trainees in Neurology and Neurosurgery • Case-based discussion (current and archived autopsy cases and neurosurgical cases) <p>FRCPPath Part 2 examination in Diagnostic Neuropathology: macroscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on case-based discussions • Pass in FRCPPath Part 2 examination in Diagnostic Neuropathology: mainly macroscopical component

<ul style="list-style-type: none"> • Brainstem syndromes • Stroke syndromes • Spinal cord syndromes • Patterns of weakness, muscle wasting and sensory loss in nerve and root lesions • Patterns of weakness and muscle wasting in primary myopathies 		
<p>Gross pathology of the brain, its coverings and the skull, including:</p> <ul style="list-style-type: none"> • Traumatic brain injury • Hypoxic brain injury • Vascular pathology • Neoplasms • Demyelinating diseases • Degenerative diseases • Infections • Nutritional and metabolic disorders 	<p>1. Year 2 Assessment - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess progress of candidate's systematic and thematic study of archived formalin-fixed material. (Lecturing and case-based discussion) • Assess progress and competence of candidate's ability to perform brain cut and dissect spinal cord (direct observation of practical skill) • Assess progress and competence of candidate in conducting neuropathological examination of current autopsy cases, including: <ul style="list-style-type: none"> ➢ Construction of macroscopical pathology report (DOPS) ➢ Judicious selection and sampling of tissue blocks for microscopical examination (CBD, DOPS) ➢ Judicious selection of histochemical & immunohistochemical stains to assist differential diagnosis (CBD, DOPS) ➢ Presentation of cases at multidisciplinary team meetings (ECE) 	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology

	<ol style="list-style-type: none"> 2. Deanery's Annual Review of Competency Progression 3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly macroscopical component 	
<p>Gross pathology of the spinal cord, its coverings and the vertebral column, including:</p> <ul style="list-style-type: none"> • Traumatic injury • Vascular pathology • Neoplasms • Demyelinating diseases • Degenerative diseases • Infections • Nutritional and metabolic disorders 	<ol style="list-style-type: none"> 1. Year 2 Assessment - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should: <ul style="list-style-type: none"> Assess progress of candidate's systematic and thematic study of archived formalin-fixed material. (Lecturing and case-based discussion) Assess progress and competence of candidate's ability to perform brain cut and dissect spinal cord (direct observation of practical skill) Assess progress and competence of candidate in conducting neuropathological examination of current autopsy cases, including: <ul style="list-style-type: none"> ➤ Construction of macroscopical pathology report (DOPS) ➤ Judicious selection and sampling of tissue blocks for microscopical examination (CBD, DOPS) ➤ Judicious selection of histochemical & immunohistochemical stains to assist differential diagnosis (CBD, DOPS) ➤ Presentation of cases at multidisciplinary team meetings (ECE) 2. Deanery's Annual Review of Competency Progression 3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly macroscopical component 	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology

<p>Non-oncological neurohistology, including:</p> <ul style="list-style-type: none"> • Traumatic brain injury • Hypoxic brain injury • Vascular pathology • Neoplasms • Demyelinating diseases • Degenerative diseases • Infections • Nutritional and metabolic disorders 	<p>1. Year 2 and Year 3 Assessments - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess progress of candidate's systematic and thematic study of archived paraffin-processed material (and related EM and frozen tissue preparations). • Assess progress and competence of candidate in reporting microscopical findings in current neuropathological autopsy cases, including: <ul style="list-style-type: none"> ➢ Identification and interpretation of microscopical pathology ➢ Construction of full and final autopsy report, indicating: <ul style="list-style-type: none"> • neuropathological diagnosis • relevance of any pathology to cause of death • correlation of pathological findings with clinical history • assessment of medico-legal implications, if any ➢ Presentation of cases at multidisciplinary team meetings <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
<p>Developmental neuroanatomy and Developmental neuropathology</p>	<p>1. Year 3 Assessments - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess knowledge and understanding of developmental neuroanatomy. • Assess knowledge and recognition of cellular reactions in the developing central nervous system. • Assess progress of candidate's systematic and thematic study of <i>archived</i> formalin-fixed and paraffin-processed material (and related EM and frozen tissue preparations) • Assess progress and competence of candidate in reporting gross and microscopical findings in current paediatric 	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual

	<p>neuropathological autopsy cases, including:</p> <ul style="list-style-type: none"> ➤ Identification and interpretation of gross and microscopical pathology ➤ Construction of full and final autopsy report, indicating: <ul style="list-style-type: none"> • neuropathological diagnosis • relevance of any pathology to cause of death • correlation of pathological findings with clinical history • assessment of medico-legal implications, if any ➤ Presentation of cases at multidisciplinary team meetings <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPATH Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<p>Review of Competency Progression</p> <ul style="list-style-type: none"> • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
<p>Sampling protocols according to clinical problem</p>	<p>1. Year 2 and Year 3 Assessments - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess knowledge of standardised protocols for block selection at brain cuts • Assess understanding of the clinical and pathological basis for block selection at brain cuts from adult autopsy cases and selection of appropriate special stains / immunohistochemical preparations • Assess understanding of the clinical and pathological basis for block selection at brain cuts from paediatric autopsy cases and selection of appropriate special stains / immunohistochemical preparations <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPATH Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology

Surgical neuro-oncology	<p>1. Year 2 and Year 3 Assessments - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess progress and competence of candidate's systematic and thematic study of archived paraffin-processed biopsy material. • Assess progress and competence of candidate's study of frozen sections and wet smear preparations of archived biopsy material. • Assess progress and competence of candidate's ability to perform neurosurgical biopsy cut-up. • Assess progress and competence of candidate in reporting current neurosurgical biopsies, including: <ul style="list-style-type: none"> ➤ Intra-operative smear and frozen sections ➤ Paraffin sections stained with haematoxylin & eosin ➤ Judicious use and interpretation of immunohistochemical methods in differential diagnosis ➤ Construction of reports ➤ Presentation of cases at multidisciplinary team meetings <p>2. Deanery's Annual Review of Competency Progression².</p> <p>3. FRCPath Part 2 exam in Diagnostic Neuropathology: mainly microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
Skeletal muscle pathology	<p>1. Year 3 Assessment - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess progress of candidate's systematic and thematic study of archived skeletal muscle biopsy material • Assess progress and competence of candidate in reporting current skeletal muscle biopsies, including: <ul style="list-style-type: none"> ➤ Judicious use and interpretation of immunohistochemical methods in differential diagnosis ➤ Judicious use of electron microscopy in differential 	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based

	<p>diagnosis</p> <ul style="list-style-type: none"> ➤ Construction of reports ➤ Presentation of cases at multidisciplinary team meetings <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<p>assessment</p> <ul style="list-style-type: none"> • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
Peripheral nerve pathology	<p>1. Year 3 Assessment - Through use of lecturing programme (as above) and workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess progress of candidate's systematic and thematic study of archived peripheral nerve biopsy material, including: <ul style="list-style-type: none"> ➤ Paraffin sections ➤ Semi-thin, plastic-embedded sections ➤ Teased nerve fibre preparations ➤ Electron microscopy • Assess progress and competence of candidate in reporting current peripheral nerve biopsies, including: <ul style="list-style-type: none"> ➤ Judicious use and interpretation of immunohistochemical methods in differential diagnosis ➤ Judicious use of electron microscopy in differential diagnosis ➤ Construction of reports ➤ Presentation of cases at multidisciplinary team meetings <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory lecture(s) without reference to notes and other textual prompts as judged by personal observation by educational supervisor and through collated feedback from other members of the audience • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology

5. ASSESSMENT OF SKILLS IN NEUROPATHOLOGY		
Skill	Assessment	Evidence of Competence
Perform general body autopsy	<p>1. Year 1 and Year 2 Assessment - Through use workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess competence of candidate to perform a general body autopsy (case-based discussion, direct observation of practical skill) • Assess progress and competence of candidate in presenting the findings in current autopsy cases, including: <ul style="list-style-type: none"> ➢ Construction of macroscopical pathology report (DOPS) ➢ Judicious selection and sampling of tissue blocks for microscopical examination (CBD, DOPS) ➢ Judicious selection of histochemical & immunohistochemical stains to assist differential diagnosis (CBD, DOPS) ➢ Correct formulation of cause of death (CBD, DOPS) ➢ Presentation of cases to clinicians and at multidisciplinary team meetings (Evaluation of clinical events) <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPath Part 2 examination in Diagnostic Neuropathology: macroscopical component</p>	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
Examination of skull and intracranial contents, including: dural venous sinuses pituitary gland cranial nerves middle ear cavities	<p>1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to examine the skull and intracranial contents (CBD and DOPS), including:</p> <ul style="list-style-type: none"> • dural venous sinuses • pituitary gland • cranial nerves 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression

skull sinuses	<ul style="list-style-type: none"> • middle ear cavities • skull sinuses <ol style="list-style-type: none"> 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Examination and dissection of the arterial circle of Willis	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to examine, remove and display the arteries in the neck, including the vertebral arteries, and at the base of the brain, including the circle of Willis and its branches (CBD and DOPS) 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Removal of the brain	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to remove the brain at autopsy (CBD and DOPS) 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Examination of the spine and removal of spinal cord and dorsal root ganglia	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to remove the spinal cord and dorsal root ganglia at autopsy (CBD and DOPS) 2. Deanery's Annual Review of Competency Progression 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression

	3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component	<p>Progression</p> <ul style="list-style-type: none"> • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Exposure and removal of cervical, brachial and lumbar plexuses	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to expose and remove the cervical, brachial and lumbar plexuses at autopsy (CBD and DOPS) 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Examination of carotid sheath, including sympathetic and vagal ganglia	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to expose and examine the carotid sheath at autopsy and to remove the sympathetic chain and vagal ganglia contained therein. 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Removal of thoracic sympathetic chain	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to expose and remove the thoracic sympathetic chain at autopsy 2. Deanery's Annual Review of Competency Progression 3. FRCPATH Part 2 examination in Diagnostic Neuropathology: macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology

<p>Sampling of muscles supplied by motor cranial nerves</p>	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should: <ul style="list-style-type: none"> • Assess candidate's ability to identify and sample facial and cervical muscles supplied by the motor cranial nerves at autopsy 2. Deanery's Annual Review of Competency Progression 3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
<p>Exposure and removal of the vertebral artery along its entire course</p>	<ol style="list-style-type: none"> 1. Year 1 Assessment - Through use workplace-based assessment tools, educational supervisor should: <ul style="list-style-type: none"> • Assess candidate's ability to expose and remove the vertebral artery along its entire course at autopsy 2. Deanery's Annual Review of Competency Progression 3. FRCPath Part 2 examination in Diagnostic Neuropathology: mainly macroscopical component 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
<p>Dissection, examination and sampling of the fixed brain (in coronal and/or horizontal plane) and spinal cord</p>	<ol style="list-style-type: none"> 1. Year 1 and Year 2 Assessments - Through use workplace-based assessment tools, educational supervisor should: <ul style="list-style-type: none"> • Assess candidate's ability to dissect and examine the fixed adult brain (in coronal and/or horizontal plane) and spinal cord • Assess candidate's ability to identify cortical (Brodmann) areas and named nuclei and white matter tracts in subcortical parts of the adult cerebrum, the brainstem, the cerebellum and spinal cord • Assess judicious block selection at brain cuts from adult autopsy cases and judicious selection of appropriate special stains / immunohistochemical preparations 2. Year 2 and Year 3 Assessments <ul style="list-style-type: none"> • Assess candidate's ability to dissect and examine the fixed 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPath Part 2 examination in Diagnostic Neuropathology

	<p>paediatric or fetal brain (in coronal and/or horizontal plane) and spinal cord</p> <ul style="list-style-type: none"> Assess judicious block selection at brain cuts from paediatric and fetal autopsy cases and judicious selection of appropriate special stains / immunohistochemical preparations <p>3. Year 3 Assessment</p> <ul style="list-style-type: none"> Further assess candidate's skill at dissection and macroscopical examination of brain and spinal cord from adult, paediatric and fetal autopsy cases <p>4. Deanery's Annual Review of Competency Progression</p> <p>5. FRCPath Part 2 examination in Diagnostic Neuropathology: macroscopical component</p>	
Observational skills (must not miss macroscopical neuropathology)	<p>1. Year 2 and Year 3 Assessments - Through use workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> Assess the candidate's ability to detect and identify macroscopical pathology in the adult brain and spinal cord Assess the candidate's ability to detect and identify macroscopical pathology in the paediatric or fetal brain and spinal cord <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPath Part 2 examination in Diagnostic Neuropathology: macroscopical component</p>	<ul style="list-style-type: none"> Satisfactory report from educational supervisor on all components of workplace-based assessment Satisfactory outcome at Annual Review of Competency Progression Pass in FRCPath Part 2 examination in Diagnostic Neuropathology
Neurosurgical diagnosis	<p>1. Year 1 and Year 2 Assessments - Through use workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> Assess progress of candidate's systematic and thematic study of <i>archived</i> paraffin-processed biopsy material. Assess progress of candidate's study of frozen sections and wet smear preparations of <i>archived</i> biopsy material. Assess progress of candidate's ability to perform 	<ul style="list-style-type: none"> Satisfactory report from educational supervisor on all components of workplace-based assessment Satisfactory outcome at Annual Review of Competency Progression Pass in FRCPath Part 2 examination in Diagnostic Neuropathology

	<p>neurosurgical biopsy cut-up.</p> <p>2. Year 2 and Year 3 Assessments - Through use workplace-based assessment tools, educational supervisor should assess competence of candidate in reporting <i>current</i> neurosurgical biopsies, including:</p> <ul style="list-style-type: none"> • Intra-operative smear and frozen sections • Paraffin sections stained with haematoxylin & eosin • Judicious use and interpretation of immunohistochemical methods in differential diagnosis • Construction of reports • Presentation of cases at multidisciplinary team meetings • To assess competence in all aspects of diagnostic neuropathology <p>3. Deanery's Annual Review of Competency Progression</p> <p>4. FRCPATH Part 2 examination in Diagnostic Neuropathology: microscopical component</p>	
<p>Intra-operative neurosurgical diagnosis</p>	<p>1. Year 2 Assessment - Through use workplace-based assessment tools, educational supervisor should assess competence of candidate in preparing intra-operative smear preparations and frozen sections from neurosurgical biopsies</p> <p>2. Year 2 and Year 3 Assessments - Through use workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess competence of candidate in making provisional or definitive diagnosis, as appropriate, on intra-operative smear preparations and frozen sections from neurosurgical biopsies • Assess candidate's ability to communicate effectively the result of intra-operative smear preparation and/or frozen section to the neurosurgeon(s) <p>3. Deanery's Annual Review of Competency Progression</p>	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology

	4. FRCPATH Part 2 examination in Diagnostic Neuropathology: mainly microscopical component	
CSF cytological diagnosis	<p>1. Year 2 and Year 3 Assessments - Through use workplace-based assessment tools, educational supervisor should:</p> <ul style="list-style-type: none"> • Assess competence of candidate in making pathological diagnosis on cytological preparations of cerebrospinal fluid • Assess candidate's ability to report the findings on examination of cytological preparations of cerebrospinal fluid <p>2. Deanery's Annual Review of Competency Progression</p> <p>3. FRCPATH Part 2 examination in Diagnostic Neuropathology: microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology
Skeletal muscle biopsy	<p>1. Year 2 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to interpret and report pathological changes in a skeletal muscle biopsy based on:</p> <ul style="list-style-type: none"> • Frozen sections • Enzyme histochemistry • Immunohistochemistry • Electron microscopy <p>2. Year 3 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to report of skeletal muscle biopsies, including:</p> <ul style="list-style-type: none"> • Judicious use and interpretation of immunohistochemical methods in differential diagnosis • Judicious use of electron microscopy in differential diagnosis • Construction of reports • Judicious referral for molecular and genetic studies, including western blot analysis and mitochondrial DNA analysis 	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology

	<ul style="list-style-type: none"> • Judicious referral for analysis of respiratory chain enzyme activities • Presentation of cases at multidisciplinary team meetings <p>3. Deanery's Annual Review of Competency Progression</p> <p>4. FRCPATH Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	
Peripheral nerve biopsy	<p>1. Year 2 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to interpret and report pathological changes in a peripheral nerve biopsy material, based on:</p> <ul style="list-style-type: none"> • Paraffin sections • Semi-thin, plastic-embedded sections • Teased nerve fibre preparations • Electron microscopy <p>2. Year 3 Assessment - Through use workplace-based assessment tools, educational supervisor should assess candidate's ability to report of skeletal muscle biopsies, including:</p> <ul style="list-style-type: none"> • To assess progress of candidate in reporting current peripheral nerve biopsies, including: • Judicious use and interpretation of immunohistochemical methods in differential diagnosis • Judicious use of electron microscopy in differential diagnosis • Construction of reports • Presentation of cases at multidisciplinary team meetings <p>3. Deanery's Annual Review of Competency Progression</p> <p>4. FRCPATH Part 2 examination in Diagnostic Neuropathology: mainly microscopical component</p>	<ul style="list-style-type: none"> • Satisfactory report from educational supervisor on all components of workplace-based assessment • Satisfactory outcome at Annual Review of Competency Progression • Pass in FRCPATH Part 2 examination in Diagnostic Neuropathology

RECOMMENDED TEXTBOOKS IN NEUROANATOMY, NEUROLOGY & NEUROSURGERY

Substantial Textbooks

Adams and Victor's Principles of Neurology, 9th Revised edition, Allan H Ropper, Martin Allen Samuels

Neurological Differential Diagnosis, 2nd edition, by John Patten.

Principles of Neurosurgery, 2nd revised edition, by Rengachary, Setti Ellenbogen, Richard Setti S Rengachary, Richard G Ellenbogen

Neuroradiology: The Requisites by David M. Yousem, Robert D. Zimmerman, & Robert I. Grossman

Human Neuroanatomy by James R Augustine

Human Neuroanatomy, 3rd edition, by J Edward Bruni, Donald G Montemurro

Introductory Textbooks

Neuroanatomy, 4th revised edition, by Alan R Crossman, David Neary

Neuroanatomy through Clinical Cases, Second Edition, by Hal Blumenfeld

Clinical Neuroradiology: A case-based approach by Gasser Hathout

Essential Neurosurgery, 3rd revised edition, by Andrew Kaye

Essential Neurology, 4th Edition, by Iain Wilkinson & Graham Lennox

APPENDIX 2: COMPETENCES IN BASIC HISTOPATHOLOGY

Stage A

The aims of this stage are to provide:

- a structured introduction to histopathology (including cytopathology and autopsy pathology)
- a short practical introduction to paediatric pathology (either stage A or B, recommended 2 weeks total)
- a short practical introduction to neuropathology (either stage A or B, recommended 2 weeks total).

Competences required to exit stage A:

- independent cut-up of most simple specimens (e.g. appendicectomy, cholecystectomy, skin biopsies, etc.)
- independent cut-up of common larger specimens (e.g. colectomy for cancer, simple nephrectomy, breast lumpectomy, etc.)
- ability to write an appropriate report for a wide range of histopathology and cytopathology specimens (common biopsies, common cancer resections, e.g. colorectal carcinoma, fine needle aspiration specimens)
- ability to demonstrate time management and task prioritisation (e.g. prioritisation of specimens for cut-up and reporting, timely turn-around of reporting histopathology or cytopathology specimens, keeping LEPT entries up to date)
- independent evisceration and dissection of a straightforward autopsy
- ability to write an autopsy report including appropriate clinicopathological correlation for a straightforward case.

Stage B

The aims of this stage are to:

- broaden experience and understanding of histopathology
- broaden understanding of subspecialty pathology including all subspecialties
- provide a short practical introduction to paediatric pathology (either stage A or B, recommended 2 weeks total)
- provide a short practical introduction to neuropathology (either stage A or B, recommended 2 weeks total)
- develop a basic knowledge base in cytopathology and autopsy pathology.

Competencies required to exit stage B:

- independent cut-up of all simple specimens (see above for examples)
- independent cut-up of all common larger specimens (including mastectomy, prostatectomy, complex hysterectomy specimens, etc)
- ability to primary screen cervical samples
- ability to write an appropriate report for a wide range of histopathology and cytopathology specimens (including more complex specimens than those described for stage A above)
- ability to demonstrate effective time management and task prioritisation
- independent evisceration and dissection of more complex autopsies (see those described as 'Complex post-mortems for observation' in stage A)

- curriculum content, page 37)
- ability to write an autopsy report including appropriate clinicopathological correlation for a more complex case (as described above).

Stage A (18 in stage, 12 directed)

Directly Observed Practical Skills (DOPS) (six from the following):

Set up and use microscope

Autopsy:

- performing a straightforward evisceration
- dissection of single organ / system

Cut-up:

- completion of a simple cut up session (e.g. simple skins, gall bladders, appendices)
- macroscopic description and block taking of a major cancer resection (e.g. colonic cancer)

Microscopy:

- demonstrate ability to recognise normal histology
- demonstrate ability to recognise straightforward pathological entities (e.g. basal cell carcinoma, adenocarcinoma in biopsies, acute appendicitis)

Cytology:

- screen a gynae cytology slide and correctly identify various cells

Comment: all six DOPS undertaken in Stage A will be taken from this list

Evaluation of Clinical Events (ECEs) (three from the following):

Histology/cytology:

- present a case with ancillary investigations to a consultant trainer

Autopsy:

- presentation to trainer or clinicians of findings in straightforward cases (e.g. bronchopneumonia, myocardial infarction, pulmonary embolus, cerebrovascular accident)

Audit:

- present at audit meeting and lead discussion, having discussed findings with trainer beforehand

Poster presentation:

- show a poster at the Pathological Society meeting or similar

Teaching event for medical students or demonstration of interesting case to other trainees:

- to be observed by trainer

Referral letter:

- write a draft letter on a case for referral

Comment: three further ECEs in stage A may be taken from outside this list.

Case-Based Discussions (CBDs) (three from the following):**Autopsy:**

- write an appropriate post-mortem report with clinicopathological correlation and cause of death

Histology/non-cervical cytology:

- present a case with ancillary investigations (e.g. additional levels, blocks or immuno- or histo-chemical stains, review of previous samples) to a consultant trainer, indicating the relevance of the ancillary investigations
- write an appropriate report for a major cancer resection (with appropriate TNM staging and prognostic information)

Cytology:

- present and discuss a case of cervical dyskaryosis (including appropriate follow-up and clinical management)

Comment: three further CBDs in stage A may be taken from outside this list.

Stage B (18 in stage, 12 directed)**Directly Observed Practical Skills (DOPS) (four from the following):****Autopsy:**

- performing an evisceration (not including complex case, e.g. post-operative)
- dissection of single organ/system

Cut-up:

- completion of a whole cut-up session
- macroscopic description and block taking of a major cancer resection (e.g. radical prostatectomy or hysterectomy for cancer)

Microscopy:

- demonstrate ability to recognise pathological entities (e.g. ulcerative colitis, small cell carcinoma of the lung, urothelial carcinoma *in situ*)

Cytology:

- screen a gynae cytology slide and correctly grade the degree of dyskaryosis
- demonstrate the ability to recognise simple pathological entities in non-cervical cytology samples (e.g. fibroadenoma, Warthin's tumour, non-

small cell carcinoma of the lung)

Photography:

- macro or microscopic specimens

Comment: two further DOPS undertaken in stage B may be taken from outside this list.

Evaluation of Clinical Events (ECEs) (four from the following):

Histology/cytology:

- present a case with ancillary investigations to a consultant trainer

Autopsy:

- presentation to trainer or clinicians of findings (e.g. carcinomatosis, road traffic accident, gastrointestinal haemorrhage, cirrhosis)

Audit:

- present at audit meeting and lead discussion, having discussed findings with trainer beforehand

Poster presentation:

- show a poster at the Pathological Society or similar

Teaching event for medical students or demonstration of interesting case to other trainees:

- to be observed by trainer

Referral letter:

- write a draft letter on a case for referral

MDTs

- demonstrate a case that the trainee has reported at MDT or other clinicopathological meeting

Comment: two further ECEs in stage B may be taken from outside this list.

Case-Based Discussions (CBDs) (four from the following):

Autopsy:

- write an appropriate post-mortem report with clinicopathological correlation and cause of death

Histology/non-cervical cytology:

- present a case with ancillary investigations (e.g. additional levels, blocks or immuno- or histo-chemical stains, review of previous samples) to a consultant trainer, indicating the relevance of the ancillary investigations
- write an appropriate report for a major cancer resection (with appropriate TNM staging and prognostic information)

Cytology:

- present and discuss a case of cervical dyskaryosis (including appropriate follow-up, clinical management and histocytological correlation)

- present and discuss a non-cervical cytology case (with appropriate follow-up, clinical management and histocytological correlation)

Comment: two further CBDs in stage B may be taken from outside this list.

For further detail, please refer to the [Histopathology curriculum, 2010](#)

APPENDIX 3: COMPETENCES IN CLINICAL NEUROSCIENCE

Competences in Clinical Neuroscience must be acquired by trainees entering from Histopathology. Whilst these are embedded in the *Diagnostic Neuropathology* curriculum, it may be useful to list the competences separately here. They are drawn from [1] the GMC-approved curriculum for specialty training in *Neurology* and from [2] the GMC-approved curriculum for *Neurosurgery*. The competences consist mostly of the acquisition of knowledge, rather than learned skills or behaviour. This is to be expected as the skills required of a neurologist and neurosurgeon are very different to those required of a neuropathologist.

The following sections have been extracted from the *NEUROLOGY CURRICULUM* and edited for relevance to *Diagnostic Neuropathology* training. The numbering used in that document is retained for ease of cross-reference.

1.4 Differential Diagnosis, Investigation and Initial Management

Knowledge

- Knowledge of the different presentations of common and less common neurological diseases.

Skills

- Understanding of the roles and usefulness of investigations including neuroimaging and neurophysiology.
- Able to formulate an appropriately ordered differential diagnosis based on an appreciation of the patient, their past history and current problems and their likely causes. Consideration given for different racial, social & ethnic groups.
- Able to formulate a focussed and relevant series of investigations.

1.10 Clinical Pharmacology of Neurological Disorders

Knowledge

- Principles of treatment, especially for vascular disease, migraine, epilepsy, pain, psychiatric disorders, movement disorders, multiple sclerosis, autoimmune disorders, infections, dementia, motor neuron disease.

2.1 Head Injury

Knowledge

- Knowledge of symptoms and signs of head injury and its complications; indications for investigations; indications for medical interventions, ITU referral, urgent and delayed neurosurgery.

2.2 Headache

Knowledge

- Knowledge of the clinical features, differential diagnosis and specific pharmacological and general treatment of the causes of headache and facial pain.

- An understanding of the role of relevant investigations: brain scanning, urgent blood tests, lumbar puncture.

2.3 Disorders of Consciousness

Knowledge

- Knowledge of anatomy and physiology of consciousness, and the pathophysiology of disorders of consciousness; definitions, causes, pathophysiology, clinical features and prognosis of permanent vegetative state, locked in state and brainstem death.
- An understanding of the legal issues relating to disorders of consciousness.

2.4 Disorders of Sleep

Knowledge

- Knowledge of narcolepsy, daytime hypersomnolence, parasomnias, obstructive sleep apnoea, effects of neurological conditions on sleep; principles of physical and pharmacological treatment.
- An understanding of the effects of sleep on the EEG.

2.5 Disorders of Higher Function & Behaviour

Knowledge

- An understanding of memory, language, visuospatial function & behaviour; definition and epidemiology of dementia; pathology and clinical features of individual dementias; relevant investigations, specific treatments, genetic aspects, risks and costs of investigations; role of neuropsychological evaluation (inc. dementia and mood scales).

2.6 Epilepsy and Loss of Consciousness

Knowledge

- Knowledge of the differential diagnosis of paroxysmal and transient events; scope and limitations of investigations; use of anti-epileptic drugs; treatment of refractory seizures; serial seizures and status epilepticus; role of epilepsy surgery.
- Awareness of issues related to women and pregnancy and sudden death.
- Knowledge and management of other causes of loss of consciousness including syncope, drop attacks and vaso-vagal episodes.

2.7 Cerebrovascular Disease

Knowledge

- Knowledge of the cerebral circulation and its determinants; pathophysiology of cerebral infarction, cerebral haemorrhage, subarachnoid haemorrhage, cerebral venous thrombosis and vascular dementia.
- Knowledge of the epidemiology, risk factors and their management; features of stroke /transient ischaemic attack (TIA), intracranial haemorrhage and venous thrombosis; investigation and management of acute stroke (including thrombolysis) and TIA as medical emergencies; the role of medical secondary prevention and surgical interventions (e.g. hemicraniectomy, endarterectomy).

- An understanding of the role and limitation of imaging.
- Cerebral aneurysm and arteriovenous malformation (AVM); interventional, surgical and radiotherapy treatment.

2.8 Tumours of the Nervous System, Neurological Complications of Systemic Cancer, Complications of Treatment of Cancer

Knowledge

- Neuropathological classification of brain tumours; clinical features of the common tumours of the nervous system including malignant meningitis.
- Clinical features and immunology of paraneoplastic syndromes; benefits and risks of therapies including surgery and radiotherapy; neurological complications of chemotherapy and radiotherapy.
- Understanding the role of the neuro-oncology MDT.

2.9 Infections of Nervous System

Knowledge

- Principles of neurological infectious disease; clinical features of these diseases and their causes (including meningitis, encephalitis, tuberculosis, HIV, neurosyphilis).
- Diagnostic techniques and their appropriate use; anti-microbial therapies and their use; the importance of liaison with infectious disease physicians, microbiologists, public health and occupational health medicine in relation to neurological infections.
- Knowledge of prion disorders and its wider implications, such as infection control risk.

2.10 CSF Disorders

Knowledge

- CSF composition and dynamics; anatomy and radiology of the ventricular system; genesis of hydrocephalus; biochemistry and immunology of CSF; blood brain barrier; indications, techniques, and contraindications of CSF examination.
- Methods of intracranial pressure monitoring; treatments of raised intracranial pressure, management of shunts.

2.11 Demyelination & Vasculitis

Knowledge

- Biology of demyelination & vasculitis; clinical features of multiple sclerosis (MS), related demyelinating disorders and vasculitic and arteritic disorders.
- Management of specific impairments and disabilities arising in MS; role of disease modifying drugs, symptomatic treatments and therapies.
- Use of disability rating scales.

2.12 The Neurological Complications of Immunosuppression

Knowledge

- Principles of immune responses in relation to the nervous system; immunological basis underlying auto-immune neurological disease; clinical features of these diseases; diagnostic techniques and their appropriate use.
- Immunosuppressive and immunomodulatory therapies; their actions, side effects and indications.

2.13 Parkinsonism & Movement Disorders

Knowledge

- Clinical features and differential diagnosis of parkinsonism, chorea/athetosis, dystonia, tics and tremor; role of investigations in diagnosis.
- Treatment (and complications of treatment) of movement disorders; role of neurosurgical interventions.

2.14 Motor Neuron Disease

Knowledge

- Clinical features and differential diagnosis of motor neuron syndromes; disease modifying and symptomatic treatments.

2.15 Toxic & Metabolic States

Knowledge

- Biochemistry and neuropathology of exposure to alcohol and other recreational drugs (cocaine, amphetamine, opiates), heavy metals, pesticides and therapeutic agents; clinical features of alcohol, cocaine, opiate, amphetamine neurotoxicity; of heavy metal, CO, NO and organophosphate poisoning; of therapeutic agent neurotoxicity (e.g. vincristine, lithium, radiation).
- Neurological presentations of renal & hepatic failure, nutritional deficiencies and porphyria.
- Role and value of blood and urine toxicology, imaging and neurophysiology; assessment of other organ damage; clinical features and management of hyper/hypo-thermia, sodium, potassium, calcium and acid base disorders.

2.16 Disorders of the Visual System

Knowledge

- Applied anatomy and physiology of the visual and oculomotor systems; clinical evaluation of the eye and adnexae, vision (acuity, fields and higher function); clinical features and conditions which may affect these systems.

2.17 Disorders of Cranial Nerves

Knowledge

- Anatomy of the skull base, particularly the orbit, cavernous sinus, pituitary fossa, foramen magnum and jugular foramen; pathological processes involving cranial nerves and their central connections; clinical features & clinical assessment of cranial nerve function.

2.18 Disorders of Spine, Spinal Cord, Roots and Spinal Injury

Knowledge

- Anatomy of the spine, spinal cord, roots; clinical features of spinal cord, root and cauda equina syndromes; indications for urgent investigation; potential and limitations of spinal CT, MRI, myelography and spinal angiography.
- Emergency management of spinal cord or root compression, of spinal injury; management of neck and low back pain and sciatica.

2.19 Disorders of Peripheral Nerve

Knowledge

- Anatomy and pathology of peripheral nerves; clinical features & investigation of genetic and acquired axonal and demyelinating neuropathies, traumatic & entrapment neuropathies, plexopathies and mononeuritis multiplex; management of Guillain-Barré syndrome and other severe paralyzing neuropathies; general management of acute neuromuscular paralysis.

2.20 Disorders of Automatic Nervous System (ANS)

Knowledge

- Anatomy and physiology of ANS; clinical features of ANS disorders alone and as part of other condition e.g. multi-system atrophy; investigations including autonomic function tests.
- Pharmacological and physical managements of urinary retention, erectile disorder, constipation, postural hypotension, autonomic dysreflexia.

2.21 Disorders of Muscle

Knowledge

- Clinical features and investigation of genetic and acquired disorders of the neuromuscular junction and voluntary muscle including periodic disorders and disorders of energy metabolism (e.g. mitochondrial disorders).

2.22 Pain

Knowledge

- Theories of pain generation; pain patterns in neurological and systemic diseases; effective use of pharmacological agents and other measures for pain relief including nerve blocks, TNS, acupuncture and neurosurgical interventions.

3.1 Clinical Neurophysiology

Knowledge

- EEG - normal range of EEG findings; common epileptiform abnormalities; capabilities and limitations in neurological disorders; evaluation of sleep disorders.
- EMG/NCS/repetitive stimulation – principles of techniques; abnormalities in common nerve entrapments, peripheral neuropathies; motor neuron disease; disorders of neuromuscular junction; muscle disease.

- Evoked potentials - common abnormalities in neurological diseases, particularly demyelination; role of intraoperative EP.
- Understand role and practice of neurophysiological investigations in disorders of the nervous system; ability to interpret a neurophysiology report.

3.2 Neuroendocrinology

Knowledge

- Relationships with neurological disorders.
- Steroid therapy and its complications.
- Understand the principles of the NS in endocrine function and neurological features of endocrine disorder particularly pituitary disease.

3.3 Neurogenetics

Knowledge

- Basic genetic principles including inheritance patterns and common diagnostic methods; roles of a detailed family history and of DNA-based diagnostic tests.
- Genetic contribution to multifactorial neurological disease (e.g. stroke, multiple sclerosis, subarachnoid haemorrhage, epilepsy).
- Clinical features of common genetic conditions (hereditary ataxias, Huntington's disease, hereditary neuropathies, muscle diseases, and neurocutaneous syndromes).
- An understanding of the role of bioinformatic databases of human disease.
- Understand the principles of genetics as applied to neurological disorder; ability to interpret a genetics report.

3.4 Neurointensive Care

Knowledge

- Clinical features, causes, investigation and management of coma (including epilepsy and raised intracranial pressure), failure to regain consciousness and paralysis; diagnosis of and ability to define the vegetative state; management of status epilepticus; the principles of cardiovascular and respiratory support; indications for and methods of artificial nutrition.
- ICU neurological complications of major surgery, sepsis, drugs & medical disorders.
- Clinical, legal and ethical issues in brain death, coma and vegetative state.

3.5 Neuro-otology

Knowledge

- Applied anatomy and physiology of hearing and balance; history and examination techniques including vestibular manoeuvres; conditions affecting the vestibulocochlear system.

3.6 Neuropaediatrics

Knowledge

- Understanding of neurological disorders in intrauterine life and childhood; key stages of development and range of normality; knowledge of developmental disorders (including effects of intrauterine and perinatal factors on neural development), metabolic conditions, cerebral palsy, learning disability and autism.
- Knowledge of paediatric conditions that can present in adulthood.

3.8 Neuropsychiatry

Knowledge

- Understanding of common psychiatric disorders (including learning disability), neurological features which may have psychiatric causes (including medically unexplained symptoms, conversion disorder, somatisation); the mental health act and when it can be used.

3.9 Neuropsychology

Knowledge

- Understanding of neuroanatomical and neurophysiological basis of memory, attention, language and perception; understand the value and limitations of neuropsychological interventions such as Cognitive Behavioural Therapy; understand mini-mental state examination and basic neuropsychological tests employed by Clinical Psychologists, e.g. NART, WAIS.

3.10 Neuroradiology

Knowledge

- Principles of, and indications for, neuro-radiological investigations: CT scan cranial/angiography, MR scan cranial/spinal/angiography, catheter angiography diagnostic/interventional, myelography, ultrasound carotid/transcranial/cardiac, other special investigations e.g. PET, SPECT).

Skills

- Ability to evaluate neuroradiological investigations and reports; liaise effectively with the neuroradiologist; understand the role, risks and limitations of common techniques.

3.12 Neurosurgery

Knowledge

- Understand the role of neurosurgery in the management of head injury, raised intracranial pressure, intracranial haemorrhage and ischaemic stroke, aneurysm, vascular malformation and tumours, spinal cord and root disorder and peripheral nerve lesions.
- Understand the purpose, limitations, process and complications of biopsy procedures (brain, muscle, nerve).
- Understanding of the principles of general and specific risks and complications of neurosurgical interventions.

3.13 Neurourology

Knowledge

- Understand normal control of micturition and sexual function; differential diagnosis of causes of disordered micturition and erectile dysfunction; understand hypo- and hyper-sexuality; understand treatment strategies for disorders of micturition and sexual function.

The following sections have been extracted from the *NEUROSURGERY CURRICULUM* and edited for relevance to *Diagnostic Neuropathology* training. They have been selected because they highlight competences that have not already been covered in the *Neurology* section. The headings used in that document are retained for ease of cross-reference.

Embryology and maldevelopment

Knowledge

- Embryogenesis of the brain and spinal cord
- Embryogenesis of supporting structures - skull and vertebral column
- Common anatomical variations and developmental abnormalities

Anatomy of the skull

Knowledge

Structure, blood supply, innervation, surface and three-dimensional relationships of the:

- scalp
- skull
- meninges
- orbit
- cranial fossae
- cranial foraminae
- cranial nerves

Anatomy of the brain

Knowledge

- Cortical topography
- Projection and association tracts
- Organisation of the basal ganglia
- Structure, organisation and connections of the cerebellum, pons and brainstem
- Cranial nerves and their relationships

- Visual and auditory pathways
- Ventricular system and choroid plexus
- Subarachnoid space and cisterns
- Circle of Willis and principle regional and segmental blood supply
- Venous drainage and dural sinuses

Anatomy of the spine

Knowledge

Structure, blood supply, innervation, surface and three-dimensional relationships of the:

- vertebral column
- spinal cord: ascending and descending tracts
- spinal nerve roots
- cauda equina

Anatomy of the autonomic and peripheral nervous system

Knowledge

- Sympathetic and parasympathetic pathways
- Visceral and pelvic innervation: control of sphincter function
- Brachial plexus
- Lumbosacral plexus
- Course, distribution and innervation of the major peripheral nerves

Functional neurophysiology

Knowledge

- Structure and function of neurones and glial cells
- Synaptic function, action potentials and axonal conduction
- Higher cerebral functions
- Sleep and coma
- Memory and disorders of the limbic system
- Control of motor function: ascending and descending pathways, basal ganglia and cerebellar function
- The special senses
- Functions of the autonomic nervous system
- Hypothalamic-pituitary function

Pathophysiology of intracranial disorders

Knowledge

- Cerebral blood flow and metabolism
- Cerebral autoregulation and vasospasm
- Blood brain barrier and cerebral odema
- Intracranial pressure dynamics
- Cerebral ischaemia and neuroprotection
- CSF hydrodynamics - production and absorption

General management of the head injured patient

Knowledge

- Pathophysiology of head injury and of multiple trauma including an understanding of:
 - Cerebral perfusion and oxygenation
 - Raised intracranial pressure
 - Impaired intracranial compliance
 - Intracranial herniation
- Medical management of acutely raised intracranial pressure
- Indications for operation intervention including the use of pressure monitoring
- Principles of diagnosis and confirmation of brain death
- Principles of intensive care of head injured patients
- Principles of spinal stabilisation and radiological assessment in head injured patients
- Natural history of recovery from head injury including neurological, cognitive and behavioural disability and post- traumatic epilepsy

Insertion of intracranial pressure (ICP) monitor

Knowledge

- Indications for ICP monitoring
- Applied anatomy of the skull vault
- Interpretation of ICP traces
- Potential complications of the procedure

Burr hole evacuation of chronic subdural haematoma

Knowledge

- Pathophysiology of chronic subdural haematomas
- Applied anatomy of the skull vault and subdural space

- Indications for surgery
- Surgical options
- Complications of surgery
- Management of anti-platelet and anti-coagulant medication

General management of subarachnoid haemorrhage (SAH)

Knowledge

- Aetiology and pathophysiology of SAH
- WFNS grading of SAH
- Principles of management of post-haemorrhagic hydrocephalus
- Indications for endovascular and surgical intervention

Skills

- Interpretation of CT scans including assessment of intracranial blood load, haematomas and hydrocephalus
- Basic interpretation of cerebral angiography

Management of delayed secondary ischaemia

Knowledge

- Pathophysiology of delayed cerebral ischaemia including the impact of secondary insults
- Principles governing the augmentation of cerebral blood flow

Management of post-haemorrhagic hydrocephalus

Knowledge

- Pathophysiology of hydrocephalus
- Indications for external ventricular drainage and lumbar subarachnoid drainage
- Applied anatomy of the skull vault, subdural space and ventricular system
- Complications of surgery

Skill

Interpretation of CT scans

Adult hydrocephalus

Knowledge

- The pathophysiology of CSF circulation
- Applied surgical anatomy of the ventricular system

- Indications for external ventricular drainage, ventriculoperitoneal shunting, lumbar CSF drainage and shunting, ventriculo-cisternostomy
- Complications of surgery

Assessment and peri-operative management of patients with space-occupying intracranial tumours

Knowledge

- Clinical presentations of intracranial tumours
- Indications for neuroimaging
- Management of raised intracranial pressure
- Principles of operative management
- Detection and management of post-operative complications

Skill

Basic interpretation of CT and MRI scans

Image-guided biopsy of intracranial tumour

Knowledge

- Indications for biopsy of intracranial tumours
- Risks of biopsy
- Principles of image-guided surgery

APPENDIX 4: REQUIREMENTS FOR ARCP YEAR BY YEAR

Trainees are required undertake workplace-based assessment throughout their training in Diagnostic Neuropathology. In general, workplace-based assessments are designed to be formative in nature; as such they are best suited to determine educational progress in different contexts. To this end, it is strongly recommended that workplace-based assessment be carried out regularly throughout training to assess and document a trainee's progress. A minimum number of "satisfactory" workplace-based assessments should be completed during each stage of training. These include:

Case-based discussion (CbD) – minimum of 6 each year of training

- Directly observed practical skills (DOPS) – minimum of 6 each year of training
- Evaluation of clinical events (ECE) – minimum of 6 each year of training
- Multi-source feedback (MSF) – one at the end of the first year of training and another every other year thereafter.

The workplace-based assessments should be selected to provide the documentary evidence that the trainee has acquired the competences required within each particular year of training. These competences are set out in table form below:

	Know, describe and recognise:	Understand and be aware of:	Be able to do:
End of Year 1 / ST3	<ul style="list-style-type: none"> • General pathology • Gross and microscopical anatomy of general body organs and tissues • Gross & microscopical anatomy of the developed brain and spinal cord • Gross & microscopical anatomy of the developing brain and spinal cord • Principles of neurology • Principles of neurosurgery • Principles of neuroimaging 	<ul style="list-style-type: none"> • Principles & use of histochemical techniques • Principles & use of immuno-histochemical techniques • Clinical context of the diagnostic dilemma • The law regulating the removal, retention and use of human tissue • Functional neuroanatomy • Clinico-anatomical correlation • Diseases of the nervous system 	<ul style="list-style-type: none"> • Conduct a general autopsy • Conduct cut-up and sampling of biopsy specimens • Dissect a formalin-fixed brain • Remove the brain (not spinal cord) and general organs from a body at autopsy • Use a light microscope • Interpret H&E-stained sections • Diagnose basic pathological processes in a variety of diseased organs and tissues • Diagnose typical examples of common neuropathological disorders • Draft autopsy and biopsy reports
End of Year 2 / ST4	<ul style="list-style-type: none"> • Basic gross & microscopical pathology of major organs • Basic gross and microscopical neuropathology • Tumours of the nervous system & its coverings • Hypoxic & ischaemic injury of the CNS • CNS infection • Demyelinating diseases 	<ul style="list-style-type: none"> • Principles & use of molecular pathology techniques • Principles of neurological differential diagnosis 	<ul style="list-style-type: none"> • Conduct a neuropathological autopsy, including removal of the spinal cord & dorsal root ganglia • Self-assessment and audit • Improved accuracy in drafts of autopsy & biopsy reports • Present straightforward cases at multi-disciplinary meetings

	Know, describe and recognise:	Understand and be aware of:	Be able to do:
End of Year 3 / ST5	<ul style="list-style-type: none"> • Paediatric & developmental neuropathology • Lysosomal, peroxisomal & mitochondrial disorders • Traumatic neuropathology • Diseases of peripheral nerve • Diseases of skeletal muscle • Extended knowledge of systemic pathology 	<ul style="list-style-type: none"> • Principles and application of electron microscopy 	<ul style="list-style-type: none"> • Extend neuropathological autopsy to include removal of vertebral arteries, autonomic nerves • Improve the accuracy of drafts of autopsy & biopsy reports • Begin to draft reports on intra-operative biopsy specimens • Present cases that have some degree of diagnostic uncertainty at multi-disciplinary meetings • Demonstrate knowledge of <i>General and basic systemic pathology</i> by success in FRCPATH Part 1 examination in <i>Histopathology</i>
End of Year 4 / ST6	<ul style="list-style-type: none"> • Neurodegenerative diseases • Prion diseases • Pathology of epilepsy • Principles of diagnostic (non-neuro) cytopathology • Principles of laboratory management • Medical law and ethics relevant to neuropathological practice 	<ul style="list-style-type: none"> • The cellular and molecular basis of diseases of the nervous system and of skeletal muscle 	<ul style="list-style-type: none"> • Extend neuropathological autopsy to include removal of the brachial and lumbar plexuses • Improve the accuracy of intra-operative biopsies • Improve the accuracy of drafts of autopsy & biopsy reports • Demonstrate competence by success in FRCPATH Part 2 examination in <i>Diagnostic Neuropathology</i>
End of Year 5 / ST7	<ul style="list-style-type: none"> • Advanced knowledge of gross and microscopical neuropathology 		<ul style="list-style-type: none"> • CCT in <i>Diagnostic Neuropathology</i>