MODERNISING SCIENTIFIC CAREERS

Scientist Training Programme
MSc in CLINICAL SCIENCE
Curriculum
CELLULAR SCIENCE
2013/14
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READERSHIP

This Scientist Training Programme (STP) MSc Clinical Science curriculum describes the MSc Clinical Science programmes that, together with the work based learning guide, provide the details of each themed STP in the UK for:

- academic and administrative staff, including external examiners within Higher Education Institutions (HEIs);
- trainees, host departments and managers of services that employ healthcare science staff;
- work based trainers, including all those involved in supervising, mentoring, coordinating, assessing and delivering STP education and training;
- Local Education and Training Boards (LETBs) and all healthcare science education and training commissioning organisations in the UK;
- patients and the public;
- Modernising Scientific Careers (MSC) accreditation panels.

A glossary of terms used is provided in the Appendices.
Section 1: Introduction to Modernising Scientific Careers (MSC) and the Scientist Training Programme (STP)

1.1 Introduction to Modernising Scientific Careers (MSC)

1. The healthcare science (HCS) workforce plays a central role in safe and effective patient care across all pathways of care from health and wellbeing to end of life. There are approximately 55,000 employees in the healthcare science workforce in the NHS in the UK, and approximately 80% of all diagnoses can be attributed to their work.

2. Healthcare science involves the application of science, technology and engineering to health. Good Scientific Practice (GSP) [Appendix 3] sets out the principles and values on which good practice within healthcare science is founded. It makes explicit the professional standards of behaviour and practice that must be achieved and maintained by all those who work in healthcare science. GSP and the Education and Training Standards of the Health and Care Professions Council (HCPC) together form the basis for all MSC training curricula which contextualise the Standards of Proficiency set down by the HCPC in a way that is accessible to the profession and the public.

3. The healthcare science workforce and services have traditionally been grouped into three broad areas called divisions, namely: Life Sciences/Clinical Laboratory Sciences, Physical Sciences/Medical Physics and Biomedical Engineering, and Physiological Sciences/Clinical Physiology Sciences. Within each division there are a number of healthcare science specialisms. With advances in scientific technology, changes to the delivery of healthcare scientific services and the development of MSC, the boundaries between these divisions have been shifting. MSC recognises this important change and to date has identified twelve STP themes within healthcare science, which enables training across a total of 28 healthcare science specialisms, with curricula for additional specialisms still under development.

1.2 Introduction to the Scientist Training Programme (STP)

4. The STP is designed to provide healthcare scientist trainees with strong science-based, patient-centred clinical training in a specialist area of healthcare science. Initial rotational training provides a broad base of knowledge, skills and experience across a group of related cognate specialisms reflective of the evolving clinical and scientific changes and requirements followed by specialisation in a single HCS specialism. STP is a three-year pre-registration postgraduate academic (MSc Clinical Science) and work based programme.

5. Recruitment to the programme is competitive, and in England a national recruitment process is led by the National School of Healthcare Science (NSHCS). Following induction, workplace training commences with a rotational training programme in a themed group of up to four healthcare science specialisms, followed by training in a specific specialism.
6. The STP is an integrated training programme combining academic study leading to the award of a specifically commissioned MSc in Clinical Science and a work based training programme. Completion of both will lead to the award of a Certificate of Completion of the Scientist Training Programme (CCSTP) by the NSHCS. Graduates are eligible to apply to the Academy for Healthcare Science for a Certificate of Attainment and will then be eligible to apply to HCPC for registration as a Clinical Scientist.

1.3 Scientist Training Programme Outcomes: 2013/14

Graduates of the STP will possess the essential knowledge, skills, experience and attributes required of a newly qualified Clinical Scientist. STP graduates will have clinical and specialist expertise in a specific healthcare science specialism, underpinned by broader knowledge and experience within a healthcare science division or theme. They will be competent to undertake complex scientific and clinical roles, defining and choosing investigative and clinical options, and making key judgements about complex facts and clinical situations within a quality assurance framework. Many will work directly with patients and all will have an impact on patient care and outcomes. They will be involved, often in lead roles, in innovation and improvement, research and development, and/or education and training.

On completion of the STP all graduates should be able to demonstrate the following.

Professional Practice

1. Professional practice that meets the professional standards of conduct, performance and ethics defined by Good Scientific Practice and the regulator (HCPC), and is safe, lawful and effective, and within the scope of practice for the role undertaken, while maintaining fitness to practise.
2. Personal qualities that encompass communication skills, self-management, self-awareness, acting with integrity and the ability to take responsibility for self-directed learning, maintaining their own health and wellbeing, critical reflection and action planning to maintain and improve performance.
3. The ability to be an independent self-directed learner acting autonomously in a non-discriminatory manner when planning and implementing tasks at a professional level, contributing to the education and training of colleagues and providing mentoring, supervision and support as appropriate.
4. The ability to work, where appropriate, in partnership with other professionals, often as part of a multidisciplinary team, supporting staff, service users and their relatives and carers while maintaining confidentiality.
5. The ability to work with public, service users, patients and their carers as partners in their care, embracing and valuing diversity.

Scientific and Clinical Practice

6. A systematic understanding of relevant knowledge, and a critical awareness of current problems, future developments and innovation in health and healthcare science practice, much of which is at, or informed by, the forefront of their professional practice in a healthcare environment.
7. High-quality clinical and scientific practice that applies basic, core scientific knowledge, skills and experience in a healthcare setting, places the patient and the public at the centre of care, prioritising patient safety and dignity and reflecting NHS/health service values and the NHS Constitution.

8. The ability to perform quality assured appropriate diagnostic or monitoring procedures, treatment, therapy or other actions safely and skilfully, adhering to applicable legislation and in compliance with local, national and international guidelines.

9. The ability to deal with complex scientific and clinical issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences, including patients and the public.

10. The ability to define and choose investigative and scientific and/or clinical options, and make key judgements about complex facts in a range of situations.

11. Originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in healthcare and healthcare science and their specialism.

Research, Development and Innovation

12. A comprehensive understanding of the strengths, weaknesses and opportunities for further development of healthcare and healthcare science as applicable to their own clinical practice, research, audit, innovation and service development, which either directly or indirectly leads to improvements in patient experience, clinical outcomes and scientific practice.

13. Conceptual understanding and advanced scholarship in their specialism, enabling them to critically evaluate and critique current research and innovation methodologies and, where appropriate, propose new research questions and hypotheses.

Clinical Leadership

14. Scientific and clinical leadership based on the continual advancement of their knowledge, skills and understanding through the independent learning required for continuing professional development.

15. The ability to critique, analyse and solve problems, define and choose investigative and scientific and/or clinical options, and make key judgements about complex facts in a range of situations.
1.4 Overview of the MSc Clinical Science Programme

7. This document sets out the proposed structure, high-level learning outcomes and indicative content for the proposed three-year, part-time Masters in Clinical Sciences that forms part of the Scientist Training Programme (STP). The programme combines and integrates the generic professional practice learning, themed learning in a group of specialisms and individual specialist programmes.

8. Figure 1 depicts the overall structure and timing of each STP programme while Figure 2 depicts the broad framework around which all MSc Clinical Science programmes must be structured. However, each division within the Modernising Scientific Careers Programme (MSC) has interpreted and adapted this framework.

Figure 1: Modernising Scientific Careers: Scientist Training Programme (STP): Diagrammatic representation of employment-based, pre-registration, three-year NHS-commissioned education and training programme
### Figure 2: High-Level Framework for MSc Clinical Science

<table>
<thead>
<tr>
<th>Year 3 Specialist Practice</th>
<th><strong>Healthcare Science</strong></th>
<th><strong>Research Project</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Specialist Learning</td>
<td>Students would usually begin a work based research project in Year 2 and complete the project in Year 3</td>
</tr>
<tr>
<td></td>
<td>with integrated Professional Practice</td>
<td>[30]</td>
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<table>
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<tr>
<th>Year 2 Specialist Practice</th>
<th><strong>Research Methods</strong></th>
<th><strong>Healthcare Science</strong></th>
<th><strong>Research Project</strong></th>
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<tr>
<td></td>
<td>Research Methods</td>
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<td>with integrated Professional Practice</td>
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<tr>
<th>Year 1 Core Modules</th>
<th><strong>Healthcare Science</strong></th>
<th><strong>Healthcare Science</strong></th>
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<tbody>
<tr>
<td></td>
<td>Integrating science and Professional Practice</td>
<td>Integrating underpinning knowledge required for each rotational element with Professional Practice</td>
</tr>
</tbody>
</table>

| Generic Modules: Common to all divisions of healthcare science | Division/Theme-Specific Modules: Common to a division or theme | Specialist Modules: Specific to a specialism |
Section 2: Entry Routes, Award Title, Delivery, Accreditation of Prior Learning

2.1 Entry Routes

9. In England there are two routes of entry into STP. Through the **direct entry route**, the trainee will be competitively appointed. Alternatively, some STP trainees may enter into training with support of their employers through an **in-service training** route, as long as employers can demonstrate the ability to support STP training by meeting work based accreditation standards. In both cases potential STP applicants **must** participate in the national recruitment/assessment process and meet the minimum entry requirements for the academic and work based programme. For direct entry applicants, this will be a competitive process, whereas in-service trainees will be required to go through the national recruitment process to ensure that they meet the standards for entry into STP.

2.2 Progression

10. No condonement/compensation of modules and no aggregation of marks are permitted. Students must pass all modules to be eligible for the final award.

2.3 Award Titles

11. The title of the degree programme should be consistent with current MSC terminology. The award titles are:

**Life Sciences**
- MSc Clinical Science (Blood Sciences)
- MSc Clinical Science (Cellular Sciences)
- MSc Clinical Science (Genetics)
- MSc Clinical Science (Infection Sciences)

**Physical Sciences and Biomedical Engineering**
- MSc Clinical Science (Medical Physics)
- MSc Clinical Science (Clinical Engineering)
- MSc Clinical Science (Reconstructive Science)
- MSc Clinical Science (Clinical Pharmaceutical Science)

**Physiological Sciences**
- MSc Clinical Science (Cardiac, Critical Care, Vascular, Respiratory and Sleep Sciences)
- MSc Clinical Science (Gastrointestinal Physiology and Urodynamic Science)
- MSc Clinical Science (Neurosensorry Sciences)

**Across all Divisions**
- MSc Clinical Science (Clinical Bioinformatics)

In accordance with their own discretion and regulations, HEIs may be able to seek a variation in the award title to enable the specialism to be identified. This
should be raised as part of MSC Accreditation and discussed with the commissioner.

2.4 Mode of Delivery: Part-time

2.5 Relevant Quality Assurance Agency (QAA) Code(s) of Practice

12. HEIs should adhere to the current QAA Code of Practice for the Assurance of Academic Quality and Standards in Higher Education. At the time of preparing this document the QAA is in the final stages of a major review of the Code of Practice and is expected to publish 'The UK Quality Code for Higher Education'. Further details can be found on the QAA website: http://www.qaa.ac.uk/Pages/default.aspx

2.6 Awarding Body

13. While the full programme could be delivered and awarded by a single university provider, equally a collaborative partnership between a number of universities may be preferable. It would be expected that where collaborative provision is proposed a memorandum of agreement or understanding is in place. The delivery arrangements must be clearly defined, including the academic and logistical responsibilities of each partner and the financial arrangements between the university and its partner. The awarding university must satisfy itself that the partner is able to discharge its responsibilities satisfactorily and will be responsible for the quality assurance of the programme.

2.7 Accreditation of Prior Learning

14. A process for Accreditation of Prior Learning (APL) that conforms to the guidelines below must be defined by each HEI provider. This must clearly define the minimum and maximum level of APL that will be awarded, the timing, costs and process, and align to statutory requirements for healthcare science. Good practice supports the view that such prior learning should only be used once, double counting is not recommended.


2.8 Programme Delivery and Monitoring

15. The tender and subsequent MSC accreditation process will require an HEI to provide a detailed description of the content of each module and the teaching and learning and assessment strategy to demonstrate how the programme and module aims/learning outcomes will be met.
Section 3: The MSc Clinical Science Curriculum

3.1 Purpose

16. The purpose of the STP MSc curriculum is to clearly set out the expectations of graduates from the programme, including the academic skills, knowledge and understanding that each trainee will be expected to gain, develop and apply during work based training. Set within an integrated academic and work based programme the expectations of all MSc programmes should be read alongside the work based learning guides.

Additionally, the purpose is to signal the importance of providers being aware of the current structure, strategic direction and priorities of healthcare delivery in the UK, for example the NHS Constitution. The requirement to prioritise patients and their care and ensure that the patient and service provided by healthcare science is at the centre of all learning, assessment and work based practice is equally important.

3.2 Curriculum Development and Maintenance

17. Curriculum development began in 2010 and has been led by the Modernising Scientific Careers (MSC) team working with NHS and higher education colleagues and patients. Since 2012 the NSHCS has also contributed to curriculum development and maintenance via the professional leads and each of the NSHCS themed boards. Professional bodies have been represented in some curriculum working groups and have also been invited to provide feedback as the work developed, either directly or via the NSHCS themed boards.

All programmes have also been reviewed and approved by Health Education England via the Healthcare Science Professional Board Education and Training Working Group. External feedback from a review undertaken in 2012 by the Institute of Education has been incorporated into all programmes from 2013 onwards. All of the latest versions of the MSc Clinical Science programmes and work based learning guides can be found on the NHS Networks website by following the link: http://www.networks.nhs.uk/nhs-networks/msc-framework-curricula

All MSC curricula will be subject to regular review, with all stakeholders given the opportunity to contribute to each review. This process is currently being set out in an MSC long-term curriculum maintenance plan.

18. STP MSc Clinical Science programmes leading to an academic award must be aligned to current NHS policy and strategy, and at the time of writing this guide should consider the recommendations of:

- *Strategy for UK Life Sciences (December 2011)*
HEIs should ensure they keep abreast of future strategic direction and policy.

### 3.3 Tender Process and Monitoring

19. Local Education and Training Boards are responsible for the commissioning of MSc Clinical Science programmes and the quality of each programme. The lead commissioner function for MSC programmes sits within the West Midlands.

### 3.4 MSC Accreditation

20. All MSc Clinical Science programmes must hold MSC Accreditation to confirm that commissioned MSc in Clinical Science programmes delivered by an HEI meet the requirements of the MSC Scientist Training Programme outlined in *Modernising Scientific Careers: The UK Way Forward* (DH, 2010). This accreditation process is currently the responsibility of the MSC Accreditation team, with advice given by the Health Education England Healthcare Science Professional Board (HEE HCSPB) and its Education and Training Working Group (HEE HCSPB ETWG).

### 3.5 Programme Delivery

21. HEIs are expected to ensure that all teaching, learning and assessment is up to date and informed by research to ensure that at graduation, Clinical Scientists meet the Framework for Higher Education Qualifications (FHEQ) descriptor at level 7 (http://www.qaa.ac.uk/). By undertaking a substantive research project bearing 60 credits, students should become aware of the major contribution the healthcare science workforce makes to research and innovation to benefit patients and the delivery of healthcare.
22. The key principles include:

- programmes must deliver the MSC learning outcomes and indicative content, which the HEE HCSPB Education and Training Working Group has advised meets the requirements of Modernising Scientific Careers: The UK Way Forward;
- wherever possible, delivery of the principles and knowledge underpinning practice should occur before the work based learning;
- programmes must meet current NHS education quality metrics and current Health and Care Professions Council (HCPC) Standards of Education and Training;
- the NSHCS, host departments, patients and the public should be involved in the design, implementation, delivery and review;
- assessment programmes must be fair, valid and reliable, and clearly articulated for all modules, and the timing and content should consider and complement the work based assessment programme;
- a robust student support and mentoring system must be in place and arrangements to support students in difficulty agreed with the NSHCS;
- a high-quality teaching and learning environment with appropriate resources and facilities to support teaching and research;
- teaching staff who are research active with a track record of undertaking high-quality research of national and international standing that is relevant to the practice of healthcare science and the NHS;
- evidence that each MSc programme meets the equivalent of the relevant HCPC Standards of Education and Training.

23. The Professional Practice and Good Scientific Practice underpin the MSc and work based programme. Key professional practice learning outcomes are included in the MSc programme and it is important that the MSc programme embeds the standards of professionalism set out in Good Scientific Practice in all aspects of the delivery and assessment of the programme. Trainees should be encouraged to develop a range of skills to support their professional life, and continuing professional development spanning communication, leadership, personal reflection, duty of care, duty of candour, critical reflection, giving and receiving feedback, career planning, commitment to lifelong learning.

HEIs should ensure that all staff involved in each MSc programme have read and are aware of the requirements of Good Scientific Practice, a copy of which can be found in the Appendices.

3.6 Academic Induction

24. It is expected that there will be a period of academic induction at the start of each MSc programme.

3.7 Teaching and Learning
25. It is expected that a blended learning approach will be adopted, based on a model of student-centred adult learning that balances and integrates face-to-face teaching, e-learning, etc., and considers the broader requirements of each STP. It is expected that a broad range of teaching and learning activities will be utilised, appropriate to the learning outcomes. Trainees should be enabled to gain the skills necessary to manage their own learning, and to exercise initiative and personal and professional responsibility. The learning strategy matrix and pro formas outlined in ‘Liberating Learning’ describe a range of activities that may be appropriate to this MSc programme; they are likely to include:

- Advanced library study
- Case study/discussions
- Debate
- Discussion forum
- Expert briefings
- Individual tutoring
- Interactive lectures
- Personal critical reflection and action planning
- Problem-based learning
- Role play
- Student-led and tutor-led seminars
- Skills teaching
- Simulation
- Self-assessment
- Self-directed learning activities
- Team projects
- Tutor-led small group learning

26. It is also expected that e-learning and m-learning opportunities will be available to enable students to be active participants in a range of learning activities. Work based learning will also contribute to the academic educational experience of the trainees, for example seminars, journal clubs, local, national and international scientific and education meetings.

All contributors to the MSc should have up-to-date knowledge of the requirements of the programme, current healthcare science and education practice.

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2 JISC TechDis: see http://www.jisctechdis.ac.uk/technologymatters/mobilelearning for further information with respect to mobile (m) learning.
3.8 Interprofessional Learning

27. Opportunities to enable interprofessional and interdisciplinary learning, within and outside healthcare science, should be a fundamental part of each programme.

3.9 Patient and Public Involvement

28. The HEI programme team should have mechanisms in place to ensure that there is meaningful patient and public involvement in the design, delivery, development and quality assurance of each programme. It is expected that patients will be represented on course committees at all levels and contribute to teaching, learning and assessment.

Descriptions of MSc programmes need to make clear and explicit links to new models of service delivery, care and patient pathways. The delivery of high-quality, compassionate, patient-centred care should be an integral part of each degree programme, with the emphasis on the contribution of the healthcare science workforce to ensure trainees are aware that their actions have an impact on the patient and the patient’s family. The responsibility of all staff in the NHS to maximise quality and productivity and efficiency and to continually strive to improve services should be stressed. Equally important is the ability of graduates from the STP to communicate with the general public with respect to healthcare science, leading to a better educated public that is encouraged to take responsibility for its own health and wellbeing and has a greater understanding of the role that science plays in society.
Section 4: Assessment

4.1 Purpose of Assessment

29. The purpose of assessment is to enable the trainee to demonstrate that they have the requisite knowledge, skills, attitudes and beliefs to work as a Clinical Scientist and, together with the successful graduation from the work based element of the STP, that they meet the HCPC standards of education and training, professional skills, conduct performance and ethics to provide reassurance to the public.

30. The MSc Clinical Science assessment programme should support assessment for learning, and in particular:

- help clarify what good performance is (goals, criteria, standards);
- encourage ‘time and effort’ on challenging learning tasks;
- deliver high-quality feedback information that helps learners to self-correct;
- encourage positive motivational beliefs and self-esteem;
- encourage interaction and dialogue around learning (peer and teacher–student);
- facilitate the development of self-assessment and reflection in learning;
- involve students in decision making about assessment policy and practice;
- support the development of learning communities;
- integrate and complement the work based assessment programme;
- help teachers adapt teaching to student needs.

31. The HEI must have in place a clear, overarching strategic and systematic approach to assessment that fits with the curriculum and delivers assessment methods that are valid, reliable/generalisable, feasible, fair, acceptable and defensible, and is led by assessment experts. The approach to the assessment of the MSc Clinical Science should also be cognisant of and complement the work based assessment programme.

32. The assessment programme should be designed to enable the trainee to obtain regular constructive feedback on progress and achievement. It should encourage critical reflection and action planning, identifying both strengths and areas for development and improvement.

33. The approach to assessment should include and be overseen by a central coordinating leadership group or assessment-focused group who oversee, advise and scrutinise assessment across modules and years in order to build a consistent approach to assessment across the whole programme, involving module/programme leaders as appropriate. The overall assessment strategy

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3 Quality Assurance Agency Code of Practice.

should be documented in a clear and accessible manner with accountabilities clearly allocated. The strategy should also demonstrate how the approach is based on a sound understanding of the evidence base, academic literature and good practice in assessment.

4.2 **Key areas that must be covered by the Assessment Strategy include:**

- A clear statement of accountabilities, including the governance structure for assessment.
- The balance between formative and summative assessment.
- The assessment of each module, including the contribution of individual assessments and examinations within the module.
- Progression criteria.
- The range of valid, reliable and appropriate assessment techniques that will be utilised across the programme and for each module.
- The process for providing clear and timely information for students.
- How all examiners will be trained (including refresher training) and the guidelines that will be given.
- The mechanisms in place to ensure comparability of standards and to share good practice, including external examiners.
- How standard setting is undertaken.
- How student feedback will be given, including time lines.
- The arrangements for assessment of students with a disability.
- An assessment blueprint demonstrating the relationship between each assessment and the learning outcomes of the programme.
- Exemplar criteria and marking scheme, including critical reflective writing.
- The process of appointing external examiners.
- A defined role for external examiners that includes contributing to the review and development of assessment strategies and providing advice from an overarching perspective.
Section 5: Trainee Supervision, Support and Mentoring

34. The trainee supervision, support and mentoring systems will span the academic and work based elements of STP, and the relationship between the two systems must be clear to trainees, work based staff and HEI staff. The trainee supervision, support and mentoring system must be designed to encourage safe and effective practice, independent adult learning, appropriate professional conduct of the trainee and the safety of the patient. Those undertaking the role of supervisor or mentor must have relevant qualifications and experience and have undertaken appropriate and up-to-date training. The HEI will be expected to have an academic supervisory, support and mentoring scheme in place and to provide access to student support services.

**Academic supervisor(s):** Responsible, usually as part of a supervisory team, for guiding and assisting students during their period of academic study, including the research module.

**Work based education supervisor:** Responsible for monitoring, supporting and assessing the trainee on a day-to-day basis in their scientific, clinical and professional work and may take on the role of co-supervisor of the research project as part of the academic supervisory team.

5.1 **Fitness to Practise**

35. The HEI must have a clear policy with respect to Fitness to Practise, which must clearly articulate how staff and students are made aware of the policy and how the policy is implemented. Alongside this must be a clear policy on how student whistleblowers are supported. Breaches of professional practice and behaviour identified by the HEI or during HEI activities must be reported and investigated in accordance with this Fitness to Practise policy and accurate records maintained within the HEI. The NSCHCS should be informed of any issues with respect to fitness to practise and professional suitability.
Section 6: Progression, Annual Monitoring of Progress, Equality and Diversity, Curriculum Review and Updating

6.1 Progression

36. All trainees will usually be expected to complete the requirements for the MSc Clinical Science award within three years after initial registration (periods of suspension will not lead to an automatic extension of this period). This aligns with the duration of the STP and it is expected that successful STP graduates will be required to attain both an MSc in Clinical Science and certification of completion of STP work based training.

6.2 Annual Monitoring of Progress

37. The programme governance must include annual monitoring of progress that considers the outcome of the review of each module (including student and lay evaluation) and the handling and consideration of the external examiner’s report. This process should enable the programme leaders to identify and propose changes to the programme in response to feedback.

6.3 Equality and Diversity

38. All programmes should reference and be able to demonstrate evidence of adherence to the Disability Discrimination Act 1995 (DDA) which was extended to education in September 2002, following amendments introduced by the Special Educational Needs and Disability Act (SEND) 2001. Additionally evidence should be demonstrated to show adherence to the Disability Discrimination Act (2005) which includes the Disability Equality Duty and the QAA Code of Practice on Students with Disabilities should be available. All degree programmes should also include evidence of adherence to the 2010 Equality Act and any superseding legislation with respect to equality.

As part of this commitment to equality staff should be committed to inspiring and supporting all those who work, train and provide training in healthcare science to operate in a fair, open and honest manner. The approach taken is a comprehensive one and reflects all areas of diversity, recognising the value of each individual. This means that no one is treated less favourably than anybody else on the grounds of ethnic origin, nationality, age, disability, gender, sexual orientation, race or religion. This reflects not only the letter but also the spirit of equality legislation, taking into account current equality legislation and good practice.

Key legislation includes:

- Race Relations Act 1976 and the Race Relations Amendment Act (RRAA) 2000
- Disability Discrimination Act 1995 and subsequent amendments
- Human Rights Act 1998
- Employment and Equality (Sexual Orientation) Regulations 2003
- Employment and Equality (Religion or Belief) Regulations 2003
- Gender Recognition Act 2004

6.4 Curriculum Review and Updating

39. The review and updating of the doctoral level academic award curriculum will be part of the long-term MSC curriculum maintenance programme currently being developed.

If you have any feedback with respect to this programme please contact: msc.hee@nhs.net
Section 7: Relationships and Partnerships

7.1 National School of Healthcare Science

40. The NSHCS provides a national coordinating and oversight function to support trainees and host departments in the delivery of STP training. It is responsible for:

- national recruitment into STP, enabling a transparent and robust selection of the very best science graduates;
- providing national oversight of STP trainees throughout their training by managing and monitoring their progress through the Online Learning and Assessment Tool (OLAT), supporting trainees in difficulty as well as coordinating national structured assessments both during and at the end of STP training;
- evaluation of ongoing work based assessment outcomes through the OLAT, enabling the School to benchmark training programme delivery for early identification of programme issues that may need to be addressed and resolved, and reporting these as part of agreed MSC governance arrangements;
- liaising with each HEI’s MSc Clinical Science programme director to ensure the integration and coordination needed to deliver the academic and work based programmes that form the STP; liaising with MSC Strategic Health Authority (SHA) leads (and education and quality leads in the future arrangements) on local issues and problems and their resolution;
- working closely with workplace training departments and providing support as appropriate;
- organising national ‘Train the Trainer’ programmes to ensure common standards of delivery and content, and recommending ongoing training activities to support the continuing professional development of work based trainers.

41. Professional Leads in each of the scientific divisions within the NSHCS will provide help and support with respect to organising rotations and/or specialist training that might require national coordination. In order to optimise the educational benefit and value of OLAT and the e-learning Portfolio, Professional Leads will also work with and support training departments in its use.

The School can be contacted on the following email: nshcs@Westmidlands.nhs.uk and at www.nshcs.org.uk.

7.2 The Academy for Healthcare Science

41. The Academy for Healthcare Science (AHCS) provides the professional voice for the healthcare science workforce. Its functions are to:

- act as a strong and coherent professional voice;
• be able to influence and inform a range of stakeholders on all matters relating to healthcare science and scientific services;
• act as the overarching body for professional issues related to education, training and development in the UK health system including the provisions of UK wide quality assurance across education and training arrangements;
• provide the infrastructure to support the professional regulation/registration of the healthcare science workforce including:
  o establishing a system of professional accreditation of education and training programmes for the regulation/registration of the healthcare science workforce;
  o setting the professional standards for the delivery of accredited registers as required by CHRE (to be renamed the Professional Standards Authority for Health and Social Care) to ensure consistency and coherence across all MSC programmes;
  o taking the central role in the sponsorship of the voluntary registers to achieve ‘accredited’ status as set out by CHRE (to be renamed the Professional Standards Authority for Health and Social Care);
  o becoming an HPC education provider for the statutory regulation of clinical scientists;
  o establishing a system for equivalence across the whole of the healthcare science workforce.

http://www.academyforhealthcarescience.co.uk/

The following sections of this MSc Curriculum provide an overview of the STP for the specialisms within this theme. This is followed by the Generic, Division and Themed Learning Outcomes and Indicative Content, together with the high-level work based learning outcomes.
Section 8: Professional Practice

Professional practice spans the whole of the three-year training programme, underpinning both work based training and the MSc in Clinical Science and is described in the document Good Scientific Practice. This document sets out the principles and values on which good practice undertaken by the Healthcare Science workforce is founded. Wherever possible teaching should be contextualised to patients and patient care recognising that the work of all members of the healthcare science workforce have an impact on patients and their care.

*Good Scientific Practice* sets out for the profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities, the provision of care and personal conduct.

*Good Scientific Practice* uses as a benchmark the Health Professions Council (HPC) Standards of Proficiency and Standards of Conduct, Performance and Ethics, but expresses these within the context of the specialities within Healthcare Science, recognising that three groups of the workforce, Biomedical Scientists, Clinical Scientists and Hearing Aid Dispensers are regulated by the HPC. The aim is that the standards are accessible to the profession and understandable by the public.

*Good Scientific Practice* represents standards and values that apply throughout an individual’s career in healthcare science at any level of practice. The standards will be contextualised by the role within Healthcare Science that an individual undertakes. This means that the standards must be interpreted based on the role that an individual performs. For example, in supervised roles where individuals work within defined procedures, rather than autonomously, some standards will need to be interpreted appropriately for the context of the specific role. There will, however, always be a requirement for an individual to work within the limits of their scope of practice and competence.

Students and trainees will be expected to be working towards meeting the expectations set out in this document. However, if an individual is undertaking further training and development following qualification from a professional training programme, he or she will be expected to be able to meet the standards in this document within their scope of practice.

The standards have been used to support curriculum development and will be used to underpin the process of judging individual equivalence, particularly for emerging specialisms.

The standards have been divided into five domains. The domains of *Good Scientific Practice* detailed in section 2 are:

1. Professional Practice
2. Scientific Practice
3. Clinical Practice
4. Research and development
5. Clinical Leadership
Further details including the content of each domain can be found in Appendix 3.

Within the MSc Clinical Sciences (Genetic Science) key outcomes for trainees are for all modules are shown below.

<table>
<thead>
<tr>
<th>Learning Outcomes: Associated Personal Qualities and Behaviours (Professionalism)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On successful completion of this module the trainee will, in the context of clinical biochemistry:</td>
</tr>
<tr>
<td>1. Present complex ideas in simple terms in both oral and written formats.</td>
</tr>
<tr>
<td>2. Consistently operate within sphere of personal competence and level of authority.</td>
</tr>
<tr>
<td>3. Manage personal workload and objectives to achieve quality of care.</td>
</tr>
<tr>
<td>4. Actively seek accurate and validated information from all available sources.</td>
</tr>
<tr>
<td>5. Select and apply appropriate analysis or assessment techniques and tools.</td>
</tr>
<tr>
<td>6. Evaluate a wide range of data to assist with judgements and decision making.</td>
</tr>
<tr>
<td>7. Conduct a suitable range of diagnostic, investigative or monitoring procedures with due care for the safety of self and others.</td>
</tr>
<tr>
<td>8. Report problems and may take part in restorative action within quality control/assurance requirements to address threats of performance deterioration.</td>
</tr>
<tr>
<td>9. Work in partnership with colleagues, other professionals, patients and their carers to maximise patient care.</td>
</tr>
</tbody>
</table>
Section 9: MSc Clinical Science (Cellular Sciences)

9.1 Overview of STP in Genetic Science

The diagram below provides an overview of the STP each trainee in Genetic Science will follow.

Figure 1: Modernising Scientific Careers: Scientist Training Programme (STP): Diagrammatic representation of employment-based, pre-registration, three-year NHS-commissioned education and training programme

9.2 Cellular Sciences Route Map

The route map overleaf shows how the high-level framework has been interpreted for the MSc in Clinical Science (Cellular Sciences) for three specialisms, namely:

i. Histopathology
ii. Cytopathology
iii. Reproductive Sciences
MSc Clinical Sciences: Cellular Sciences Route Map

Year 1

| Introduction to Healthcare Science, Professional Practice and Clinical Leadership [20] |
| Introduction to Cellular Sciences – underpinning knowledge for rotational work based training [40] |

Year 2

| Research Methods [10] |

Year 3

EITHER: Histopathology

| Pathological Basis of Disease [10] |
| Systematic Investigation of Pathological Specimens [10] |
| Research Project [30] |
| Major Organ Histopathology excluding Cancer [10] |
| Cancer [10] |
| Specialised Histopathology [10] |
| Research Project [30] |

OR

Cytopathology

| Pathological Basis of Disease [10] |
| Systematic Investigation of Pathological Specimens [10] |
| Research Project [30] |
| Major Organ Cellular Pathology including Cancer [10] |
| Gynaecological Cytopathology [10] |
| Non-Gynaecological Cytopathology [10] |
| Research Project [30] |

OR

Reproductive Science

| Infertility, Treatment and the Role of Regulation [10] |
| Gametes and Fertilisation [10] |
| Research Project [30] |
| Culture of Gametes and Embryos [10] |
| Micromanipulation and Cryopreservation [10] |
| Embryology [10] |
| Research Project [30] |

Credits

<table>
<thead>
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<th>Generic</th>
<th>Division/Theme</th>
<th>Specialism</th>
<th>Total</th>
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</thead>
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<td>40</td>
<td>50</td>
<td>60</td>
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<tr>
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<td>60</td>
<td>60</td>
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<td>0</td>
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<td>60</td>
<td>60</td>
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</tbody>
</table>
Section 10: Generic Modules

Generic Curriculum

The generic STP MSc Clinical Science curriculum followed by all trainees comprises three modules:

- Introduction to Healthcare Science, Professional Practice and Clinical Leadership: Year 1
- Research Methods: Year 2
- Research Project: Years 2 and 3

The generic STP work based programme generic curriculum modules are:

- Professional Practice: Years 1, 2 and 3
- Elective: following completion of the rotational training programme

These modules align to Good Scientific Practice (see Appendix).

**Year 1: Generic Module**

*Introduction to Healthcare Science, Professional Practice and Clinical Leadership*  
[20 credits]

The overall aim of this introductory module is to provide all trainees with a broad knowledge and understanding of science and scientific knowledge, contextualised to the practice of healthcare science and the services provided by their healthcare science division/specialism. Central to this is the contribution of healthcare science to patient care, patient safety, service delivery, research and innovation, often at the cutting edge of science, for example genomics and bioinformatics. All members of the healthcare science workforce must understand the impact of their work on patients and patient care and remember that their work has a direct or indirect impact on patient care.

It is recognised that some of the learning within this module will not be at master's level, as allowed for in university regulations, but achievement of each learning outcome provides the building blocks for the division- and specialism-specific learning to follow, ensuring a common starting point for all trainees. While some of the learning may be at a lower level, the application of that knowledge in the divisional and specialist modules will be at master's level.

As an introductory module it is expected to provide an overview and reinforcement of key concepts with respect to the organisation, structure and function of the body, and important areas such as the psychosocial aspects of health and disease, clinical pharmacology and therapeutics, genomics and bioinformatics.
A major focus of this module is professional practice. This module will introduce and critically review the frameworks and academic literature underpinning professional practice and enable trainees to gain the knowledge, skills, experience and tools to develop, improve and maintain high standards of professional practice at all times.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

**Scientific Basis of Healthcare Science**
1. Describe the cellular, tissue and systems responses to disease and discuss those body systems and processes relative to your division/specialism.
2. Explain the main principles and core concepts of clinical genetics and genomics and discuss in the context of patients referred to services provided by your division/specialism.
3. Explain the main principles and core concepts of the sociology of health and illness and discuss those relevant to patients and the role of your division/specialism.
4. Explain the basis of epidemiology, public health and health protection and discuss in relation to patients and the safety of patients referred to services provided by your division/specialism.
5. Explain the basic principles of clinical pharmacology and therapeutics and discuss in relation to patients and the safety of patients referred to services provided by your division/specialism.
6. Explain the basic principles of physics that underpin healthcare science and discuss in relation to patients and the safety of patients referred to services provided by your division/specialism.
7. Discuss and justify how bioinformatics, including large biological datasets, contributes to patient safety, patient care and the practice of healthcare science and defend the governance and ethical frameworks within which bioinformatics can be used.

**Professional Practice**
8. Discuss and appraise the ethical foundations of professionalism, including critical reflection, and how these relate to the clinical scientist, the patient, the practice of healthcare science and the wider healthcare environment.
9. Explain and critically evaluate the structures, processes and methodologies that underpin the quality of the service provided by the NHS and quality improvement initiatives to promote high-quality patient care and enhance patient safety, and discuss the quality mechanisms relevant to your division/specialism.
10. Explain the principles of effective written and verbal communication and feedback, considering the needs and dignity of patients, the public, health professionals and scientists.
11. Describe and evaluate the basic principles and structures underpinning history taking, clinical examination and clinical decision making and discuss their role in your division.
Clinical Leadership

12. Discuss, compare and contrast a range of leadership models, including those that underpin current NHS Leadership and Competency Frameworks, and identify and critically evaluate how your personal values, principles and assumptions affect your personal leadership style.

13. Explain the current structure and management of health and social care systems and services at a national (UK-wide) and local level and the way in which the voice of patients and the public is embedded in all aspects of healthcare and healthcare education.

Learning Outcomes: Practical Skills

On successful completion of this module the trainee will:

1. Practise the skill of history taking.
2. Practise the skill of giving and receiving meaningful feedback.

Indicative Content

Review of the organisation, structure and function of the body

- Chemical, cellular and tissue level of organisation of the body
- Metabolism
- Function of blood as a tissue, blood cells (types and life times)
- Anatomy and physiology:
  - skin
  - skeletal system
  - respiratory system
    - ventilation
    - gas exchange
    - blood gas transport
  - heart, blood vessels and lymphatic system
- Central, peripheral and autonomic nervous system
- Vision, hearing and equilibrium
- GI tract, including digestion and absorption of food, the liver and liver function tests
- Renal system
- Endocrine system
- Electrolyte and acid-base balance
- Hormonal mechanisms and control
- Abdomen, pelvis and perineum, including male and female reproductive tract

Review of pathophysiology: cellular, tissue and systems responses to disease

- Review of the pathological processes underpinning common diseases:
  - cell death
  - inflammation
  - neoplasia
  - hypertrophy
  - hyperplasia
- tissue response to injury and repair

**Introduction to the main principles and core concepts of clinical genetics and genomics**
- Meiosis and Mendelian inheritance
- Nucleic acid structure and function
- Chromosome structure and function
- Nomenclature used to describe the human genome
- Common genetic disorders
- Impact of genetic disorders on the patient and their families
- Genomic technology and role of the genome in the development and treatment of disease

**Introduction to sociology of health and illness**
- Factors affecting health and their contribution to inequalities in health between populations
- Basis of health protection, including principles of surveillance
- Patients' responses to illness and treatment, including the impact of psychological and social factors including culture, on health and health-related behaviour
- Health belief models
- Diversity of the patient experience
- Disability, including learning disabilities
- Potential health inequalities
- Self-care
- Impact of life-threatening and critical conditions
- Patient involvement in decisions regarding their healthcare

**Introduction to epidemiology, public health and health protection**
- Health and disease in population terms
- The importance of population factors in individual health/disease processes
- Data interpretation, including the variability of biological data and application of statistics
- Investigating disease, epidemiology and natural history, including mathematical modelling
- Role of local, national and international bodies associated with health protection
- Principles of surveillance, the characteristics of different surveillance systems and key current policies and programmes used to protect health
- Screening programmes, including design, strengths and weaknesses

**Introduction to clinical pharmacology and therapeutics**
- Overview of the basic principles of pharmacokinetics
- Overview of the basics of drug metabolism and excretion
- Basic mechanisms and clinical importance of drug interactions

**Basic principles of physics underpinning common measurement techniques used in healthcare science**
- Structure of matter (atomic and nuclear models)
• Radiation: nature and its measurement and radiation safety
• Physics and mathematics of image formation
• Basic electricity and magnetism as it relates to the measurement of physiological signals
• Viscous and inertial flow of simple liquids

**Ethical foundations of professionalism and the patient at the centre of care**
• Defining professionalism within health and healthcare science
• Characteristics (personal traits) that impact on professionalism and professional practice in the workplace
• Ethical, legal and governance requirements arising from working at the level of the Clinical Scientist

**Critical Reflective Practice**
  o Evidence base
  o Reflection as a structure for learning
  o Frameworks that support critical reflective practice
  o Reflection to improve professional practice
  o Reflection as a model for developing deep learning
  o Reflection as a means of improving patient care, service delivery and scientific investigation

**Introduction to quality, quality improvement**
• Patient safety
• Definition of terms
• Quality management
• Quality control
• Quality assurance
• Quality improvement
• Quality methodologies
• Quality processes and procedures
• Clinical governance
• Current NHS quality management and improvement systems
• Quality assurance to protect patients and assure high-quality healthcare science services, and deliver safe and effective services

**Introduction to history taking, clinical examination**
• Importance of patient-centred care, treating patients with respect, honesty and compassion, maintaining patient dignity and confidentiality and putting the patient first
• Duty of candour and the importance of this in healthcare
• Informed consent
  o Principles, guidance and law with respect to informed consent
  o Introduction to the patient, including role of the Clinical Scientist
  o Explanation to the patient
• Structured models for presenting a patient history
• Process of patient-centred interviewing and the features of a good consultation
  o Initiating the session
  o Gathering information
Building the relationship
Explaining and planning
Closing the session
- Link between the patient history and examination and development of clinical investigation and management plans
- Shared clinical decision making
- How information from a history and examination is used to develop clinical management plans

**Introduction to communication skills**
- Principles of effective communication, including:
  - written and electronic
  - verbal
  - non-verbal
- Importance of:
  - signposting
  - listening
  - paraphrasing
  - language
  - commonly used questioning techniques
  - non-verbal behaviour
  - ideas
  - beliefs
  - concerns
  - expectations
  - summarising
  - communication
- Range of question types that can be used in a communication
- Key features of effective patient interviews and information giving
- Adapting communication methods for people/groups/culture
- Feedback
  - The role of feedback in clinical education and continuing professional development
  - Feedback models
  - Characteristics of effective feedback

**Introduction to leadership within the NHS**
- Theories and models of leadership
- Concept of shared leadership
- Associated personal qualities and behaviours that promote shared leadership
- Overview of the NHS Leadership Framework and Clinical Leadership Competency

**Introduction to the structure of the NHS**
- Structure of the NHS across the four UK countries
  - Structure
  - Accountabilities
  - Funding arrangements
  - Working relationships
• NHS Constitution
  o The seven key principles that guide the NHS in all it does
  o NHS Values
    ▪ Respect and dignity
    ▪ Commitment to quality of care
    ▪ Compassion
    ▪ Improving lives
    ▪ Working together for patients
    ▪ Everyone counts
• Quality improvement structures and processes within the NHS
• Patient safety and the requirement to protect patients from avoidable harm
• Patient focus
  o Shared decision making with patients
  o Access to information
  o Choice
  o Personalised care
  o Safeguarding patients

Year 2: Generic Module
Research Methods
[10 credits]

The overall aim of this module is to ensure that the trainee has the knowledge, skills and experience of the role of research, development and innovation in the NHS in improving patient care, including prevention, diagnostics, treatment and service delivery. On completion of this module and the research project, trainees should be able to generate ideas; assess, plan, conduct, evaluate, interpret and report research and innovation projects, which includes original research; and disseminate the findings and, where appropriate, the adoption of the findings. Trainees should also be able to use research to improve practice.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Discuss and critically evaluate the context within which research, development, innovation and audit are undertaken to improve patient care, promote innovation and improve service delivery.
2. Describe, compare and contrast a range of research methods/approaches, including cohort studies, qualitative, quantitative, systematic review, sampling techniques and clinical trials.
3. Explain and justify current UK ethical and governance frameworks and processes spanning the conduct of human and animal research, innovation and audit.
4. Critically evaluate the literature/evidence base to identify a research question and create a new approach or technique to improve patient care or service delivery.
5. Discuss and justify the research, audit and innovation process from idea generation to dissemination/implementation, including patient/user
involvement and intellectual property.
6. Describe and evaluate a range of data analysis techniques to ensure the validity, reliability and appropriateness to the research aim, design and conclusion.
7. Describe how clinical guidelines are produced and the concept of evidence-based practice, including the role of current statutory and advisory regulatory bodies.
8. Identify potential sources of research and innovation funding for healthcare science/Clinical Scientists.

Learning Outcomes: Practical Skills
On successful completion of this module the trainee will:

1. Undertake an evidence-based literature review, critically appraise the output, draw appropriate conclusions and report the findings, and where appropriate, use the findings to inform a research project.
2. Identify, discuss and critically evaluate a research, innovation or audit project that has resulted in an improvement in patient care, diagnostics or service delivery.

Indicative Content

Research methods/approaches
- Differentiation between audit and research
- Cohort studies
- Qualitative
- Quantitative
- Systematic review
- Meta-analysis
- Sampling techniques
- Clinical trials (pre-clinical to translational)
- Epidemiological studies
- Study design
- Hypothesis generation and testing

Ethical and governance research frameworks
- Good Clinical Practice (GCP)
- Human research
- Animal research
- Innovation
- Audit

Research, audit and innovation process
- Literature searching and referencing
- Innovation pathway (Invention, Evaluation, Adoption and Diffusion)
- Idea generation
- Patient/user involvement
- Peer/expert review
- Practical and financial criteria and constraints affecting research
- Dissemination/implementation
- Intellectual property
- Quality assurance
- Monitoring and reporting
- Archiving
- Roles and responsibilities of the research/innovation team

**Data analysis techniques**
- Data validity, reliability and appropriateness
- Application and interpretation of statistical techniques
- Power calculations
- Intention-to-treat analyses

**Clinical guidelines**
- Evidence-based practice
- Statutory and advisory regulatory bodies

**Research and innovation funding**
- Sources of funding including research councils and charities
- Grant applications
Section 11: Division/Theme-Specific Modules

Introduction to Cellular Sciences

This section covers the division/theme-specific module that will be studied by all trainees undertaking the Cellular Sciences STP programme.

<table>
<thead>
<tr>
<th>Division:</th>
<th>Life Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme:</td>
<td>Cellular Sciences</td>
</tr>
<tr>
<td>Years 1 and 2:</td>
<td>Introduction to Cellular Sciences [40 credits]</td>
</tr>
</tbody>
</table>

The overall aim of this module is to provide the trainee with the knowledge that underpins the rotations in the first 12 months of the Cellular Sciences STP and the common learning required within the division. The 40-credit module may conveniently be considered as three cellular specialisms-focused rotational modules plus Genetics and Molecular Science from the Genetics STP programme, each of 10 credits, although it is recognised that they may not be delivered in discrete modules.

A high-level description of the work based learning is included to provide MSc Clinical Science providers with information on how the academic and MSc elements of each STP integrate. The full work based Learning Guide can be found at:


<table>
<thead>
<tr>
<th>Division:</th>
<th>Life Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme:</td>
<td>Cellular Sciences</td>
</tr>
<tr>
<td>Year 1 and 2:</td>
<td>Introduction to Cellular Sciences [40 Credits in total]:</td>
</tr>
<tr>
<td></td>
<td>• Histopathology Rotation: HP-1: Introduction to the Principles and Practice of Histology [10 credits]</td>
</tr>
<tr>
<td></td>
<td>• Cytopathology Rotation: CP-1: Principles and Practice of Cervical Cytology and Diagnostic Cytopathology [10 credits]</td>
</tr>
<tr>
<td></td>
<td>• Reproductive Science Rotation: RS-1: Principles and Practice of Reproductive Science and Diagnostic Semen Analysis [10 credits]</td>
</tr>
<tr>
<td></td>
<td>• Genetics Rotation: CG-1: Genetics and Molecular Science [10 credits]</td>
</tr>
</tbody>
</table>

Training capacity may be an issue in Reproductive Science and Genetics. Therefore, the rotational modules in these specialisms have been designed so that trainees can complete them without having to spend a full three months in a specialist laboratory. Work based experience in areas of Histopathology and Cytopathology are relevant.

Histopathology Rotation
HP-1: Introduction to the Principles and Practice of Histology [10 credits]

This module will provide the trainee with knowledge and understanding of the principles and practice of histology as applied to clinical medicine. They will be expected to apply this knowledge and understanding in the workplace as they
use a range of histological techniques and gain experience of interpreting results from patient investigations.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Describe and recognise normal the cellular morphology of specified tissues and organs and relate these to the pathobiological processes associated with them.
2. Describe the receipt, preparation and processing of specimens for histopathological diagnosis.
3. Describe the appropriate demonstration technique as part of the diagnostic process.
4. Explain and evaluate microscopical examination techniques.
5. Describe and evaluate the application of quality assurance methodologies to histopathology.
6. Discuss the purpose and process of preparation and interpretation of clinical diagnostic reports.
7. Discuss the partnership of histopathology with other clinical specialisms in histological investigation and contribution to patient care.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Receive, prepare and process specimens for histopathological investigation. To include dissection, tissue selection cutting, fixation and staining, as appropriate.
2. Select the appropriate demonstration technique in the investigation of representative histopathology specimens.
3. Use microscopic examination techniques to investigate histopathological specimens.
4. Recognise normal cellular morphology of representative tissues and organs and common pathobiological processes associated with them.
5. Comply with quality assurance processes associated with histopathological investigations.

**Indicative Content**

- Normal cellular morphology and ultrastructure of specified tissues and organ systems, including skin, building on basic anatomy and physiology
- Introduction to tissue preparation techniques
- Specimen acquisition, viability, collection and delivery
- Principles and practice of fixation
  - Principles of specimen dissection and block selection
- Tissue processing and embedding techniques
- Pre-treatment, e.g., decalcification
- Macrophotography
- Introduction to demonstration techniques and their rationale and hazards
  - Haematoxylin and eosin
  - Special stains to identify individual tissue/cellular components, e.g., connective tissues, nucleic acids, mucins, lipids, pigments
  - Histochemical techniques
  - Immunocytochemistry
  - Molecular diagnostics
  - Electron microscopy
- Microscopy principles and practice
  - Microtomy, cryotomy, ultramicrotomy
- Quality assurance
  - Artefacts
- Basic principles of pathobiology, to include inflammation, fibrosis, necrosis, hypertrophy, hyperplasia, atrophy, metaplasia and apoptosis

**Cytopathology Rotation**

**CP-1: Principles and Practice of Cervical Cytology and Diagnostic Cytopathology**

[10 credits]

This module will provide the trainee with knowledge and understanding of cervical cytology and an overview of the role and limitations of diagnostic cytopathology. They will apply and relate this knowledge as they learn to recognise normal cells in cervical cytology preparations. They will also gain and apply knowledge of the cervical screening programme, the role of fine needle aspiration cytology and non-gynaecological cytology preparation techniques.

<table>
<thead>
<tr>
<th>Learning Outcomes: Knowledge and Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>On successful completion of this module the trainee will:</td>
</tr>
<tr>
<td>1. Explain the physiology and pathophysiology of the female reproductive tract.</td>
</tr>
<tr>
<td>2. Describe the appearance of normal and relate this to abnormal cellular patterns in cervical cytology.</td>
</tr>
<tr>
<td>3. Discuss and evaluate the organisation and delivery of current cervical screening programmes.</td>
</tr>
<tr>
<td>4. Describe relevant techniques for non-gynaecological cytology samples.</td>
</tr>
<tr>
<td>5. Describe and evaluate the application of quality assurance methodologies to cytopathology.</td>
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<td>6. Discuss the purpose and process of preparation and interpretation of clinical diagnostic reports.</td>
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<td>7. Describe the partnership of cytopathology to other clinical specialisms in cytological investigation and contribution to patient care.</td>
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<tr>
<th>Learning Outcomes: Associated Work Based Learning</th>
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</table>
High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Receive, prepare and process specimens for cytopathological investigation.
2. Select appropriate methods for preparation, fixation and staining.
3. Use microscopic examination techniques on a selection of cytopathology samples.
4. Recognise the appearance of normal and abnormal cellular patterns in Cervical Cytology.

Indicative Content
- Overview of the cervical screening programme, including aetiology, principles of screening, coverage, and call and recall and failsafe
- Understanding of the role and impact of Human Papilloma virus (HPV) vaccination and testing on the cervical screening programme
- Principles of quality assurance, including internal quality control (IQC), external quality assessment (EQA) and audit
- The anatomy and physiology of the female reproductive tract
- Cell patterns of normal and abnormal cervical cytology samples
- Basic understanding of the use of information technology (IT) systems in cytology laboratories and the interface with laboratory computer systems
- Treatment options for cervical intra-epithelial neoplasia (CIN) and cervical cancer
- Principles of liquid-based cytology and imaging technologies
- The roles of staff in a cytology department: pathologists, biomedical scientists, consultant biomedical scientists (advanced practitioners), ‘checkers’, medical laboratory assistants and cytology screeners
- Principles of non-gynaecological cytology preparation techniques
- The advantages and limitations of fine needle aspiration (FNA) cytology in the diagnosis of benign conditions and malignant disease
- The role of immunocytochemistry and molecular techniques in gynaecological and non-gynaecological cytology

Reproductive Science Rotation
RS-1: Principles and Practice of Reproductive Science and Diagnostic Semen Analysis
[10 credits]

This module will provide the trainee with knowledge and understanding of the normal physiology of the male and female reproductive tracts. They will apply this knowledge as they learn to perform a range of techniques and interpret results from diagnostic semen analysis. They will also gain knowledge of current legislation and regulations.
Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Describe male and female reproductive anatomy.
2. Describe male and female reproductive physiology.
3. Explain and evaluate current legislation and regulation as it relates to reproductive science.
4. Describe relevant techniques for semen analysis and preparation.
5. Describe and evaluate the application of quality assurance methodologies to reproductive science.
6. Discuss the purpose and process of preparation and interpretation of clinical diagnostic reports.
7. Describe the partnership of reproductive science with other clinical specialisms and contribution to patient care.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Apply and interpret quality assurance methodologies in reproductive science.
2. Apply health and safety methodologies and practices appropriate to the reproductive science laboratory.
3. Perform to accepted standard relevant techniques for semen analysis and preparation.
4. Prepare, interpret and report on diagnostic semen analysis (under supervision).
5. Work in partnership with the reproductive science laboratory and other clinical specialisms in the investigation of infertility.

Indicative Content

- Overview of sexual differentiation, including differentiation of the fetal testes and ovary, and the endocrinology and embryology of sexual differentiation
- The anatomy and physiology of the male reproductive tract
- The anatomy and physiology of the female reproductive tract
- Hormonal control of female reproduction, including the menstrual cycle, follicle growth, autocrine and paracrine factors regulating follicle growth, follicular fluid, ovulation, corpus luteum
- Hormonal control of male reproduction
- Basic understanding of the regulatory mechanisms associated with human assisted reproductive therapy (ART)
The roles of ART centre staff: clinicians, scientists, clinical embryologists, nurses, counsellors
- Principles of and standards for diagnostic semen analysis
- Characteristics of normal and abnormal semen samples
- Semen preparation, including different methodologies, diagnostic tests and functional tests

### Genetics Rotation
**CG-1: Genetics and Molecular Science**

[10 credits]

This module will provide the trainee with an introduction to human genetics and molecular science. They will understand the organisation and delivery of a genetics laboratory service. They will perform some common methods used in genetics and gain an understanding of the interpretation of patient results in a variety of clinical settings.

### Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Explain nucleic acid structure and function and chromosome structure and function.
2. Explain and apply the nomenclature used to describe the human genome.
3. Discuss patterns of inheritance.
4. Describe and evaluate the design, operation and performance of methods used in the investigation of chromosomal abnormality.
5. Describe and evaluate the design, operation and performance of methods used to investigate the molecular basis of disease.
6. Describe the partnership of genetics to other clinical specialisms in the investigation and management of genetic disorders and the contribution to patient care.

### Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will

1. Assist with the investigation of chromosomal abnormality, the correct sampling technique and the use of the International System for Chromosome Nomenclature (ISCN).
2. Play a supporting role in cell culture, slide making and G-band staining techniques used in the investigation of chromosome anomalies.
3. Assist with the investigation of the molecular basis of disease, the correct sampling technique and relevant quality parameters.
4. Perform DNA extraction technique, polymerase chain reactions (PCRs) and observe sequencing reactions used in the investigation of the molecular basis of disease.

5. Apply the principles of internal quality control and external quality assessment and draw conclusions about assay performance.

6. Assist with the interpretation and reporting of laboratory results in the context of named genetic disorders.

7. Participate in activities that involve working in partnership with other clinical specialisms in the investigation of genetic disorders.

Indicative Content

- Cell biology, meiosis and mitosis, chromosome segregation
- Chromosome structure and function
- Mechanisms of origin of numerical and structural abnormalities, and behaviour of structural chromosome anomalies at meiosis
- Nucleic acid structure and function, chemical structure of DNA and replication, transcription and translation
- Patterns of inheritance – autosomal dominant and recessive, X-linked
- Introduction to the human genome
- Understanding of current Human Genome Variation Society (HGVS) and International System for Human Cytogenetic Nomenclature (ISCN) nomenclature
- Introduction to the molecular basis of disease
- Molecular science methodology
- Laboratory techniques and application of new cytogenetic tests, e.g. fluorescence in-situ hybridisation (FISH), comparative genomic hybridisation (CGH)
- DNA extraction, polymerase chain reaction (PCR), DNA sequencing, Southern blotting
- RNA extraction, reverse transcription PCR (RT-PCR)
- Application of DNA-based testing for gene mapping, linkage and mutation detection
- Sensitivity and specificity of molecular scientific tests
- Potential application of new DNA tests
- Plasma DNA and RNA
### Section 12: MSc Clinical Science Specialist Modules for Cytopathology

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<th>Specialist Modules</th>
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<td>Major Organ Cellular Pathology including Cancer</td>
<td>[10] Major Organ Cellular Pathology including Cancer</td>
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<td>Gynaecological Cytopathology</td>
<td>[10] Gynaecological Cytopathology</td>
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<td>Non-Gynaecological Cytopathology</td>
<td>[10] Non-Gynaecological Cytopathology</td>
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<th>Year 2</th>
<th>Specialist Modules</th>
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<td></td>
<td>Research Methods</td>
<td>[10] Research Methods</td>
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<td>Pathological Basis of Disease</td>
<td>[10] Pathological Basis of Disease</td>
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<td>Systematic Investigation of Pathological Specimen</td>
<td>[10] Systematic Investigation of Pathological Specimen</td>
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<th>Year 1</th>
<th>Core Modules</th>
<th>Module Titles</th>
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<td></td>
<td>Introduction to Cellular Sciences Underpinning knowledge for rotational elements and integrated professional practice</td>
<td>[40] Introduction to Cellular Sciences Underpinning knowledge for rotational elements and integrated professional practice</td>
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**Color Key:**
- Blue: Generic Modules: Common to all divisions of healthcare science
- Yellow: Division/Theme-Specific Modules: Common to a division or theme
- Orange: Specialist Modules: Specific to a specialism
This module will provide the trainee with knowledge and understanding of the pathological basis of disease and the use of histopathology and cytopathology to detect and diagnose disease. They will apply a range of techniques to case studies in clinical practice and gain experience of interpreting results from patient investigations.

This module is also part of histopathology specialist training. The module may be delivered as a combined module or as separate modules with appropriate clinical context.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Describe the mechanisms and microscopic appearances of inflammatory disease.
2. Describe the mechanisms and microscopic appearances of cell proliferation, growth and death.
3. Describe the mechanisms and microscopic appearances of infectious disease.
4. Describe the mechanisms and microscopic appearances of the immune response and immunological disease.
5. Describe the mechanisms and microscopic appearances of tissue and cell injury, wound healing and repair.
6. Describe the mechanisms and microscopic appearances of local and metastatic tumour spread.
7. Discuss the partnership between histopathology and cytopathology laboratories and other clinical specialisms as part of the diagnosis and review of individual cases and patient care.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Recognise and interpret the microscopical appearance of the tissue or cell and relate to the pathobiological process.
2. Determine adequacy of samples taken by clinicians.
3. Determine adequacy of margins of excision or clearance where applicable.
4. Advise on or request appropriate additional tests to aid in the diagnosis of disease.
5. Recognise carcinoma and local and metastatic tumour spread in microscopic specimens.
6. Under supervision, prepare preliminary reports based on using interpretive and diagnostic skills.
7. Work in partnership with other clinical specialisms as part of the diagnosis and review of individual cases.

**Indicative Content**
- General principles of different pathological processes at the macroscopic, microscopic and molecular level
- Normal appearance of a variety of tissues, including endocrine, renal, gastrointestinal, respiratory, cardiovascular, male and female genital tract, central and peripheral nervous systems, and the urinary and lymphatic systems
- An understanding of pathological processes such as oncogenesis, carcinogenesis, inflammation, embolism, infarction, ischaemia, congestion, oedema and hypertension
- Epidemiology of common named pathologies associated with the tissues studied
- Principles of infectious diseases and the immune response to infection
- An appreciation of the relationship between cytopathological diagnosis, histopathological diagnosis and clinical outcomes

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Cytopathology  
**Year 2:** CP-3  
**Systematic Investigation of Pathological Specimens**  
[10 credits]

This module will provide the trainee with knowledge and understanding of the systematic investigation of pathological specimens as part of the clinical investigation of patients. They will understand and apply a range of techniques to several clinical disorders and gain experience of interpreting results from patient investigations.

This module is also part of histopathology specialist training. The module may be delivered as a combined module or as separate modules with appropriate clinical context.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:
1. Describe a wide range of invasive and non-invasive surgical procedures, and their relationship to the collection of histopathology and cytopathology specimens.
2. Describe appropriate investigations for named clinical conditions.
3. Describe and develop investigations that contribute to the treatment and monitoring of disease.
4. Describe the limitations of a variety of investigative techniques in the diagnostic process.
5. Describe the sensitivity and specificity of a variety of investigative techniques in named clinical conditions.
6. Discuss and interpret the outcomes of a variety of investigative techniques in named clinical conditions.
7. Discuss and justify the importance of laboratory and clinical evaluation of new equipment and methods for histopathology and cytopathology.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Participate in the collection of a range of histopathology and cytopathology clinical specimens.
2. Perform investigations for the diagnosis, treatment and monitoring of named clinical conditions.
3. Evaluate and communicate the limitations of a range of investigative techniques in named clinical conditions.
4. Determine and give clinical advice on the sensitivity and specificity of investigative techniques in named clinical conditions.
5. Under supervision, prepare and interpret reports that involve a range of histological and cytological techniques as part of the systematic investigation of named clinical conditions.
6. Work in partnership with other clinical specialisms as part of the diagnosis and review of individual cases.

**Indicative Content**

- Application of a wide range of invasive and non-invasive surgical procedures, and their relationship to histopathology and cytopathology specimens, e.g. smears, aspirates, biopsies, excisions, resections
- Awareness of the relationship between imaging and the histological or cytological sample, e.g. ultrasound to identify the specific sample site
- Use of standard operating procedures (SOPs) applied to the systematic investigation of a disease process in a specific tissue type
- Application of a range of sampling and staining techniques and using them in a systematic way, according to protocols designed for that tissue type and ensuring quality control procedures are in place
• An appreciation of how accurate and timely histopathological and cytopathological diagnosis and reporting is essential in shaping the treatment and management of the patient. To include supplementary reporting when results of immunocytochemistry or molecular techniques become available
• Current legislation relating to the retention of tissues and organs
• Evaluation of new methods and techniques for processing tissue and for the investigation of tissue and cell preparations
• Cells in each sample type e.g. cervical samples, urine cytology and serous effusions
• Human Tissue Authority Regulations relating to the retention of tissues and organs
• Quality management of laboratory operations
• Evaluation of new methods and techniques for processing tissue and for the investigation of tissue and cell preparations

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Cytopathology
Years 2 and 3: CP-Res
Research Project in Cytopathology [60 credits]

The overall aim of this module, building on the Research Methods module, is for the trainee to undertake a research project that shows originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in a specialism of healthcare science. The research project may span scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement or supporting professional service users to meet the expected learning outcomes. Research projects should be designed to take into account the research training required by individual trainees and the needs of the department in which the research is to be conducted.

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<th>Learning Outcomes: Knowledge and Understanding</th>
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On successful completion of this module the trainee will:

1. Discuss the stages of the research and innovation process from conceptualisation to dissemination and, if appropriate, translation into practice.
2. Describe the purpose and importance of different kinds of research, including scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement and supporting professional service users, and relate these to the roles undertaken by Clinical Scientists in the trainee’s specialism.
3. Discuss and evaluate the use of reference manager systems.
4. Justify the rationale for research governance and ethical frameworks when undertaking research or innovation in the NHS.
5. Describe the process and requirements for publication in a peer-reviewed journal and the current system of grading research publications.

### Learning Outcomes: Practical Skills

On successful completion of this module the trainee will:

1. Design, plan and undertake a research project to test a hypothesis from conception to completion/archiving in accordance with ethical and research governance regulations, drawing on expert advice where necessary and involving patients and service users.
2. Analyse the data using appropriate methods and statistical techniques, and interpret, critically discuss and draw conclusions from the data.
3. Prepare a written project that describes and critically evaluates the research project, clearly identifying the strengths and weaknesses.
4. Present a summary of the research project and outcome that conforms to the format of a typical scientific presentation at a national or international scientific meeting, responding to questions appropriately.
5. Prepare a summary of the research project suitable for non-specialist and lay audiences.

### Indicative Content
- Critical evaluation of the literature/evidence base
- Reference management
- Identification of a research question
- Research ethics and regulatory requirements, including issues related to access and use of information
- Data protection and confidentiality guidelines
- Patient safety
- Patient consent
- Sources of funding/grants
- Peer review/expert advice
- Possible risks and balancing risk vs benefit
- Project management techniques and tools
- Roles and responsibilities of those involved in the research
- Monitoring and reporting
- Data analysis
- Data interpretation
- Criteria/metric for assessing and grading research data and publications in the scientific, NHS and HE sectors
- Range of formats and modes of presentation of data
- Requirements for publications submitted to scientific, education and similar journals
- Current conventions with respect to bibliography and referencing of information

**Division:** Life Sciences  
**Theme:** Cellular Sciences
This module will provide the trainee with knowledge and understanding of the cellular structure and function of the major organs and the cellular pathological findings in a range of clinical disorders, including cancer. They will understand and apply a range of techniques to these clinical disorders and gain experience of interpreting results from patient investigations.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Describe the structure and function of the major organ groups in the human body and their interaction with each other.
2. Discuss the pathophysiology and clinical presentation of common disorders of major organs and common cancers.
3. Explain the processes of tumour growth, angiogenesis, apoptosis and metastasis.
4. Describe and evaluate the application of established cellular pathology techniques to a range of named disorders of the major organs and cancers.
5. Discuss and justify the ethical and legislative processes associated with the investigation of major organ disease and cancer.
6. Discuss the role of the cellular pathology report as part of the decision-making process in guiding diagnosis, management and clinical outcomes in major organ disease and cancer.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Identify and confirm the clinical presentation of a range of major organ diseases and commonly occurring forms of cancer.
2. Perform to quality standards a range of established cellular pathology techniques to named disorders of the major organs and commonly occurring forms of cancer.
3. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the cellular pathology laboratory to the diagnosis and management of major organ disease and commonly occurring forms of cancer.
4. Under supervision, prepare and interpret reports that involve cellular pathology findings as part of the investigation of major organ disease.
5. Work in partnership with other clinical specialisms as part of the diagnosis and review of named clinical diseases of major organs and commonly occurring forms of cancer.

Indicative Content

- Aetiology, pathogenesis and main clinical features of common non-malignant and malignant diseases encountered in cellular pathology and their impact on patient management, including:
  - dermatopathology, e.g. non-malignant and malignant skin lesions
  - breast pathology, e.g. adenomas, fibrocystic change, cancer
  - hepatobiliary pathology, e.g. cirrhosis, cholecystitis, cancer
  - gastrointestinal pathology, e.g. diverticulitis, polyposis, inflammatory bowel disease, cancer
  - genitourinary pathology, e.g. prostatic hyperplasia, cancer
  - cardiac and vascular pathology, e.g. ischaemic heart disease
  - respiratory pathology, e.g. chronic obstructive pulmonary disease (COPD), fibrosis, cancer

- Principles of the initiation and mechanisms of malignant growth and metastasis, including:
  - genetic deregulation and the role of proto-oncogenes and oncogenic viruses
  - the role of telomerase activation in tumourgenesis
  - cell proliferation
  - signalling pathways
  - apoptosis
  - the role of hormones
  - angiogenesis

- Application of a wide range of histological, immunocytochemical and molecular techniques to the demonstration of the disease processes

- The role of prognostic and predictive markers (e.g. oestrogen receptor, human epidermal growth factor receptor 2 [HER-2]) in the grading of tumours and monitoring the spread of disease

- Ethical and regulatory issues

- New developments in equipment, methods and procedures used in the laboratory investigation of major organ disease and cancer

- The importance of the histopathology report in assisting diagnosis, management and clinical outcomes

- Multidisciplinary team meetings

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Cytopathology
Year 3: CP-5
Gynaecological Cytopathology [10 credits]
This module will provide the trainee with knowledge and understanding of the aetiology, pathogenesis and main clinical features of cervical and other gynaecological cancers. They will understand and gain experience of the role of the cervical cytology laboratory in the diagnosis of gynaecological malignancy.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Explain the aetiology, pathogenesis and main clinical features of cervical cancer.
2. Discuss and evaluate the role of the cervical cytology laboratory in the prevention of cervical cancer.
3. Describe the national screening programme for cervical cancer.
4. Explain the aetiology, pathogenesis and main clinical features of endometrial cancer.
5. Discuss and evaluate the role of the cytology laboratory in the diagnosis of non-cervical malignancies.
6. Explain and critically evaluate the importance of new technologies, automation and ancillary techniques in cervical cancer screening and the investigation of other gynaecological cancers.
7. Discuss the role of the cytopathological report and the multidisciplinary team in the management of gynaecological cancer and patient care.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Recognise and interpret the microscopical appearance of cells and relate to the pathobiological process.
2. Recognise the clinical presentation of a range of gynaecological malignancies.
3. Screen and interpret cervical cytology samples to quality standards.
4. Advise on or request appropriate additional tests to aid in the diagnosis of disease.
5. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the cytopathology laboratory to the prevention, diagnosis and management of gynaecological malignancies.
6. Analyse national and international data on the incidence, screening, diagnosis, management and survival of gynaecological malignancies.
7. Draft interpretative reports that involve cytopathological findings as part of the investigation of gynaecological malignancies.
8. Work in partnership with other clinical specialisms as part of the diagnosis and review of gynaecological malignancies.

**Indicative Content**

- Aetiology, pathogenesis and main clinical features of cervical cancer
  - The role of HPV in cervical carcinogenesis
  - The role of HPV vaccination
  - The role of HPV testing in the UK screening programmes
  - The role of colposcopy in the diagnosis of CIN, cervical glandular intra-epithelial neoplasia (CGIN) and cervical cancer
- The role of the cervical cytology laboratory in the prevention of cervical cancer
  - Primary screening
  - Internal quality control
  - Patient management
  - Performance monitoring of individuals, laboratories and screening programmes
  - Quality assurance
  - Invasive cancer audit
  - Cytology: biopsy correlation
  - Role of the hospital-based programme coordinator
  - Management of the cervical cytology laboratory
- The role of the cytology laboratory in the reporting of microorganisms
- Treatment of CIN, CGIN and cervical cancer
- Aetiology, pathogenesis and main clinical features of endometrial cancer
- The role of the cervical cytology laboratory in the diagnosis of non-cervical malignancies
  - Endometrial carcinoma
  - Ovarian carcinoma
  - Extra-uterine malignancies
- New technologies, automation and ancillary techniques in cervical screening

**Division:**  Life Sciences  
**Theme:**  Cellular Sciences  
**Specialism:**  Cytopathology  
**Year 3:**  CP-6  
**Non-Gynaecological Cytopathology**  
[10 credits]

This module will provide the trainee with knowledge and understanding of the aetiology, pathogenesis and main clinical features of relevant non-gynaecological cancers. They will understand and gain experience of the role of the cytology laboratory in the diagnosis of non-gynaecological malignancy.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:
1. Explain the aetiology, pathogenesis and main clinical features of cancer of the respiratory tract, urinary tract, serous cavities, thyroid gland, salivary glands and lymph nodes.
2. Discuss and justify the applications of non-gynaecological cytology sampling techniques.
3. Discuss the application of specialised techniques to cytology samples.
4. Critically evaluate specialised techniques currently under development that may play a future role in cellular pathology.
5. Discuss and gain experience of the cytopathological report and the multidisciplinary team in the management of non-gynaecological cancer and patient care.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Recognise and interpret the microscopical appearance of cells and relate to the pathobiological process.
2. Recognise the clinical presentation of cancers detected by non-gynaecological cytopathology.
3. Perform to internal quality standards a range of established cytopathological techniques used in non-gynaecological cytopathology. Advise on or request appropriate additional tests to aid in the diagnosis of disease.
4. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the cytopathology laboratory to the diagnosis and management of non-gynaecological malignancies.
5. Draft interpretative reports that involve cytopathological findings as part of the investigation of non-gynaecological malignancies.
6. Work in partnership with other clinical specialisms as part of the diagnosis and review of non-gynaecological malignancies.
7. Analyse national and international data on the incidence, diagnosis, management and survival of malignancies detected by non-gynaecological cytopathology.

Indicative Content

- Aetiology, pathogenesis and main clinical features of cancer in the following areas:
  - respiratory tract
  - urinary tract
  - serous cavities
  - thyroid gland
  - salivary glands
- lymph nodes

- Applications of non-gynaecological cytology sampling techniques, including:
  - exfoliative techniques
  - aspiration techniques
  - application of specialised techniques to a variety of cytology samples
  - immunocytochemistry
  - Immunofluorescence
  - fluorescence in-situ hybridisation
  - molecular techniques, e.g. PCR
  - electron microscopy
  - image analysis
  - quantitation
  - molecular databases
  - flow cytometry

- Critical evaluation of specialised techniques currently under development that may play a future role in cellular pathology
### Section 13: MSc Clinical Science Specialist Modules for Histopathology

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<td>Year 1 Core Modules</td>
<td>Introduction to Healthcare Science, Professional Practice and Clinical Leadership [20]</td>
<td>Introduction to Cellular Sciences Underpinning knowledge for rotational elements and integrated professional practice [40]</td>
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**Legend:**
- **Orange**: Generic Modules: Common to all divisions of healthcare science
- **Blue**: Division/Theme-Specific Modules: Common to a division or theme
- **Yellow**: Specialist Modules: Specific to a specialism
This module provides the trainee with the knowledge that underpins the specialist module in histopathology. They will be expected to apply this knowledge and understanding during workplace learning.

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Histopathology  
**Year 2:** HP-2  
**Pathological Basis of Disease**  
[10 credits]

This module will provide the trainee with knowledge and understanding of the pathological basis of disease and the use of histopathology and cytopathology to detect and diagnose disease. They will apply a range of techniques to case studies in clinical practice and gain experience of interpreting results from patient investigations.

This module is also part of cytopathology specialist training. The module may be delivered as a combined module or as separate modules with appropriate clinical context.

### Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Describe the mechanisms and microscopic appearances of inflammatory disease.
2. Describe the mechanisms and microscopic appearances of cell proliferation, growth and death.
3. Describe the mechanisms and microscopic appearances of infectious disease.
4. Describe the mechanisms and microscopic appearances of the immune response and immunological disease.
5. Describe the mechanisms and microscopic appearances of tissue and cell injury, wound healing and repair.
6. Describe the mechanisms and microscopic appearances of local and metastatic tumour spread.
7. Discuss the partnership between histopathology and cytopathology laboratories and other clinical specialisms as part of the diagnosis and review of individual cases and the contribution to patient care.

### Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:
1. Recognise and interpret the microscopical appearance of the tissue or cell and relate to the pathobiological process.
2. Determine adequacy of samples taken by clinicians.
3. Determine adequacy of margins of excision or clearance, where applicable.
4. Advise on or request appropriate additional tests to aid in the diagnosis of disease.
5. Recognise carcinoma and local and metastatic tumour spread in microscopic specimens.
6. Under supervision, prepare preliminary reports based on using interpretive and diagnostic skills.
7. Work in partnership with other clinical specialisms as part of the diagnosis and review of individual cases.

### Indicative Content
- General principles of different pathological processes at the macroscopic, microscopic and molecular level
- Normal appearance of a variety of tissues, including endocrine, renal, gastrointestinal, respiratory, cardiovascular, male and female genital tract, central and peripheral nervous systems, and the urinary and lymphatic systems
- An understanding of pathological processes such as oncogenesis, carcinogenesis, inflammation, embolism, infarction, ischaemia, congestion, oedema and hypertension
- Epidemiology of common named pathologies associated with the tissues studied
- Principles of infectious diseases and the immune response to infection
- An appreciation of the relationship between cytopathological diagnosis, histopathological diagnosis and clinical outcomes

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Histopathology  
**Year 2:** HP-3  
**Systematic Investigation of Pathological Specimens**  
[10 credits]

This module will provide the trainee with knowledge and understanding of the systematic investigation of pathological specimens as part of the clinical investigation of patients. They will understand and apply a range of techniques to several clinical disorders and gain experience of interpreting results from patient investigations.

This module is also part of cytopathology specialist training. The module may be delivered as a combined module or as separate modules with appropriate clinical context.

**Learning Outcomes: Knowledge and Understanding**
On successful completion of this module the trainee will:

1. Describe a wide range of invasive and non-invasive surgical procedures, and their relationship to the collection of histopathology and cytopathology specimens.
2. Discuss and justify the choice of appropriate investigations for named clinical conditions.
3. Describe and develop investigations that contribute to the treatment and monitoring of disease.
4. Describe and evaluate the limitations of a variety of investigative techniques in the diagnostic process.
5. Discuss the sensitivity and specificity of a variety of investigative techniques in named clinical conditions.
6. Discuss and interpret the outcomes of a variety of investigative techniques in named clinical conditions.
7. Discuss the importance of laboratory and clinical evaluation of new equipment and methods for histopathology and cytopathology.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Participate in the collection of a range of histopathology and cytopathology clinical specimens.
2. Perform investigations for the diagnosis, treatment and monitoring of named clinical conditions.
3. Evaluate and communicate the limitations of a range of investigative techniques in named clinical conditions.
4. Determine and give clinical advice on the sensitivity and specificity of investigative techniques in named clinical conditions.
5. Under supervision prepare and interpret reports that involve a range of histological and cytological techniques as part of the systematic investigation of named clinical conditions.
6. Work in partnership with other clinical specialisms as part of the diagnosis and review of individual cases.

**Indicative Content**

- Application of a wide range of invasive and non-invasive surgical procedures, and their relationship to histopathology and cytopathology specimens, e.g. smears, aspirates, biopsies, excisions, resections
- Awareness of the relationship between imaging and the histological or cytological sample, e.g. ultrasound to identify the specific sample site
- Use of standard operating procedures (SOPs) applied to the systematic investigation of a disease process in a specific tissue type
• Application of a range of sampling and staining techniques and using them in a systematic way, according to protocols designed for that tissue type, and ensuring quality control procedures are in place
• An appreciation of how an accurate and timely histopathological and cytopathological diagnosis and reporting is essential in shaping the treatment and management of the patient. To include supplementary reporting when results of immunocytochemistry or molecular techniques become available
• Current legislation relating to the retention of tissues and organs
• Evaluation of new methods and techniques for processing tissue and for the investigation of tissue and cell preparations

The overall aim of this module, building on the Research Methods module, is for the trainee to undertake a research project that shows originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in a specialism of healthcare science. The research project may span scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement, or supporting professional service users to meet the expected learning outcomes. Research projects should be designed to take into account the research training required by individual trainees and the needs of the department in which the research is to be conducted.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Discuss the stages of the research and innovation process from conceptualisation to dissemination and, if appropriate, translation into practice.
2. Describe the purpose and importance of different kinds of research, including scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement and supporting professional service users, and relate these to the roles undertaken by Clinical Scientists in the trainee’s specialism.
3. Discuss and evaluate the use of reference manager systems.
4. Justify the rationale for research governance and ethical frameworks when undertaking research or innovation in the NHS.
5. Describe the process and requirements for publication in a peer-reviewed journal.
Journal and the current system of grading research publications.

**Learning Outcomes: Practical Skills**

On successful completion of this module the trainee will:

1. Design, plan and undertake a research project to test a hypothesis from conception to completion/archiving in accordance with ethical and research governance regulations, drawing on expert advice where necessary and involving patients and service users.
2. Analyse the data using appropriate methods and statistical techniques, and interpret, critically discuss and draw conclusions from the data.
3. Prepare a written project that describes and critically evaluates the research project, clearly identifying the strengths and weaknesses.
4. Present a summary of the research project and outcome that conforms to the format of a typical scientific presentation at a national or international scientific meeting, responding to questions appropriately.
5. Prepare a summary of the research project suitable for non-specialist and lay audiences.

**Indicative Content**

- Critical evaluation of the literature/evidence base
- Reference management
- Identification of a research question
- Research ethics and regulatory requirements, including issues related to access and use of information
- Data protection and confidentiality guidelines
- Patient safety
- Patient consent
- Sources of funding/grants
- Peer review/expert advice
- Possible risks and balancing risk vs benefit
- Project management techniques and tools
- Roles and responsibilities of those involved in the research
- Monitoring and reporting
- Data analysis
- Data interpretation
- Criteria/metric for assessing and grading research data and publications in the scientific, NHS and HE sectors
- Range of formats and modes of presentation of data
- Requirements for publications submitted to scientific, education and similar journals
- Current conventions with respect to bibliography and referencing of information

**Division:** Life Sciences
**Theme:** Cellular Sciences
**Specialism:** Histopathology
**Year 3:** HP-4
Major Organ Histopathology excluding Cancer
[10 credits]

This module will provide the trainee with knowledge and understanding of the cellular structure and function of the major organs and the cellular pathological findings in a range of clinical disorders other than cancer. They will understand and apply a range of techniques to these clinical disorders and gain experience of interpreting results from patient investigations.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Describe the structure and function of the major organ groups in the human body and their interactions with each other.
2. Explain the pathophysiology and clinical presentation of common disorders of major organs.
3. Describe systemic and local disease within major organ systems.
4. Describe the application of established histopathological techniques to a range of named disorders of the major organs.
5. Discuss the principles and practice of major organ transplantation, including immunosuppression.
6. Discuss and critically evaluate the ethical and legislative processes associated with the investigation of major organ disease.
7. Discuss the role of the histopathology report as part of the decision-making process in guiding diagnosis, management and clinical outcomes in major organ disease.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Identify and confirm clinical presentation of a range of major organ diseases.
2. Perform to quality standards a range of established histopathological techniques to named disorders of the major organs.
3. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the histopathology laboratory to the diagnosis and management of major organ disease.
4. Under supervision, prepare and interpret reports that involve histopathological findings as part of the investigation of major organ disease.
5. Work in partnership with other clinical specialisms as part of the diagnosis and review of named clinical diseases of major organs.
Indicative Content

- Aetiology, pathogenesis and main clinical features of common diseases encountered in cellular pathology and their impact on patient management, including:
  - dermatopathology, e.g. non malignant skin lesions
  - breast pathology, e.g. adenomas, fibrocystic change
  - hepatobiliary pathology, e.g. cirrhosis, cholecystitis
  - gastrointestinal pathology, e.g. diverticulitis, polyposis, inflammatory bowel disease
  - genitourinary pathology, e.g. prostatic hyperplasia, pyelonephritis, urothelial papillary lesions
  - cardiac and vascular pathology, e.g. ischaemic heart disease
  - respiratory pathology, e.g. chronic obstructive pulmonary disease (COPD), fibrosis
  - gynaecological pathology, e.g. endometriosis, fibrous diseases
  - male reproductive pathology, e.g. epididymal cysts
  - endocrine pathology, e.g. goitre
  - ear, nose and throat (ENT) pathology, e.g. nasal polyps, tonsillitis, cystic lesions
  - osteoarticular pathology, e.g. osteoarthritis and rheumatoid arthritis

- Application of a wide range of histological techniques to the demonstration of the disease processes, e.g. diagnostic algorithms
- Awareness of the multi-organ impact of disease and treatment
- Organ transplantation and the morphological presentation of rejection
- Multi-organ transplant
- Ethical and regulatory issues
- New developments in equipment, methods or procedures used in the laboratory investigation of major organ disease
- The importance of the histopathology report in assisting diagnosis, management and clinical outcomes

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Histopathology  
**Year 3:** HP-5  
**Cancer [10 credits]**

This module will provide the trainee with knowledge and understanding of the principles of carcinogenesis, malignancy and metastasis. They will understand and apply cellular pathology to the diagnosis and management of a range of common cancers. They will apply cellular pathology techniques in cancer and gain experience of interpreting results from patient investigations.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Describe the biology of normal and abnormal growth.
2. Describe the processes of tumour growth, angiogenesis, apoptosis and
metastasis.

3. Explain the role of oncogenes in cancer development and the molecular basis of oncogenesis.

4. Describe and justify the use of diagnostic algorithms to aid the diagnosis of malignant disease.

5. Describe the use of prognostic indicators to provide advice on clinical and surgical treatment in a multidisciplinary setting.

6. Discuss and critically evaluate the application of clinical and surgical treatment modalities for cancer, including the underpinning evidence base.

7. Discuss and justify the relevance of national and international targets and achievements in the diagnosis, management and survival of cancer patients.

8. Discuss the partnership of histopathology to other clinical specialisms in the investigation and management of cancer and patient care.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Identify and confirm the clinical presentation of a range of common cancers.

2. Perform to quality standards a range of established histopathological techniques to named cancers.

3. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the histopathology laboratory to the diagnosis and management of cancer.

4. Apply diagnostic algorithms and prognostic indicators to the investigation and management of cancer patients.

5. Draft preparation and interpretation of reports that involve histopathological findings as part of the investigation of cancer.

6. Work in partnership with other clinical specialisms as part of the diagnosis and review of a range of common cancers.

Indicative Content

- Principles of the initiation and mechanisms of malignant growth and metastasis, including:
  - genetic deregulation and the role of proto-oncogenes and oncogenic viruses
  - the role of telomerase activation in tumourgenesis
  - cell proliferation
  - signalling pathways
  - apoptosis
  - the role of hormones
- angiogenesis
- The principles and significance of clonality
- The principles of radioactive and chemical carcinogenesis
- Karyotyping and familial predisposition to certain types of cancer
- Tumour–host interactions
- Aetiology, homeostasis, pathogenesis and the main clinical features, including age-related factors, of malignant diseases encountered in organ group-specific malignant disease, including:
  - skin malignancy
  - breast malignancy
  - hepatobiliary malignancy
  - gastrointestinal malignancy
  - genitourinary malignancy
  - vascular malignancy
  - respiratory malignancy
  - gynaecological malignancy
  - male reproductive malignancy
  - endocrine malignancy
  - haemopoietic malignancy
  - neuromuscular malignancy
  - ENT malignancy
  - ophthalmic malignancy
  - osteoarticular malignancy
- Application of a wide range of histological techniques to the diagnosis of cancer
- The processes of grading and staging of cancer
- Role of diagnostic prognostic and predictive markers in the clinical management of patients
- National screening programmes for cancer
- The role of clinical and surgical treatment options in the management of disease
- The impact of diagnostic histopathology on clinical outcomes
- Multidisciplinary team meetings
- Cancer targets – fast-track from GP to treatment (to include initial diagnosis of organ-specific tumour site, e.g. breast, prostate)

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Histopathology  
**Year 3:** HP-6  
**Specialised Histopathology**  
[10 credits]

This module will provide the trainee with knowledge and understanding of application of histopathology to specialised clinical situations, including autopsy. They will apply this knowledge as they use cellular pathology techniques in specialised situations and gain experience of interpreting results from patient investigations.
Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Describe the structure and function of specialised organ groups in the human body and their interactions with each other.
2. Discuss and evaluate the application of histopathology in clinical sub-specialist areas, including paediatrics.
3. Discuss and evaluate the application of specialised histopathology equipment and techniques in a variety of clinical settings.
4. Discuss the contribution of the histopathology report to the diagnosis and further management of specialised organ groups and clinical sub-specialist areas.
5. Explain and evaluate the organisation and delivery of specialised histopathology services and the procedures required for use of those services.
6. Discuss the autopsy process and the associated regulatory framework.
7. Discuss the partnership of histopathology to other clinical specialisms in the investigation and management of cancer and patient care.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Identify the clinical presentation of a range of relevant disorders of specialised organ groups and clinical subspecialist areas.
2. Perform to quality standards a range of specialised histopathology techniques.
3. Identify and evaluate new equipment, methods, or procedures to enhance the contribution of the histopathology laboratory to the diagnosis and management of specialised organ groups and clinical subspecialist areas.
4. Support the organisation and use of specialised histopathology laboratory services in the UK.
5. Under supervision, prepare and interpret histopathology reports that involve specialised organ groups and clinical subspecialist areas.
6. Support mortuary operation, the autopsy process and the associated regulatory framework. Where appropriate, observe autopsy in action.
7. Work in partnership with other clinical specialisms as part of the diagnosis and review of patients with disorders of specialised organ groups and from clinical subspecialist areas.

Indicative Content

- Aetiology, pathogenesis and main clinical features of common diseases encountered in cellular pathology and their impact on patient management, including:
• haemopoietic pathology, e.g. hyperplasia, lymphadenitis
• neuromuscular pathology, e.g. neuroma, schwannoma, myology
• central nervous system (CNS) pathology
• ophthalmic pathology, e.g. trachoma
• eye
• brain
• muscle
• nerve
• paediatric pathology
• haematopathology

• Application of specialised techniques to a variety of tissues:
  • specialised immunocytochemistry
  • immunofluorescence
  • fluorescence in-situ hybridisation
  • molecular techniques, e.g. PCR
  • electron microscopy
  • image capture
  • quantitation
  • molecular databases

• Specialised techniques currently under development that may play a future role in cellular pathology

• Knowledge of autopsies and the underlying principle of consent:
  • perinatal and paediatric post mortems
  • coroner’s post mortems
  • forensic post mortems

• Human Tissue Authority (HTA) regulations relating to the retention of tissues and organs

• Tissue banking
### Section 14: MSc Clinical Science Specialist Modules for Reproductive Science

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**Legend:**
- **Blue:** Generic Modules: Common to all divisions of healthcare science
- **Green:** Division/Theme-Specific Modules: Common to a division or theme
- **Orange:** Specialist Modules: Specific to a specialism

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This module will provide the trainee with knowledge and understanding of the causes and treatment options for male and female infertility and the approach to managing the infertile couple. They will understand the role of regulation in treating infertility and become familiar with legislative quality management aspects of licensed treatments.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Discuss the causes and diagnosis of male and female infertility.
2. Discuss and justify the treatment options for male and female infertility.
3. Describe different ovarian stimulation regimens, including the endocrine and physiological responses.
4. Explain and critically evaluate the statutory and regulatory requirements of fertility treatments and professional codes of practice.
5. Explain and evaluate the principles and practice of quality management and validation.
6. Discuss the linkages between the reproductive science laboratory and other clinical specialisms in the investigation of male and female infertility and patient care.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Suggest a patient’s pathway, including treatment options and stimulation regimens based on clinical presentation.
2. Perform procedures within the statutory and regulatory framework.
3. Perform quality management tasks.

**Indicative Content**

- Investigation of the infertile male, including specialist andrology testing
- Causes of male infertility, including endocrine deficiencies, obstructions, genetic and chromosomal disorders, autoimmunity, varicocele
- Treatment options for male infertility
- Investigation of the infertile female
Causes of female infertility, including endocrine disorders, genetic and chromosomal disorders, tubal disorders, endometriosis
- Treatment options for female infertility
- In-vivo oocyte development and ovarian stimulation regimens, including mechanism of actions of antagonists and agonists
- Endocrine and physiological response to ovarian stimulation
- Luteal endocrinology
- Outcomes of ART treatment
- The Human Fertilisation and Embryology Act and Code of Practice
- Legislation and regulatory mechanisms in the UK compared with those both within and outside the EU
- Governing bodies and accrediting organisations
- Licensing for both treatment and research in the UK
- Social and ethical responsibilities of a clinical embryologist
- Quality control tests routinely employed in the ART lab – mouse embryo bioassay and sperm survival tests
- Quality management system within an (in-vitro fertilisation) IVF centre
- Validation of equipment and processes

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Reproductive Science
Year 2: RS-3
Gametes and Fertilisation
[10 credits]

This module will provide the trainee with knowledge and understanding of the development of male and female gametes and the process of fertilisation. They will understand and gain experience of insemination methodologies and of reporting outcomes from insemination/fertilisation.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Explain spermatogenesis and spermiogenesis.
2. Explain oogenesis and oocyte maturation.
3. Discuss the cellular and molecular basis of fertilisation.
4. Describe relevant techniques for gamete preparation and handling.
5. Describe methods of insemination and be able to identify normal and abnormally fertilised oocytes.
6. Discuss the linkages between the reproductive science laboratory and other clinical specialisms in the selection and management of patients who will undergo insemination/fertilisation.

Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found
On successful completion of this module the trainee will:

1. Handle gametes correctly to maintain viability.
2. Undertake an egg recovery procedure and identify oocytes.
3. Perform the different methods of sperm preparation techniques.
4. Identify patients who, based on clinical parameters, require either in vitro fertilisation (IVF) or intracytoplasmic sperm injection (ICSI).
5. Advise patients on their treatment pathway through discussion of the different insemination methods. Perform the different methods of routine (not ICSI) insemination.
6. Identify stages of oocyte maturity and normally and abnormally fertilised oocytes.
7. Record and report accurately patients’ fertilisation results.

Indicative Content

- Developmental and genetic control of spermatogenesis and spermiogenesis, including cytology of spermatogenesis, spermatocytes and spermatids
- Physiology of mature sperm
- Acrosome reaction
- Sperm capacitation and zona pellucida binding
- Follicle growth in the human ovary
- Oocyte growth and maturation, including genetic and cellular regulation of meiosis and mitosis
- Structure and properties of the zona pellucida
- Cellular and molecular basis of fertilisation
- The pronuclear oocyte, including completion of the second meiotic division and pronuclear formation
- Syngamy
- Basic laboratory skills and aseptic technique for semen preparation and oocyte collection and handling
- Normal and abnormally fertilisation (polyspermy and parthenogenesis), including failed to fertilise oocytes, theories of origin and implications for patient treatment
- Insemination methodologies
- Risks of loss of viability associated with the handling of gametes and relevant control measures
- Reporting outcomes from insemination/fertilisation

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Reproductive Science
Year 2 and 3: RS-Res
Research Project in Reproductive Science
[60 credits]
The overall aim of this module, building on the Research Methods module, is for the trainee to undertake a research project that shows originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in a specialism of healthcare science. The research project may span scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement, or supporting professional service users to meet the expected learning outcomes. Research projects should be designed to take into account the research training required by individual trainees and the needs of the department in which the research is to be conducted.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Discuss the stages of the research and innovation process from conceptualisation to dissemination and, if appropriate, translation into practice.
2. Describe the purpose and importance of different kinds of research, including scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement and supporting professional service users, and relate these to the roles undertaken by Clinical Scientists in the trainee’s specialism.
3. Discuss and evaluate the use of reference manager systems.
4. Justify the rationale for research governance and ethical frameworks when undertaking research or innovation in the NHS.
5. Describe the process and requirements for publication in a peer-reviewed journal and the current system of grading research publications.

**Learning Outcomes: Practical Skills**

On successful completion of this module the trainee will:

1. Design, plan and undertake a research project to test a hypothesis from conception to completion/archiving in accordance with ethical and research governance regulations, drawing on expert advice where necessary and involving patients and service users.
2. Analyse the data using appropriate methods and statistical techniques, and interpret, critically discuss and draw conclusions from the data.
3. Prepare a written project that describes and critically evaluates the research project, clearly identifying the strengths and weaknesses.
4. Present a summary of the research project and outcome that conforms to the format of a typical scientific presentation at a national or international scientific meeting, responding to questions appropriately.
5. Prepare a summary of the research project suitable for non-specialist and lay audiences.
Indicative Content
- Critical evaluation of the literature/evidence base
- Reference management
- Identification of a research question
- Research ethics and regulatory requirements, including issues related to access and use of information
- Data protection and confidentiality guidelines
- Patient safety
- Patient consent
- Sources of funding/grants
- Peer review/expert advice
- Possible risks and balancing risk vs benefit
- Project management techniques and tools
- Roles and responsibilities of those involved in the research
- Monitoring and reporting
- Data analysis
- Data interpretation
- Criteria/metric for assessing and grading research data and publications in the scientific, NHS and HE sectors
- Range of formats and modes of presentation of data
- Requirements for publications submitted to scientific, education and similar journals
- Current conventions with respect to bibliography and referencing of information

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Reproductive Science
Year 3: RS-4
Culture of Gametes and Embryos
[10 credits]

This module will provide the trainee with knowledge and understanding of the principles and practice of culture systems used in an IVF laboratory. They will gain experience of the culture of gametes and embryos in a clinical setting.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Explain and justify the design requirements of a laboratory used to support reproductive science.
2. Describe culture systems used in reproductive science.
3. Describe the importance of the culture environment and the implications for gamete and embryo viability.

Learning Outcomes: Associated Work Based Learning
High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Use sterile technique to prepare culture dishes appropriate for gametes and embryos.
2. Culture embryos to maintain viability.
3. Perform quality control checks within the laboratory.
4. Analyse key performance indicators with respect to defined outcomes.
5. Identify, troubleshoot and solve problems.

**Indicative Content**

- Laboratory design and regulatory requirements
- Preimplantation embryo metabolism, including the energy and nutritional requirements of gametes and embryos
- Principles of culture systems used in the IVF laboratory, including types of culture systems (e.g. microdrops) and different incubator environments (e.g. low oxygen)
- Types of media and their applications
- Control of the culture environment for gametes/embryos in the ART laboratory, the role of buffers and the implications of pH and temperature on cellular processes
- Regulatory issues
- Laboratory quality indicators

**Division:** Life Sciences  
**Theme:** Cellular Sciences  
**Specialism:** Reproductive Science  
**Year 3:** RS-5  
**Micromanipulation and Cryopreservation**  
[10 credits]

This module will provide the trainee with the knowledge and understanding of the principles and practice of micromanipulation and cryopreservation and associated regulatory requirements. They will gain experience of the micromanipulation and cryopreservation of gametes and embryos in a clinical setting.

**Learning Outcomes: Knowledge and Understanding**

On successful completion of this module the trainee will:

1. Describe the principles and practices of micromanipulation.
2. Explain cryobiology and describe the practices of cryopreservation and thawing.
3. Discuss and justify the statutory and regulatory requirements of
Learning Outcomes: Associated Work Based Learning

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Perform micromanipulation techniques.
2. Perform cryopreservation and thawing/warming of gametes and embryos.

Indicative Content

- Micromanipulation equipment and methodology
- Principles and practices of intra-cytoplasmic sperm injection (ICSI)
- Risks and regulation associated with ICSI
- Cryobiology, including the physical and chemical processes occurring during cryopreservation and thawing
- Properties of cryoprotectants
- Handling of liquid nitrogen and the appropriate health and safety regulations
- Thermodynamics of slow freezing and vitrification
- Physiological changes that occur in gametes and embryos during cryopreservation
- Regulatory issues with regard to cryostorage

Division: Life Sciences
Theme: Cellular Sciences
Specialism: Reproductive Science
Year 3: RS-6
Embryology [10 credits]

This module will provide the trainee with the knowledge and understanding of the development and assessment of human pre-implantation embryos. They will gain experience of grading and assessing embryos and of interpreting the outcomes of assisted reproductive technology.

Learning Outcomes: Knowledge and Understanding

On successful completion of this module the trainee will:

1. Explain the cellular and molecular development of the human pre-implantation embryo.
2. Describe relevant techniques for oocyte and embryo morphological assessments.
3. Describe and evaluate the relevant technique for the process of embryo transfer.
4. Discuss implantation and endometrial function.

**Learning Outcomes: Associated Work Based Learning**

High-level description of the work based learning that accompanies this academic module. Further details of the work based programme can be found in the Work Based Learning Guide, including the Clinical Experiential Learning, Competences and Applied Knowledge and Understanding.

On successful completion of this module the trainee will:

1. Perform oocyte and embryo morphology assessments.
2. Perform embryo transfer.
3. Assess, interpret and report embryology results.

**Indicative Content**

- Human embryonic development and differentiation at all stages of the pre-implantation embryo
- Genetic regulation of early embryonic development, including maternal and embryonic gene activity
- Cellular and molecular aspects of embryo development
- Chromosomal abnormalities, including meiotic origins and causes of monosomy and trisomy
- Process of implantation and endometrial function
- Grading methodologies from oocyte to blastocyst stage, assessment at all preimplantation stages
- Identification of damaged, non-viable or abnormal gametes, zygotes or embryos
- Assessment of gametes and embryos for intended use and implications for direct patient treatment
- Handling and manipulation of embryos, including preparation of embryos and process of embryo transfer
- Reporting outcomes of ART procedures
Appendix 1: Contributor List

Members of the STP MSc and Work Based Programme Life Sciences: Cellular Sciences and Genetic Science (for rotational programme)

Development of the STP curriculum for the MSc Clinical Sciences and Work Based programme for Cellular Sciences has been coordinated by the Modernising Scientific Careers team and the National School of Healthcare Science working with NHS and Higher Education colleagues. The professionals who have contributed to the development of STP Programme since 2009 include:

Sue Avery    Birmingham Women’s Hospital NHS Foundation Trust
Alison Baker  Brighton and Sussex Universities Hospitals NHS Trust
David Baty    Ninewells Hospital, Dundee
Jennie Bell    Birmingham Women’s Hospital
Derek Bishop  Ninewells Hospital, Dundee
Jane Blower   University Hospitals of Leicester NHS Trust
Rachel Cutting Sheffield Teaching Hospitals
Anne Dalton   Sheffield Children’s NHS Foundation Trust
Val Davison   National School of Healthcare Science
Karen Denton  North Bristol NHS Trust
Andrew Evered Llandough Hospital, Penarth
Lorraine Gaunt St Mary’s Hospital, Manchester
Anne Goodall  Oxford Radcliffe NHS Hospitals Trust
Tracey de Haro Leicester Royal Infirmary
Nick Kirk      Papworth Hospital, Cambridge
Paul Knaggs   Neath Port Talbot Hospital
Christine Leary University of Sheffield
Kevin Lindsay Hammersmith Hospital, London
Barbara Lloyd  Addenbrooke’s Hospital, Cambridge
Gordon Lowther Southern General Hospital, Glasgow
Gordon McNair Antrim Area Hospital, Northern Ireland
Julia Sarson   Oxford Radcliffe NHS Hospitals Trust
Karen Schnauffer Liverpool Women’s Hospital
Anneke Seller  Churchill Hospital, Oxford
Behdad Shambayati Ashford Hospital, Kent
John Smith     Royal Hallamshire Hospital, Sheffield
Jane Stewart   Newcastle Hospitals
Ian Sturdgess  Addenbrooke’s Hospital, Cambridge
Kevin West     Leicester Royal Infirmary
Allan Wilson   Monklands Hospital, Airdrie
Eileen Williams Southmead Hospital, Bristol
Richard Winder NHS Cancer Screening Programmes

Professional bodies and societies were invited to review this STP Programme and their feedback has shaped the final publication:

Association of Biomedical Andrologists
Association of Clinical Cytogeneticists
Association of Clinical Electron Microscopists
Association of Clinical Embryologists
British Society for Clinical Cytology
Clinical Molecular Genetics Society
Institute of Biomedical Science
Royal College of Obstetricians and Gynaecologists
Royal College of Pathologists
UK National External Quality Assessment Schemes

The National School of Healthcare Science Themed Board reviewed the MSc Clinical Science (Cellular Sciences) Curriculum on 10 January 2013 and their feedback has also shaped the final publication.

Modernising Scientific Careers Professional Advisors
Dr Graham Beastall
Ms Nicky Fleming
Mr Barry Hodgson

National School of Healthcare Science Professional Leads
Ms Nicky Fleming
Dr Barbara Lloyd
Appendix 2: Programme Amendments

This section lists the programme amendments following first publication.

Amendments – May 2011

1. Page 3 section 1.1 High level MSc Framework – title change to read ‘High Level Framework MSc in Clinical Science’.
2. Page 5 section 1.2 Cellular Sciences Route Map.
3. Title in table of Year 2, Cellular Sciences (Genetics) – removed ‘Clinical Genetics’ and replaced with ‘Genetics of Neuromuscular Disorders’.
4. The content in the curriculum was correct and is unaltered.

The refreshed version is called MSc Cellular Sciences 2010-11 v2 on the footer.

For any queries regarding this change please email: msc.hee@nhs.net

Amendments – March 2013

These amendments apply to trainees commencing STP in the academic year 2013/14.

1. A generic introduction to all STP MSc Clinical Science programmes has been added.
2. In order to improve the alignment to QAA level 7 the word ‘understand’ has been replaced with an appropriate verb from Bloom’s Taxonomy for the Knowledge domain.
3. The generic module Healthcare Science has been renamed ‘Introduction to Healthcare Science, Professional Practice and Clinical Leadership’.
4. The generic modules Healthcare Science (which incorporates Professional Practice) and Research Methods have been revised and updated.
5. The Research Project has been revised and all students are expected to complete a single 60-credit research project spanning Years 2 and 3, see relevant section.
6. *Good Scientific Practice* (GSP) sets out for the healthcare science profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities, the provision of care and personal conduct. GSP has been added in the Appendices of each curricula and aspects of professionalism strengthened to reflect areas such as the need to ensure the shared nature of clinical decision making.
7. The learning outcomes related to ‘Personal Attitudes and Behaviours’ now appear in the Professional Practice section of this document but apply to all modules.
8. The role of buffers and the importance of controlling pH has been added to the indicative content within Reproductive Science (RS-4)
The new version is called: STP MSc Cellular Sciences Version 3.0 for 2013-14

For any queries regarding this change please email: msc.hee@nhs.net
Appendix 3: Good Scientific Practice

Good Scientific Practice

Section 1: The purpose of this document
There are three key components to the Healthcare Science workforce in the UK:

1. Healthcare Science Associates and Assistants who perform a diverse range of task based roles with appropriate levels of supervision.

2. Healthcare Science Practitioners have a defined role in delivering and reporting quality assured investigations and interventions for patients, on samples or on equipment in a healthcare science specialty, for example Cardiac Physiology, Blood Sciences or Nuclear Medicine. They also provide direct patient care and more senior Healthcare Science Practitioners develop roles in specialist practice and management.

3. Healthcare Scientists are staff that have clinical and specialist expertise in a specific clinical discipline, underpinned by broader knowledge and experience within a healthcare science theme. Healthcare scientists undertake complex scientific and clinical roles, defining and choosing investigative and clinical options, and making key judgements about complex facts and clinical situations. Many work directly with patients. They are involved, often in lead roles, in innovation and improvement, research and development and education and training. Some pursue explicit joint academic career pathways, which combined clinical practice and academic activity in research, innovation and education.

This document sets out the principles and values on which good practice undertaken by the Healthcare Science workforce is founded.

*Good Scientific Practice* sets out for the profession and the public the standards of behaviour and practice that must be achieved and maintained in the delivery of work activities, the provision of care and personal conduct.

*Good Scientific Practice* uses as a benchmark the Health Professions Council (HPC) Standards of Proficiency and Standards of Conduct, Performance and Ethics, but expresses these within the context of the specialities within Healthcare Science, recognising that three groups of the workforce, Biomedical Scientists, Clinical Scientists and Hearing Aid Dispensers are regulated by the HPC. The aim is that the standards are accessible to the profession and understandable by the public.
Good Scientific Practice represents standards and values that apply throughout an individual’s career in healthcare science at any level of practice. The standards will be contextualised by the role within Healthcare Science that an individual undertakes. This means that the standards must be interpreted based on the role that an individual performs. For example, in supervised roles where individuals work within defined procedures, rather than autonomously, some standards will need to be interpreted appropriately for the context of the specific role. There will, however, always be a requirement for an individual to work within the limits of their scope of practice and competence.

Students and trainees will be expected to be working towards meeting the expectations set out in this document. However, if an individual is undertaking further training and development following qualification from a professional training programme, he or she will be expected to be able to meet the standards in this document within their scope of practice.

The standards have been used to support curriculum development and will be used to underpin the process of judging individual equivalence, particularly for emerging specialisms.

The standards have been divided into five domains. The domains of Good Scientific Practice detailed in section 2 are:

1. Professional Practice
2. Scientific Practice
3. Clinical Practice
4. Research and development
5. Clinical Leadership

Section 2: The domains of Good Scientific Practice

Domain 1: Professional Practice

All patients and service users are entitled to good standards of professional practice and probity from the Healthcare Science workforce including the observance of professional codes of conduct and ethics. In maintaining your fitness to practice as a part of the Healthcare Science workforce, you must:

1.1 Professional Practice

1.1.1 Make the patient your first concern
1.1.2 Exercise your professional duty of care
1.1.3 Work within the agreed scope of practice for lawful, safe and effective healthcare science
1.1.4 Keep your professional, scientific, technical knowledge and skills up to date
1.1.5 Engage fully in evidence based practice
1.1.6 Draw on appropriate skills and knowledge in order to make professional judgements
1.1.7 Work within the limits of your personal competence
1.1.8 Act without delay on concerns raised by patients or carers or if you have good reason to believe that you or a colleague may be putting people at risk
1.1.9 Never discriminate unfairly against patients, carers or colleagues
1.1.10 Treat each patient as an individual, respect their dignity and confidentiality and uphold the rights, values and autonomy of every service user, including their role in the diagnostic and therapeutic process and in maintaining health and well-being.
1.1.11 Respond constructively to the outcome of audit, appraisals and performance reviews, undertaking further training where necessary

1.2 Probity

1.2.1 Make sure that your conduct at all times justifies the trust of patients, carers and colleagues and maintains the public’s trust in the scientific profession
1.2.2 Inform the appropriate regulatory body without delay if, at any time, you have accepted a caution, been charged with or found guilty of a criminal offence, or if any finding has been made against you as a result of fitness to practice procedures, or if you are suspended from a scientific post, or if you have any restrictions placed on your scientific, clinical or technical practice
1.2.3 Be open, honest and act with integrity at all times, including but not limited to: writing reports, signing documents, providing information about your qualifications, experience, and position in the scientific community, and providing written and verbal information to any formal enquiry or litigation, including that relating to the limits of your scientific knowledge and experience
1.2.4 Take all reasonable steps to verify information in reports and documents, including research
1.2.5 Work within the Standards of Conduct, Performance and Ethics set by your profession

1.3 Working with colleagues

1.3.1 Work with other professionals, support staff, service users, carers and relatives in the ways that best serve patients’ interests
1.3.2 Work effectively as a member of a multi-disciplinary team
1.3.3 Consult and take advice from colleagues where appropriate
1.3.4 Be readily accessible when you are on duty
1.3.5 Respect the skills and contributions of your colleagues
1.3.6 Participate in regular reviews of team performance.

1.4 Training and developing others

1.4.1 Contribute to the education and training of colleagues
1.4.2 If you have responsibilities for teaching, develop the skills, attitudes and practices of a competent teacher
1.4.3 Ensure that junior colleagues and students are properly supervised
1.4.4 Support colleagues who have difficulties with performance, conduct or health
1.4.5 Share information with colleagues to protect patient safety
1.4.6 Provide work-based development for colleagues to enhance/improve skills and knowledge

Domain 2: Scientific Practice

As a part of the Healthcare Science workforce, you will keep your scientific and technical knowledge and skills up to date to effectively:

2.1 Scientific Practice

2.1.1 Develop investigative strategies/procedures/processes that take account of relevant clinical and other sources of information
2.1.2 Provide scientific advice to ensure the safe and effective delivery of services
2.1.3 Undertake scientific investigations using qualitative and quantitative methods to aid the screening, diagnosis, prognosis, monitoring and/or treatment of health and disorders appropriate to the discipline
2.1.4 Investigate and monitor disease processes and normal states
2.1.5 Provide clear reports using appropriate methods of analysing, summarising and displaying information
2.1.6 Critically evaluate data, draw conclusions from it, formulate actions and recommend further investigations where appropriate

2.2 Technical Practice

2.2.1 Provide technical advice to ensure the safe and effective delivery of services
2.2.2 Plan, take part in and act on the outcome of regular and systematic audit
2.2.3 Work within the principles and practice of instruments, equipment and methodology used in the relevant scope of practice
2.2.4 Demonstrate practical skills in the essentials of measurement, data generation and analysis
2.2.5 Assess and evaluate new technologies prior to their routine use
2.2.6 Identify and manage sources of risk in the workplace, including specimens, raw materials, clinical and special waste, equipment, radiation and electricity.
2.2.7 Apply principles of good practice in health and safety to all aspects of the workplace
2.2.8 Apply correct methods of disinfection, sterilisation and decontamination and deal with waste and spillages correctly.
2.2.9 Demonstrate appropriate level of skill in the use of information and communications technology

2.3 Quality

2.3.1 Set, maintain and apply quality standards, control and assurance techniques for interventions across all clinical, scientific and technological activities
2.3.2 Make judgements on the effectiveness of processes and procedures
2.3.3 Participate in quality assurance programmes
2.3.4 Maintain an effective audit trail and work towards continuous improvement

Domain 3: Clinical Practice

As a part of the Healthcare Science workforce, you will keep your clinical skills up to date and undertake the clinical duties appropriate to your role in order to effectively:

3.1 Clinical Practice

3.1.1 Ensure that you and the staff you supervise understand the need for and obtain relevant consent before undertaking any investigation, examination, provision of treatment, or involvement of patients and carers in teaching or research
3.1.2 Ensure that you and the staff you supervise maintain confidentiality of patient information and records in line with published guidance
3.1.3 Ensure that you and your staff understand the wider clinical consequences of decisions made on your actions or advice
3.1.4 Demonstrate expertise in the wider clinical situation that applies to patients who present in your discipline
3.1.5 Maintain up to date knowledge of the clinical evidence base that underpins the services that you provide and/or supervise and ensure that these services are in line with the best clinical evidence
3.1.6 Plan and determine the range of clinical/scientific investigations or products required to meet diagnostic, therapeutic, rehabilitative or treatment needs of patients, taking account of the complete clinical picture
3.1.7 Plan and agree investigative strategies and clinical protocols for the optimal diagnosis, monitoring and therapy of patients with a range of disorders
3.1.8 Ensure that detailed clinical assessments are undertaken and recorded using appropriate techniques and equipment and that the outcomes of these investigations are reviewed regularly with users of the service
3.1.9 Ensure the provision of expert interpretation of complex and or specialist data across your discipline in the context of clinical questions posed
3.1.10 Undertake and record a detailed clinical assessment using appropriate techniques and equipment
3.1.11 Provide specialised clinical investigation and/or analysis appropriate to your discipline
3.1.12 Provide interpretation of complex and/or specialist data in the context of the clinical question posed
3.1.13 Provide clinical advice based on results obtained, including a diagnostic or therapeutic opinion for further action to be taken by the individual directly responsible for the care of the patient
3.1.14 Provide expert clinical advice to stakeholders in order to optimise the efficiency and effectiveness of clinical investigation of individuals and groups of patients
3.1.15 Prioritise the delivery of investigations, services or treatment based on clinical need of patients
3.1.16 Represent your discipline in multidisciplinary clinical meetings to discuss patient outcomes and the appropriateness of services provided
3.1.17 Ensure that regular and systematic clinical audit is undertaken and be responsible for modifying services based on audit findings.

3.2 Investigation and reporting

3.2.1 Plan and conduct scientific, technical, diagnostic, monitoring, treatment and therapeutic procedures with professional skill and ensuring the safety of patients, the public and staff
3.2.2 Perform investigations and procedures/design products to assist with the management, diagnosis, treatment, rehabilitation or planning in relation to the range of patient conditions/equipment within a specialist scope of practice
3.2.3 Monitor and report on progress of patient conditions/use of technology and the need for further interventions.
3.2.4 Interpret and report on a range of investigations or procedures associated with the management of patient conditions/equipment

Domain 4: Research, Development and Innovation

As part of the Healthcare Science workforce, research, development and innovation are key to your role. It is essential in helping the NHS address the challenges of the ageing population, chronic disease, health inequalities and rising public expectations of the NHS. In your role, you will undertake the research, development and innovation appropriate to your role in order to effectively:

4.1 Research, Development and Innovation

4.1.1 Search and critically appraise scientific literature and other sources of information
4.1.2 Engage in evidence-based practice, participate in audit procedures and critically search for, appraise and identify innovative approaches to practice and delivery of healthcare
4.1.3 Apply a range of research methodologies and initiate and participate in collaborative research
4.1.4 Manage research and development within a governance framework
4.1.5 Develop, evaluate, validate and verify new scientific, technical, diagnostic, monitoring, treatment and therapeutic procedures and, where indicated by the evidence, adapt and embed them in routine practice
4.1.6 Evaluate research and other available evidence to inform own practice in order to ensure that it remains at the leading edge of innovation.
4.1.7 Interpret data in the prevailing clinical context
4.1.8 Perform experimental work, produce and present results
4.1.9 Present data, research findings and innovative approaches to practice to peers in appropriate forms
4.1.10 Support the wider healthcare team in the spread and adoption of innovative technologies and practice

Domain 5: Clinical Leadership

All patients and service users have a right to expect that Healthcare Science services efficiently and effectively managed to meet service needs. As a leader in Healthcare Science, you will seek to effectively:

5.1 Leadership

5.1.1 Maintain responsibility when delegating healthcare activities and provide support as needed
5.1.2 Respect the skills and contributions of your colleagues
5.1.3 Protect patients from risk or harm presented by another person’s conduct, performance or health
5.1.4 Treat your colleagues fairly and with respect
5.1.5 Make suitable arrangements to ensure that roles and responsibilities are covered when you are absent, including handover at sufficient level of detail to competent colleagues
5.1.6 Ensure that patients, carers and colleagues understand the role and responsibilities of each member of the team
5.1.7 Ensure that systems are in place through which colleagues can raise concerns and take steps to act on those concerns if justified
5.1.8 Ensure regular reviews of team performance and take steps to develop and strengthen the team
5.1.9 Take steps to remedy any deficiencies in team performance
5.1.10 Refer patients to appropriate health professionals
5.1.11 Identify and take appropriate action to meet the development needs of those for whom you have management, supervision or training responsibilities
5.1.12 Act as an ambassador for the Healthcare Science community

Good Scientific Practice AHCS V.2 Final
September 2012
## Appendix 4: Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Clinical experiential learning</strong></td>
<td>The cyclical process linking concrete experience with abstract conceptualisation through reflection and planning.</td>
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<tr>
<td><strong>Clinical experiential learning outcomes</strong></td>
<td>The activities that the trainee will undertake to enable and facilitate their learning in the workplace.</td>
</tr>
<tr>
<td><strong>Competence</strong></td>
<td>The ability of an individual to perform a role consistently to required standards combining knowledge, understanding, skills and behaviour.</td>
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<tr>
<td><strong>Competence statements</strong></td>
<td>Active and outcome-based statements that provide a further breakdown of the Learning Outcomes — reflecting what the trainee will be able to do in the workplace at the end of the programme. Each competence should be linked back to the numbered Learning Outcomes.</td>
</tr>
<tr>
<td><strong>Component</strong></td>
<td>An indication of the type of module within a learning guide, i.e. rotational, specialist, or elective.</td>
</tr>
<tr>
<td><strong>Curricula</strong></td>
<td>An outline of the expected educational outcomes across a subject area. The learning that is expected to take place during the Scientist Training Programme described in terms of knowledge, skills and attitudes.</td>
</tr>
<tr>
<td><strong>Division</strong></td>
<td>A high-level description of an area of practice within healthcare science. There are three divisions: Life Sciences, Physical Sciences, and Biomedical Engineering and Physiological Sciences.</td>
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<tr>
<td><strong>Domains of learning</strong></td>
<td>Cognitive (knowledge and intellectual skills), affective (feelings and attitudes), interpersonal (behaviour and relationships with others) and psychomotor (physical skills).</td>
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<tr>
<td><strong>Feedback</strong></td>
<td>Specific information about the comparison between a trainee’s observed performance and a standard, given with the intent to improve the trainee’s performance (van de Ridder JMM, Stokking KM, McGaghie WC and ten Cate OT. What is feedback in clinical education? Medical Education 2008: 42: 189–197).</td>
</tr>
<tr>
<td><strong>Good Scientific Practice</strong></td>
<td>Non-statutory guidance on the minimum requirements for good practice for the healthcare science workforce.</td>
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<tr>
<td><strong>Host department</strong></td>
<td>The department which is responsible for the three-year training programme and in which the training officer is based.</td>
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<tr>
<td><strong>Job</strong></td>
<td>A specific definition of the work activities, requirements and skills required to undertake work activities within a local context. This differs from a role – see below.</td>
</tr>
<tr>
<td><strong>Key learning outcome</strong></td>
<td>A defined learning outcome linked to relevant competence(s) within the workplace Learning Guide.</td>
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<tr>
<td><strong>Knowledge and understanding</strong></td>
<td>The knowledge and understanding that must be applied in the workplace to achieve the stated competence.</td>
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<tr>
<td><strong>Learning framework</strong></td>
<td>The specification for work based learning contained</td>
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within the Learning Guide.

<table>
<thead>
<tr>
<th><strong>Learning module</strong></th>
<th>A distinct set of learning outcomes and competences that form part of a programme. Modules may be rotational, specialist, elective, or professional practice and can be combined to meet the needs of specific programmes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning outcome</strong></td>
<td>A high-level, outcome-based statement that describes what a trainee will be able to do at the end of the module.</td>
</tr>
<tr>
<td><strong>Mentoring</strong></td>
<td>Mentoring is a process in which a trainer (mentor) is responsible for overseeing the career and development of the trainee. The emphasis is therefore on the relationship (rather than the activity).</td>
</tr>
<tr>
<td><strong>Module aim</strong></td>
<td>The overall objective of a work based learning module – defining the intended learning achievements of the trainee. The aim works together with the ‘Scope’ statement to define the overall objectives and scope of the module.</td>
</tr>
<tr>
<td><strong>Module scope</strong></td>
<td>A statement within work based learning modules that defines the range/limits of the learning undertaken by the trainee in a module – patients/investigations/equipment/modalities, etc.</td>
</tr>
<tr>
<td><strong>National Occupational Standards</strong></td>
<td>Nationally recognised standards of expected workplace performance and level of competence for a role. The standards are outcome based, defining what the role holder should be able to do, as well as what they must know and understand to demonstrate competent work performance. National Occupational Standards are supported by nationally agreed frameworks of expected attitudes, behaviour and skills.</td>
</tr>
<tr>
<td><strong>Practical skill</strong></td>
<td>A cognitive, psychomotor, physical, or communicative ability that supports performance of the required role.</td>
</tr>
<tr>
<td><strong>Programme</strong></td>
<td>The package of learning, teaching assessment and quality assurance leading to an award.</td>
</tr>
<tr>
<td><strong>Provider</strong></td>
<td>An organisation that delivers required training and learning activities, to specified quality assurance requirements.</td>
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<tr>
<td><strong>Role</strong></td>
<td>A collection of functions undertaken in the workplace that represent the main broad areas of work for all similar workers at national level. A role differs from a job, the latter being defined specifically for a local context.</td>
</tr>
<tr>
<td><strong>Specialism</strong></td>
<td>A focused area of practice within a theme of healthcare science.</td>
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<tr>
<td><strong>Trainer</strong></td>
<td>A qualified individual who provides learning and development support for trainees.</td>
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<tr>
<td><strong>Theme</strong></td>
<td>A cluster of related specialisms within a division of healthcare science.</td>
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<tr>
<td><strong>Work based learning</strong></td>
<td>Learning that takes place in a real work setting and involves the application of academic learning to real...</td>
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<tr>
<td><strong>Work performance</strong></td>
<td>The requirements of satisfactory and consistent demonstration of competence in specified functions for a work role.</td>
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<td>----------------------</td>
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<tr>
<td><strong>Workplace</strong></td>
<td>A real work setting in which the trainee can apply learning.</td>
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</table>