The Royal College of Pathologists

Pathology: the science behind the cure

Transfusion Science

2016–2017

HSST Curriculum for Clinical Scientists incorporating FRCPath

Index

FRCPath Curriculum for Clinical Scientists in Transfusion Science (Higher Specialist Scientific Training)

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1.1 The Role of the Consultant Clinical Scientist in Transfusion Science

Context

Blood transfusion touches on the care of patients with a wide range of disorders; malignant and non-malignant, inherited and acquired, affecting the fetus, newborn and adult. By the end of stage two, trainees will be equipped to operate effectively among the multi-disciplinary teams managing all of these patients. The majority of patients will experience a transfusion episode only rarely, but some such as those with haemoglobinopathies may require a life-time of transfusion support. Patients such as these have specialist requirements and by the end of stage two, trainees will be equipped to provide the highly complex diagnostic investigations and clinical advice that these patients require.

Much of blood transfusion exists within the blood supply chain, which starts with blood donations freely-offered, and includes the testing, processing and distribution of blood components and plasma derivatives. This also distinguishes Transfusion Science from many other pathology disciplines. It requires blood transfusion to operate within a highly regulated environment and calls for skills in stock control and 'good manufacturing practice'. This curriculum therefore seeks to develop trainees towards a deep understanding of regulatory compliance, quality management and clinical governance.

Scientific Services and Clinical Care

Consultant Clinical Scientists in Transfusion Science are the national experts in their clinical scientific service. While their clinical scientist colleagues deliver today's services, Consultant Clinical Scientists prepare for tomorrow. Whilst Healthcare Science Practitioners and Clinical Scientists are trained to follow current guidelines, Consultant Clinical Scientists will be developing the evidence for new ones and contributing strategically to the national development of Transfusion Science.

They will make continuous critical appraisal of the scientific literature, and contribute to it; they will constantly question the evidence for practice with a sharp focus on patient outcomes, ensuring that investigations are appropriate, timely and delivered with the needs of patients at the forefront. They will be responsible for ensuring that cutting edge science is introduced into transfusion science practice, and leading developments in a wide range of areas of practice. Throughout, they will be committed to, and experienced in multi-disciplinary team working at the highest level; the various roles within the multi-professional team should collaborate synergistically in a complementary way, based on agreed care pathways that clarify the respective roles of both Clinical Scientists and medical colleagues.

Leadership and Management

Consultant Clinical Scientist in Transfusion Science will need to bring strong leadership to their own services and the profession - requiring skills above and beyond simply management. They will give their department's strategic direction, ensuring that this is compatible with the overall direction of the organisation; they will have both the knowledge and authority to develop their service, using vision and their scientific knowledge and expertise to ensure that the potential and rationale for new developments are understood. They will be accountable for service quality, developments and clinical governance, and practised in influencing other colleagues so that excellent science remains at the forefront of clinical practice. In addition they will have a key role in promoting and ensuring quality and consistency of standards across services by promoting networks for quality assurance locally and nationally.

Research, Development, Innovation and Education

Consultant Clinical Scientists in Transfusion Science will be clinical scientific leaders and will have the underpinning basic science and research skills to question their own clinical practice, as well as the breadth of cross-disciplinary technical skills to innovate and to effect change. They will be able to evaluate critically the benefits and opportunities offered by new scientific discoveries and technological advances, contextualising them to the clinical arena and the skills to influence their implementation into service for the benefit of patients. Critically, they will have learnt and practised the skills needed to teach the next generation of clinical scientists how to approach learning about science in health in order to optimise outcomes for patients. Consultant Clinical Scientists in Transfusion Science will make continuing distinguished contributions to the furtherance of the science and of practice of the specialism, and should be established and known nationally for their contribution, publications and leadership in the profession.

1.2 Overall Description of the HSST Programme

Modernising Scientific Careers (MSC) is a UK programme led by the Chief Scientific Officer (CSO), working in conjunction with the other devolved health administrations and relevant scientific, medical and surgical educational institutions. MSC provides a transparent, standards-driven educational and training framework for more than 45 specialisms in healthcare science.

Higher Specialist Scientist Training (HSST) is a five-year training programme that has been developed to enable a selected cohort of Clinical Scientists to be trained to take on the role of a Consultant Clinical Scientist. During training, Clinical Scientists in HSST and their supervisors will use this HSST curriculum to advance their learning, practice and performance, and monitor their progress by reference to the learning outcomes and competences defined within it. Clinical Scientists in HSST will be encouraged to lead their own learning and to measure their achievement against clear learning objectives. It will help the Clinical Scientist in HSST and their educational supervisor/mentor to maintain a regularly reviewed and updated education plan to ensure that all the outcomes of the curriculum are met. Finally, the curriculum will facilitate regular assessment of the Clinical Scientist's progress and satisfactory completion of training against high-quality standards, providing the means by which the public can be assured that individuals are fit for Consultant Clinical Scientist practice.

It is expected that Clinical Scientists in HSST will train in a multi-professional environment with the opportunity to learn and work with those in other training programmes across the health professions, e.g. medical, nursing, pharmacy and allied health professionals, and with those out with health, for example those following MBA, leadership, management and finance programmes.

1.3 Curriculum Development, Review, Updating and Implementation

HSST curricula were developed during 2012–2015 under the auspices of several of the Medical Royal Colleges (MRCs), following the publication in 2012 of a formal statement of support from the Academy of Medical Royal Colleges (AoMRC) [www.aomrc.org.uk/about-us/news/item/academy-statement.html]. Membership of the MRC curricula development groups included practising senior healthcare scientists nominated by scientific professional bodies and medical representatives from the MRCs, as well as educationalists from the relevant MRC and MSC teams. Consultant-level scientists from the specific scientific specialism provided the major expert input into the development of the scientific curriculum. The public, a range of scientific and medical professional bodies, universities, patients, employers and trainees were also involved. Specifically, review and comments on this curriculum were sought from other MRCs with an interest in the specialism, their related Specialty Advisory Committees (SACs) and specialist societies, healthcare science professional bodies, trainees in healthcare science, patients and the public. Governance and oversight of curricula development was through a dual process involving each relevant MRC and the Health Education England (HEE) educational approval process on behalf of the National Health Service (NHS) and HEE.

Although the curriculum content is derived from current UK clinical, diagnostic and laboratory practice in clinical science, there have been intensive efforts to identify and predict future technological developments, changes in service delivery and future patient requirements in order to ensure that the curricula are as robust and as sustainable as possible. This is in relation both to scientific content and anticipated future scientific developments (e.g. in genomics and precision/personalised medicine), and is reflective also of the new commissioning system for service and training. There will be regular reviews and updates of the curriculum to ensure that it remains relevant.

Standards of professionalism in healthcare science are set out in *Good Scientific Practice* (GSP; www.academyforhealthcarescience.co.uk/good-scientific-practice/), which describes the principles and values developed for the profession and which are comparable to the standards set by the General Medical Council (GMC) for medicine. This has been developed into a GSP syllabus that is common to all HSST curricula. The five domains of GSP emphasise clinical leadership development, expert scientific and clinical practice, research and innovation, and excellent communication and team working behaviours. For the public, it describes more specifically what can be expected from those who will be CCSs responsible for patient care.

The Academy for Healthcare Science (AHCS) will assess applications from Clinical Scientists applying for recognition of previous training, experience and qualifications ('equivalence to HSST'), based on the professional and scientific contents and standards of behaviour set out in the curricula. Applicants seeking equivalence will be evaluated through AHCS processes against HSST curricula and will need to demonstrate that they have met AHCS requirements for the Certificate of Equivalence in a given area of practice. This will entitle the Clinical Scientist to register on the Higher Specialist Scientist (HSS) Register held by the AHCS.

Implementation of the curriculum will be evaluated and monitored by the National School of Healthcare Science (NSHCS) through continuous feedback from training programmes, educational supervisors, trainers, Clinical Scientists in HSST and patients.

1.4 Curriculum Purpose

The purpose of this HSST curriculum is to define and specify the training programme and outcomes of training to ensure that Clinical Scientists undertaking HSST are fully prepared to provide, lead and innovate scientific services at consultant level in the NHS and in the rest of the UK. It aims to promote excellence through training, assessment and professional development so that Clinical Scientists exiting HSST programmes are fit to practise as Consultant Clinical Scientists.

This HSST curriculum is modular in design. It builds on the Scientist Training Programme (STP) and leads to the Certificate of Completion of Higher Specialist Scientist Training (CCHSST) issued by the NSHCS. Clinical Scientists in HSST will require evidence of satisfactory achievement of the requirements of the GSP professional syllabus, the specialty-specific syllabus and the related assessment programme (including the Innovation in Clinical Sciences [ICS] project), which together form the curriculum for the attainment of the standards of professional and specialism-based knowledge applied to practical, laboratory, clinical, teaching, research activities, as well as innovation. In addition, for those in Physical Science, the Physiological Sciences and Clinical Bioinformatics, the CCHSST will also indicate that the underpinning doctoral programme/award (DClinSci) has been achieved. In the Life Sciences, the CCHSST indicates achievement of the FRCPath and the ICS project (which together meet the learning outcomes of the doctoral programme), although the doctoral award itself is not required. The CCHSST will enable the AHCS to admit the Clinical Scientist to its HSS Register. Once admitted to this Register, Clinical Scientists will be eligible to apply for available Consultant Clinical Scientist posts.

This curriculum also describes the integral teaching, learning programme and assessment programme that are consistent with the both the Health and Care Professions Council's (HCPC) and the GMC's Standards for Curricula and Assessment Systems (April 2010).

1.5 Entry Requirements

Once the Local Education and Training Board (LETB) [or equivalent bodies in the rest of the UK] and training provider (which has been accredited by the NSHCS accreditation process) have agreed the establishment of an HSST post, entry into HSST programmes will be through a national competitive appointment and benchmarking process in England, led by the NSHCS.

Eligibility for appointment into an HSST programme requires the following:

- registration (or eligibility and application to register) as a Clinical Scientist with the HCPC;
- *normally* at least one further year in the workplace to consolidate and enhance skills, learning and experience (including research and education);
- where required, applicants must be eligible to register for doctoral-level study at a higher education institution (HEI);
- individual specialisms may also have specialty-specific requirements, which will be clarified at the time of the appointment process for the HSST post through the job description and person specification.

1.6 Routes of Entry

There will be two routes of entry into HSST training. Through the direct entry route, the Clinical Scientist in HSST will be competitively appointed into a formal HSST post, established for the purpose of training a Consultant Clinical Scientist. Alternatively, some Clinical Scientists may enter into HSST with the support of their employers through an in-service training route that does not involve the creation of a new training post *per se*, although the potential appointee will have to meet benchmarking standards for entry into HSST. In both circumstances in England, a training grant will be allocated from the LETB to the provider training unit to support training.

All HSST applicants must participate and be successful in the national appointment process. For direct entry Clinical Scientists this is a competitive process with other applicants for the available training opportunity; for in-service Clinical Scientists, participating in the national selection process ensures benchmarking against the standards for entry into HSST for this specialism. The appointment process will select not only for scientific expertise and talent in all its manifestations, but for abilities in a range of professional areas, including leadership, innovation, personal skills and values.

1.7 Equality and Diversity

The AHCS, Health Education England (HEE), Royal Colleges and their SACs are committed to the principle of diversity and equality in employment, membership, academic activities, assessment, examinations and training.

As part of this ethos these groups are committed to inspire and support 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 another 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.

1.8 The HSST Curriculum

This curriculum sets out the standards of specialism-based knowledge, clinical judgement, technical and professional skills, attitudes and behaviour that must be acquired in order to practise and progress throughout the five-year training programme. The curriculum comprises the following components:

The ***Specialist Scientific Clinical*** syllabus, providing for:

- a broad understanding of the diagnosis and management of patients within the specialism from a clinical and scientific perspective
- the diagnostic techniques required in the practice of the specialism
- understanding of the clinical areas detailed in the curriculum
- knowledge of the specialist areas defined within the curriculum

The professional generic ***Good* Sci*entific Practice*** (GSP) syllabus, setting out the requirement for the:

- communication skills required for practice in the specialism and the teaching, learning and assessment skills necessary for effective practice;
- acquisition of clinical leadership and management skills needed for the excellent delivery and development of scientific transfusion services;
- experience of research, development and innovation projects, and critical evaluation of published work in order to lead scientific, technological and service innovation
- need for a life-long commitment to adopting a structured approach to continuing personal and professional development (CPPD)
- experience of the practice of clinical governance[1] and quality improvement activity, including audit (specialist and multidisciplinary) through evaluation of practice against the standards of evidence-based medicine
- consistent demonstration and practice of attitudes, values and behaviours that support those set out in the NHS Constitution

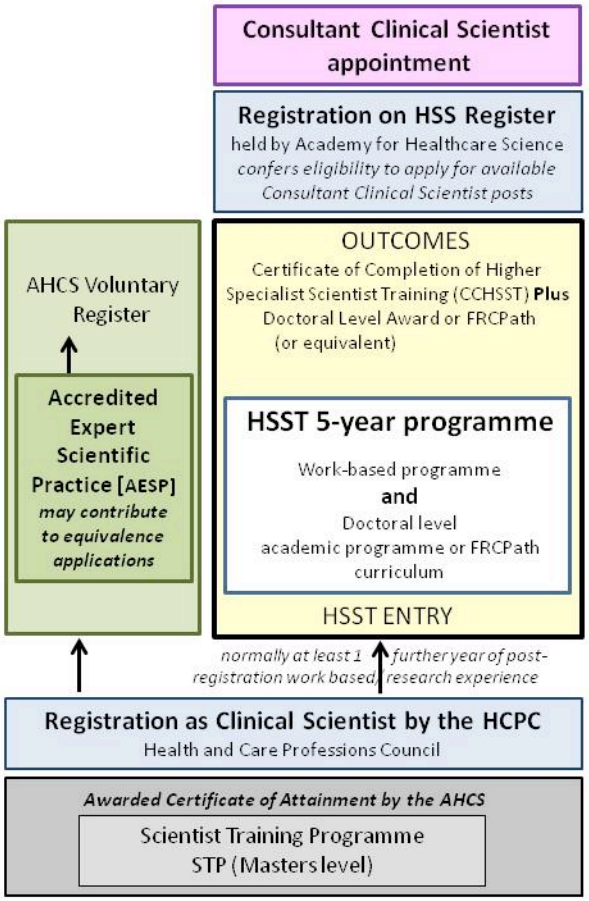
The Relationship of the GSP Syllabus to the Specialist Scientific Clinical Syllabus

The professional knowledge, skills and behaviour of *GSP* are contextualised and evidenced through clinical practice. It is not possible to achieve competence in the specialist scientific and clinical syllabus *unless* these professional skills and behaviours are also evident. Clinical Scientists in HSST must be able to show progress in acquiring GSP competences and the underpinning academic knowledge, demonstrating these behaviours across a range of situations as detailed in the scientific clinical syllabus.

1.9 The Structure and Operation of the HSST Training Programme

The broad structure and description of the HSST programme is shown overleaf.

[1] *A framework through which NHS organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care, by creating an environment in which excellence in clinical care will flourish. Schellekens W. Clinical governance in a changing NHS.* International Journal of Integrated Care*, vol 6, April to June 2006.*



Higher Specialist Scientist Training (HSST)

Composition of 5-year programme

1. Work-based training

Major component of the 5-year programme; curriculum developed in conjunction with Medical Royal Colleges (MRCs) and scientific professional bodies and overseen by the National School of Heath Care Science (NSHCS)

- training providers accredited through NSHCS
- accredited providers receive training grant through Local Education and Training Board (LETB) for each Clinical Scientist in HSST which includes academic fees
- work-based assessment programme and final assessment process conducted by NSHCS with scientific professional bodies and MRCs
- use of on-line learning and assessment portfolio (OLAT) for documenting and monitoring outcomes by NSCHS

2. Doctoral Level Academic Qualification (DClinSci)

Professional doctorate (PD) awarded by Higher Education Institute (HEI) to underpin/support work-based training (or equivalent evidence of learning) to include:

A. Leadership and professional development (120 credits)
B. Specialist scientific clinical programme (180 credits)
C. Research development and innovation (240 credits)

Note: *The professional doctorate programme is optional for those in the Pathology specialisms) as they will be undertaking the professional qualification of the Fellowship of the Royal College of Pathologists (FRCPath), although the learning outcomes of the PD must be demonstrated.*

Outcomes

- Certificate of Completion of HSST (CCHSST) from NSHCS **and** the Doctoral award or FRCPath (or equivalent) which together lead to
- registration on the Higher Specialist Scientist (HSS) Register held by the Academy for HCS (AHCS). This confers eligibility to apply for available Consultant Clinical Scientist roles.

The implementation and quality management of the HSST programme is the responsibility of the NSHCS, which will ensure through its Themed Boards that Clinical Scientists in HSST are provided with access to an appropriate range of educational experience to complete their training. The appropriate Themed Board in the NSHCS will also monitor and support the overall progress of Clinical Scientists in HSST on a regular basis, throughout the entirety of the programme.

1.10 Modularity of Training and Learning

This curriculum has been developed in a modular format, with each module having defined competences, assessment requirements and learning outcomes. There is a staged approach requiring the satisfactory completion of specified modules within each stage prior to progression to the next, so that Clinical Scientists in HSST may not progress to Stage 2 of training until they have satisfactorily completed Stage 1. They will continue to broaden their experience and understanding of common clinical and scientific problems and their management throughout their training. The underpinning doctoral-level programme will provide the underpinning academic framework for learning to support workplace practice. The knowledge gained and applied will be supported and assessed on an ongoing basis through quality assured workplace-based assessments and through a structured final assessment programme.

1.11 Doctoral-level Programme

A doctoral-level academic programme underpins HSST. The purpose of this doctoral-level programme is to formalise and *facilitate the learning* of Clinical Scientists in HSST as they:

- systematically acquire and apply a substantial body of scientific and clinical knowledge at the forefront of their specialism and embrace the future scientific and technology advances within the field
- create and interpret new knowledge through original research and scholarship requiring advanced academic enquiry
- systematically acquire, develop and apply the qualities and transferable skills necessary for employment as a Consultant Clinical Scientist, requiring the exercise of personal responsibility and taking largely autonomous initiative in complex and unpredictable situations
- develop the knowledge, skills, experience, behaviours and attitudes required of a clinical leader in an evolving and rapidly developing health and life sciences sector

Following a full tender and contracting process the doctoral programme will be provided by the Manchester Academy for Healthcare Science Education (MAHSE), a consortium of universities that will deliver the programme through partnership arrangements involving a range of organisations, including specialist professional bodies and/or MRCs. The doctoral programme will have three sections, reflecting the higher-level skills and requirements to support consultant-level practice:

- **Section A: Leadership and Professional Development** aligned to GSP, including leadership, professionalism, innovation, bio enterprise, teaching and learning, quality improvement, bioinformatics, health policy, human resource and business management, and research methods, although these areas are not necessarily exhaustive and others may be identified.
- **Section B: Specialist Scientific Clinical Programme** developed by the MRCs-led curriculum working groups of senior scientists and medical consultants, underpinned by supervised work-based and mentored training. This section will centre on the knowledge and understanding learning outcomes from the specialist scientific clinical syllabus for each HSST specialism, underpinned by supervised work-based and mentored training, reflective practice, experiential learning and a robust assessment system.
- **Section C: Research, Development and Innovation** that aims to improve health and health outcomes and may include scientific and/or clinical outcomes, service transformation, innovation, leadership, policy, education, or educational research.

Since a key purpose of the doctoral programme is to facilitate the opportunities for learning by Clinical Scientists in HSST by providing a structure within which they can obtain underpinning knowledge and learning to support their progression through the programme, it is not necessarily a requirement for the doctoral award itself to be obtained. The doctoral-level programme will be designed in a modular format, and although successful completion of the totality of the

programme will lead to the award of a professional doctorate, it is not an essential requirement for all of those undertaking HSST programmes to obtain the doctoral award *per se*.

In the Life Sciences, for example, Clinical Scientists in HSST must obtain the FRCPath, which includes the learning outcomes of the professional doctorate, but not necessarily obtain the award itself. In the Physiological Sciences, Medical Physics and Biomedical Engineering, and Clinical Bioinformatics, all Clinical Scientists in HSST will be expected to participate in the full professional doctorate programme (or potentially show equivalence to aspects of it) and gain the professional doctorate award. It will therefore be necessary for all Clinical Scientists in HSST to demonstrate that they have acquired the knowledge, skills and outcomes of the HSST curriculum to the required doctoral level in all the practice and academic elements of the programme. The doctoral-level award and programme will underpin and support this, but in itself is not an end point of the HSST programme; nor is the award required for the demonstration of competence and fitness to practise. This will be defined within the HSST assessment strategy and in conjunction with the MRCs and the NSHCS.

Research

Clinical Scientists in all HSST programmes will also be expected to undertake doctoral-level research, usually through the commissioned professional doctorate. Alternatively, research that demonstrates that such a level has been achieved may be offered, e.g. a coherent body of papers that reaches the standard suitable for publication in peer-reviewed journals, which has been undertaken during the HSST programme or during the three years before entry to the HSST programme. Clinical Scientists in HSST will also be encouraged to present and defend their research at national/international scientific conferences.

1.12 Models of Learning

HSST curricula will be delivered through work-based experiential learning and through achievement of the underpinning academic programme and/or its learning outcomes. The environment within the departments must therefore encourage independent self-directed learning and make opportunities for relevant off-the-job education by making provision for attendance at local, national and, where appropriate, international meetings and courses. It is the Clinical Scientist's responsibility, with the support of their educational supervisor and trainers, to seek learning and training opportunities and ensure that they access appropriate experiential learning. The training programme must allow for a significant component of clinical training and experience through service provision. This will normally be in the range of 30–80% of training time, depending on the specialism and the year of training.

It is therefore recognised that a large component of training will occur using an apprenticeship model of learning, under appropriate work-based supervision. Delivery of training must be under the supervision of a scientific or medical consultant and provide appropriate experiential content, including a broad exposure to both scientific and clinical issues. The environment within the department should encourage independent self-directed learning. The NSHCS will be responsible for the quality assurance of the work-based learning environment.

1.13 Learning Experiences

A wide range of teaching/learning opportunities/methods will be used during the programme to support the attainment of the learning outcomes and competences. However, it is part of the Clinical Scientist's professional development to seek out and organise relevant learning opportunities for themselves. In consultation with their educational supervisor, the Clinical Scientist in HSST may wish to consider organising some of the following learning events.

Experiential or opportunistic learning (learning through normal routine work experiences, learning by doing, observing, critical reflection) which will include*:*

- experiential working in the specialism, gaining practical and clinical skills, and observing, assisting and discussing aspects of practice with senior/consultant scientific and medical staff, patients and other members of the multi-professional team;
- task-specific, on-the-job training, working under consultant supervision and reflecting on and discussing experiences;
- observation of diagnostic/clinical/laboratory methods;
- tailored clinical experience, including team and directorate meetings in the specialty;
- attendance and participation at relevant organisational committees to enhance management and leadership skills;
- attending and participating in training provided through equipment and kit manufacturers;
- attending and participating in MDT meetings;
- teaching undergraduates and other health professionals;
- attending and participating in regional, national and international medical or scientific conferences;
- interaction with/attachment to specialist reference laboratories where required;
- completion of a doctoral-level research or innovation project from identification of the research question to dissemination of the output;
- contribution, as the leader or member of a team, to grant applications;
- dissemination of research findings through publications, presentations, etc.;
- attending and participating in medical clinics, including specialty clinics;
- gaining practical diagnostic experience;
- attending and participating in formal postgraduate education/teaching.

Learning approaches, which may include:

- independent self-directed learning;
- e-learning and m-learning (mobile learning);
- learning with peers;
- clinical skills teaching, including simulation;
- advanced library study, journal review;
- work-based experiential learning;
- small group teaching, lectures, tutorials;
- advanced journal clubs, audit meetings, etc.;
- service development projects.

1.14 Completion of Training

Successful completion of the HSST programme results in the award of a CCHSST by the NSHCS. The award will be made to Clinical Scientists in the Physical Sciences and Biomedical Engineering, the Physiological Sciences and Clinical Bioinformatics who complete the requirements of the work-based curriculum through work-based training, the ICS project and the professional doctorate, and who participate in the full training period (or as much as may be required if assessed by the AHCS as having done an equivalent period of training at some other point), including the final annual progression review/assessment, denoting satisfactory completion of the programme. In the Life Sciences, the CCHSST indicates achievement of the FRCPath and the ICS project (which together meet the academic learning outcomes of the doctoral programme), although the doctoral-level award itself is not required. Clinical

Scientists in HSST in the Life Sciences may, however, choose to undertake modules from the professional doctoral programme or, indeed, undertake the entire doctoral-level programme and achieve the DClinSci award.

The CCHSST indicates that the Clinical Scientist has achieved the standards set by the AHCS in order to gain entry to their HSS Register, having demonstrated the ability to lead, manage and critically evaluate services and practice, contributing to the team and individually to scientific, technological and service innovation. A Clinical Scientist on the HSS Register will be expected to maintain their professional development in line with GSP. It is anticipated that in due course, as for medical and surgical consultants, Consultant Clinical Scientists will undergo a regular process of revalidation that will be developed and overseen by the AHCS.

1.15 Supervisory Arrangements

Supervision and Feedback

Supervision, support and mentoring for Clinical Scientists in HSST must be available to ensure safe and effective practice for patients and the public, and to support independent learning and high standards of professional conduct. Those undertaking a supervisory, training or mentoring role for Clinical Scientists in HSST programmes must have relevant professional qualifications and experience and have undertaken appropriate and up-to-date training as agreed by the NSHCS. The HEI providing the underpinning doctoral programme will also be expected to have an academic supervisory, support and mentoring scheme in place to support the academic programme.

Clinical Scientists in HSST must be appropriately mentored, supported and supervised by the senior scientific and medical staff on a day-to-day basis, under the direction of a designated educational supervisor. Educational supervision is a fundamental conduit for delivering teaching and training in the NHS. It takes advantage of the experience, knowledge and skills of educational supervisors/trainers and their familiarity with clinical and scientific situations. It ensures regular interactions between an experienced clinician and the Clinical Scientist in a HSST programme. This is the desired link between the past and the future of scientific practice, to guide and steer the learning process of the Clinical Scientist in the programme. Clinical supervision is also vital to ensure patient safety through providing Clinical Scientists in HSST with the support to deliver high-quality services to patients. It is therefore expected that Clinical Scientists in HSST programmes reaching the end of their training will also be able to demonstrate competence in clinical supervision before the award of the CCHSST.

Educational supervision should promote independent learning and reflective practice and support the Clinical Scientist in HSST to produce action plans to address identified learning needs. It will need to ensure that the Clinical Scientist learns specific higher skills and competences, helping them to develop self-sufficiency and self-awareness in the ongoing acquisition of skills and knowledge. At every stage, patient safety must be paramount. Supervision will also require the provision of pastoral care for some Clinical Scientists in HSST. Supervision during training will be undertaken by a range of appropriately trained healthcare professionals within and without healthcare science, e.g. consultant or senior medical staff, Clinical Scientists, research scientists, senior biomedical scientists, etc.

The Educational Supervisor

The educational supervisor will be an appropriately skilled senior scientist/clinician under whose direct supervision the Clinical Scientist in HSST is working. This person(s) will be responsible for monitoring, supporting and assessing the Clinical Scientist on a day-to-day basis in their scientific, clinical and professional work, and would usually be expected to take on the role of co-supervisor of the research project as part of the academic supervisory team.

To become an educational supervisor, a senior scientist or medical consultant must have consistently demonstrated an interest in and a commitment to teaching, learning, assessment and training, have appropriate access to teaching resources and be trained in the appropriate delivery of workplace-based assessments and learner-centred feedback in accordance with the MSC HSST assessment strategy. Educational supervisors must undertake appropriate training in educational principles and assessment (e.g. Training the Trainers programme, offered by the NSHCS in England or MRCs). Attainment of formal qualifications such as a postgraduate award in teaching, learning and assessment or an MSc in Medical/Clinical Education is desirable for some members of each supervisory team. Educational supervisors are expected to keep up to date with developments in training, have access to the support and advice of their senior colleagues regarding any issues related to teaching and training, and to keep up to date with their own professional development.

The role of the HSST educational supervisor therefore, with respect to the Clinical Scientist in HSST, includes responsibilities to:

- have overall educational and supervisory responsibility for the Clinical Scientist in HSST in a given post;
- ensure that they are familiar with the curriculum for each year/stage of training;
- ensure that they have appropriate day-to-day supervision appropriate to their stage of training;
- act as a mentor and help with both professional and personal development;
- ensure that they are making the necessary clinical and educational progress;
- ensure that they are aware of the assessment system and process;
- agree a training plan (formal educational contract) to make clear the commitment required to ensure that appropriate training opportunities are available;
- ensure that an induction (where appropriate) has been carried out soon after appointment to the HSST programme;
- discuss the training requirements and progress with other trainers with whom the Clinical Scientist in HSST spends a period of training;
- undertake regular formative/supportive appraisals (at least two per year, approximately every six months) and ensure that both parties agree to the outcome of these sessions and a written record is kept;
- regularly review the evidence submitted to the Online Learning and Assessment Tool (OLAT) so that they are aware of their progress and are encouraged to discuss any issues arising during training, ensuring that records of such discussions are kept;
- keep the NSHCS Professional Lead informed of any educational or pastoral issues that may affect the Clinical Scientist's ability to complete the HSST programme.

The process of gaining competence in supervision must start at an early stage in training, with the Clinical Scientist in HSST supervising more junior trainees, e.g. those undertaking STP. The example provided by the educational supervisor is the most powerful influence on the standards of conduct and practice of a Clinical Scientist in HSST.

Supporting Roles

In addition to the educational supervisor who will have overall educational responsibility for the Clinical Scientist in HSST, there will be other clinical trainers and assessors who will help facilitate the provision of educational opportunities and feedback to the Clinical Scientist as required. They will also be in a position to provide evidence to support the educational supervisor's judgement about a Clinical Scientist's overall performance, competence and capability. Since Clinical Scientists in HSST will learn in a multi-professional environment, assessments will be carried out by a range of members of the team, including those who may not be scientifically or medically qualified. However, all those carrying out assessments must be appropriately qualified in the relevant professional specialism and trained in the methodology of workplace-based assessment, including the delivery of appropriate feedback. This does not apply to multisource feedback (MSF), where those contributing to the feedback will be from a wider pool. Clinical Scientists in HSST and their educational supervisors should look to identify opportunities to incorporate feedback from patients, where possible, in the assessment of competence.

1.16 The Assessment Programme

The assessment programme for HSST is set within the context of the overall assessment strategy for MSC. A summary of the HSST strategy is set out in Table 1, and the detailed assessment programme for Clinical Scientists in HSST is shown in Table 2. Table 1 also shows the methods by which each component is assessed.

The HSST assessment programme is designed to capture evidence of the Clinical Scientist's mastery of the three main components of HSST, reflecting the five domains of GSP.

1. Clinical/scientific skills, and values, behaviours and attitudes relating to professionalism and the delivery of scientific/clinical services (Domains 1 and 3).
2. Scientific content (Domain 2).
3. Contribution to research, innovation and leadership in healthcare science (Domains 4 and 5).

The purpose of the assessment programme is to:

- provide evidence of satisfactory acquisition and application of knowledge, skills, experience and professionalism relevant to practice;
- enable each Clinical Scientist in HSST to demonstrate readiness to progress through the training programme and generate feedback to inform progress and learning needs;
- help to identify Clinical Scientists in HSST who may be in difficulty and who may need additional support;
- provide evidence to inform an annual progression review and the completion of the workplace-based assessment component of HSST;
- gather evidence that would assure the public that the Clinical Scientist in HSST is ready for independent professional practice as a Consultant Clinical Scientist.

Approach and Methods of Assessment

Assessment for HSST is a blend of academic, professional and workplace-based assessments, which together provide evidence of the achievement of learning outcomes, clinical/scientific competence and the progression of the Clinical Scientist in HSST through to completion of training. All assessments are aligned to the curriculum and the domains of GSP. There are two routes through the HSST assessment programme to accommodate different requirements across the sciences: Route 1 is for Clinical Scientists in the Physiological Sciences, Physical Sciences and Biomedical Engineering, and Clinical Bioinformatics, and Route 2 is for Clinical Scientists in the Life Sciences. Table 1 shows that Clinical Scientists following Route 1 will complete assessments relating to the professional doctorate, an assessment of clinical skills, the workplace-based assessment programme and the ICS project. Clinical Scientists following Route 2 will be assessed through the Fellowship Examination of the Royal College of Pathologists (FRCPath), the workplace-based assessment programme (with an option to take selected modules or the entire professional doctorate) and the ICS project.

Aim of the Innovation in Clinical Science Project

The aim of the ICS project is to allow Clinical Scientists in HSST to demonstrate the achievement of the learning outcomes of the ICS set out below by:

1. conceiving an innovation[2] in healthcare science that has the potential to make a positive contribution to service delivery, patient experience, patient outcomes, health economics, or any other aspect of healthcare. The Clinical Scientist's innovation should be at doctoral level and therefore must be original and make a new contribution to knowledge. It must not draw directly from work they may have submitted previously as part of a Master's degree or PhD – although the ICS project may contribute to the HSST professional doctorate or FRCPath dissertation;
2. undertaking a critical review of the literature considering relevant research in order to develop the rationale for the innovation;
3. undertaking a feasibility study, including consultation with stakeholder groups;
4. preparing and planning for implementation;
5. leading implementation and evaluation;
6. drawing realistic and evidence-based conclusions about the potential contribution and feasibility of the innovation.

Learning Outcomes from the ICS Project in the HSST Programme

The ICS project represents one component of the overall assessment strategy for the HSST programme that must be passed in order to receive the Certificate of Completion of Higher Specialist Scientist Training (CCHSST) from the NSHCS. All Clinical Scientists in HSST (including those taking the FRCPath route to completion of HSST) will need to complete the ICS. The project is designed to support the independent learning and demonstration of achievement of the following learning outcomes grouped under three areas, which reflect key components of the GSP syllabus as set out in the HSST curriculum.[3]

Professionalism and Professional Development (Domain 1)

By the end of the ICS project the Clinical Scientist in HSST will be able to demonstrate that they have:

- gained critical insight and professional understanding of the conceptual, ethical, value-based and analytical frameworks that underpin professional practice and their relationship to *Good Scientific Practice;*
- enhanced their skills and confidence to enable them to operate effectively and creatively within a healthcare science setting and the wider, diverse and changing healthcare environment.

Leadership and Quality Improvement in the Clinical and Scientific Environment (Domains 1, 2 and 5)

By the end of the ICS project the Clinical Scientist in HSST will be able to demonstrate that they have:

- broadened, built and applied their knowledge and skill base so that they are prepared for more senior, leadership roles within healthcare science and the wider healthcare environment where they will have responsibility as a future leader and team member for setting the policy, strategic direction, leadership and quality performance of their service and organisation to provide patient centred, high quality, compassionate patient treatment;
- lead a quality improvement programme/s within their clinical environment, using the knowledge, skills and experience of organisational leadership which demonstrate the behaviours and attitudes described in the current frameworks and models of excellent leadership.

[2] Defined as *'An idea, service or product, new to the NHS or applied in a way that is new to the NHS, which significantly improves the quality of health and care wherever it is applied.'* Improvement & Efficiency Directorate, Innovation and Service Improvement (2011, p9). *Innovation, Health and Wealth: Accelerating Adoption and Diffusion in the NHS*. Department of Health.

[3] The domains indicated in the table relate to the AHCS's *Good Scientific Practice* document (http://ahcs.flinthosts.co.uk/wordpress/wp-content/uploads/2013/09/AHCS-Good-Scientific-Practice.pdf). Within every HSST curriculum is the detailed GSP syllabus that contextualises GSP to the level and practice of the Clinical Scientist in HSST.

Improving Outcomes for Health and Social Care (Domain 4)
By the end of the ICS project the Clinical Scientist in HSST will be able to demonstrate that they have:

- built on and developed the knowledge, skills and experience of research and innovation methodology to demonstrate the high level skills required to undertake doctoral level research.
- the criticality to explain the process, barriers and enablers for publication and implementation of research and innovation findings.

Overview of the ICS Project

The innovation may be developed from work that the Clinical Scientist in HSST has submitted as part of the professional doctorate, or FRCPath, or other HSST work, in consultation with their clinical supervisor. It is envisaged that completion of the ICS project will consist of the following stages**.**

Stage 1 *Conception*: identify innovation, literature review, refine innovation and rationale.

Stage 2 *Feasibility*: consultation with stakeholders, financial planning, implementation, plan, analysis of limitations and constraints.

Stage 3 *Pilot testing*: critical analysis and evaluation, reformulation of innovation.

Stage 4 *Assessment*: preparing for the ICS project assessment.

Clinical Scientists in HSST will not pass or fail the ICS project based on the success, or otherwise, of the innovation pilot alone, as it is recognised that innovations may succeed and fail due to factors that are outside the control of the Clinical Scientist. Similarly, it is recognised that Clinical Scientists are operating in a rapidly changing healthcare context and that the rationale for the innovation, or the innovation itself, may be superseded during the course of the project. The chief assessment criteria will therefore relate to the quality of the Clinical Scientist's insight into innovation and leadership in healthcare science, and the appropriateness of the conclusions drawn from their feasibility and pilot studies.

Annual Progression Review

It is a shared responsibility between the Clinical Scientist, their educational supervisor and the NSHCS to monitor and review satisfactory completion of all assessments. At the end of each year there will be a formal progression process that will consist of a meeting between the Clinical Scientist in HSST and their educational supervisor (Annual Progress Review; APR), and a formal meeting of the Annual Progression Review Board (APRB). These two processes will be overseen by the NSHCS and will be the means by which eligibility to progress through the five-year programme will be judged. As a summary of the processes:

- the APR will be conducted by the educational supervisor, using documentation, guidance, criteria and standards that are common across specialisms. The purpose of the APR is to discuss the Clinical Scientist's experiences and perceptions of progress, and to scrutinise evidence of the Clinical Scientist's performance in the workplace to enable the educational supervisor to make a recommendation to the APRB about progression. This may include a

recommendation that additional support is required. A progression recommendation will also take into account any issues regarding the completion of HSST in a non-linear way, including consideration of equality and diversity issues.

- an APRB meeting will be convened for each HSST specialism and will involve representation from the NSHCS, the relevant professional body/bodies, Consultant Clinical Scientists and a lay representative. The role of the Board will be to review the recommendations from educational supervisors, the assessment results and any additional feedback from the providers of the professional doctorate (Route 1) or FRCPath (Route 2), the important value judgements made as part of MSF, and to complete a formal scrutiny of the evidence held on the OLAT. The purpose of the APRB is to ensure that the Clinical Scientist in HSST has demonstrated sufficient evidence of achieving the learning outcomes and competences appropriate to the stage of the programme, and to confirm progression to the next year of training. Where the APRB is not able to confirm progression, the NSHCS will, with the guidance of the APRB representatives and the Clinical Scientist's educational supervisor, facilitate the implementation of a remediation and support process or, exceptionally, a HSST exit support strategy (which would require a review of evidence that the remediation and support process had not achieved the outcomes as specified by the APRB).

Table 1: Summary of HSST assessment strategy

Programme component	Route[1]	Assessment components	Assessment tool/s	Administrative responsibility[2]	Component weighting
Mastery of scientific content	**1**	Professional doctorate (PD)	As required by the HEI provider of the PD	HEI	100%; must pass PD or FRCPath to receive the Certificate of Completion for HSST from the NSHCS
	2	FRCPath, with an option to take selected, or all, components of the PD[3]	FRCPath	RCPath	
Mastery of clinical skills, values and behaviours	**1**	Workplace-based assessment (WPBA) Clinical skills assessment	Multiple WPBAs OSFA/OSCSA[4]	Workplace, recorded on OLAT and monitored by NSHCS NSHCS (in collaboration with Medical Royal Colleges [MRCs] & Professional Bodies [PBs])	100%; must have evidence of satisfactory completion of all WPBAs, and gain a 'Pass' in the OSFA/OSCSA or FRCPath to receive Certificate of Completion for HSST from the NSHCS
	2	WPBA FRCPath	Multiple WPBAs FRCPath	Workplace, recorded on OLAT and monitored by NSHCS RCPath	
Contribution to innovation, service improvement, patient safety or quality management in healthcare science	**1**	Innovation in Clinical Science (ICS) project	Short report, plus presentation to multiprofessional panel	NSHCS to administer, in collaboration with MRCs and PBs	100%; must pass component to receive Certificate of Completion for HSST from the NSHCS
	2	Contribution to innovation, service improvement, patient safety, or quality management in healthcare science	Option to (1) complete as part of FRCPath Part 2 (report and presentation to Penultimate Progression Review Board) **or** (2) complete ICS project as for non-Life Sciences[5]	(1) RCPath or (2) NSHCS to administer, in collaboration with MRCs and PBs	

[1] Route 1 is for Clinical Scientists in the Physiological Sciences, Physical Sciences and Biomedical Engineering and Clinical Bioinformatics; Route 2 is for Clinical Scientists in the Life Sciences.

[2] Where assessments are created and delivered by the NSHCS's partners, the School will request access to data about the performance of these assessments, and data on individuals' assessment outcomes.

[3] Clinical Scientists taking the FRCPath route through HSST have the option of completing any of the modules offered as part of the professional doctorate. However, in successfully completing the FRCPath (and the ICS project, which may be part of the FRCPath), the Clinical Scientist has demonstrated that they have achieved the learning outcomes of the professional doctorate.

[4] Work is ongoing to establish whether an OSFA (Objective Structured Final Assessment) or OSCSA (Objective Structured Clinical Skills Assessment) is the best fit to the assessment purpose.

[5] Clinical Scientists in Life Sciences who choose not to undertake the innovation component as part of FRCPath will be required to complete the ICS project, which will require the production of a short report and presentation to a multiprofessional panel.

Table 2: HSST assessment road map for Life Sciences

Stage	Year	Professional Doctorate	FRCPath	Formative assessment	Summative assessment	Annual Progression Review (APR)/Annual Progression Review Board (APRB)	Completion
1	1	OPTIONAL; completion in part or whole to be determined by the CS in consultation with their educational supervisor	Part 1[3]	As available for FRCPath and in workplace	12 DOPS[1]; 1 MSF; FRCPath Part 1	APR, plus APRB[2]	APRB, to include completion of FRCPath Part 1 if completing in Year 1
	2			As available for FRCPath and in workplace	12 DOPS[1]; 1 MSF; FRCPath Part 1	APR, plus APRB[2]	APRB, to include completion of FRCPath Part 1 if completing in Year 2
2	3		Part 2[3]	As available for FRCPath and in workplace	8 OCEs; 4 CBDs[1]	APR, plus APRB[2]	APRB
	4			As available for FRCPath and in workplace, plus local assessment of contribution to innovation, service improvement, patient safety or quality management in healthcare science (to be completed as part of FRCPath Part 2 **or** ICS project for non-Life Sciences)	8 OCEs; 4 CBDs[1]; 1 MSF; Innovation contribution	APR, plus APRB[3]	APRB, including assessment of innovation as part of FRCPath Part 2 or ICS project for non-Life Sciences
	5			As available for FRCPath and in workplace	FRCPath Part 2 exam; 1 MSF	Final Review Board (FRB)[3]	FRB, to include pass FRCPath Part 2
NSHCS awards the Certificate of Completion upon submission of evidence of successful completion of the WPBA programme, the FRCPath, and innovation component (as part of FRCPath or ICS project)							

[1] The number of workplace-based assessments is indicative only; as is the scheduling of DOPS, CBDs and OCEs across Stages 1 and 2. There is no requirement to complete a minimum number of WPBAs, or any requirement to complete certain assessments at particular stages of the programme. Clinical Scientists in HSST should discuss and negotiate with their educational supervisor, as part of the development of the training plan, the type and number of assessments that will be most appropriate to demonstrate achievement of the learning outcomes.
[2] Criteria for progression to be determined in consultation with stakeholders.

[3] Clinical scientists taking FRCPath should aim to take Part 1 during Year 1 or Year 2, and Part 2 during the remaining years.

The Online Learning and Assessment Tool (OLAT)

Every Clinical Scientist in HSST will need to develop and maintain an electronic learning portfolio (e-portfolio) to document and provide evidence of their progress through the training programme. The framework for the e-portfolio will be the OLAT, which is provided by the NSHCS. The OLAT will enable the Clinical Scientist in HSST to record all workplace-based assessments, supervisors' reports, multisource feedback outcomes and reflections on their progress, learning experiences and participation in learning events, such as journal clubs and national and international conferences, etc. The OLAT is also designed to facilitate and encourage ongoing dialogue between the Clinical Scientist in HSST and their supervisor about the Clinical Scientist's personal and professional development at consultant-level practice. Clinical Scientists in HSST will be given access to OLAT upon enrolment.

SECTION 2: GOOD SCIENTIFIC PRACTICE SYLLABUS: A COMMON COMPONENT OF ALL HSST CURRICULA

This syllabus is a common component of all Higher Specialist Scientist Training (HSST) curricula and must be followed throughout the whole training period, with engagement at the appropriate level, depending on the stage of training.

The syllabus is divided into five domains. These align with the five domains of *Good Scientific Practice* (GSP):

- Domain 1: Professional Practice
- Domain 2: Scientific Practice
- Domain 3: Clinical Practice
- Domain 4: Research, Development and Innovation
- Domain 5: Clinical Leadership

Each domain contains an overall learning objective, which is described by a number of competence statements. These are presented as:

- knowledge to be acquired and applied;
- practical skills to be demonstrated;
- attitudes and behaviours to be consistently displayed.

Each competence statement is supported by indicative content. Cross-referencing of the syllabus to the GSP standards is included.

Domain 1: Professional Practice

Topic	Professional Practice	GSP reference
Learning objective	By the end of the training programme Clinical Scientists in HSST will be able to exercise personal responsibility and work largely autonomously, taking the initiative in complex and unpredictable situations and performing a range of clinical/practical skills consistent with the roles and responsibilities of a Consultant Clinical Scientist.	
Knowledge	By the end of the training period Clinical Scientists in HSST will be able to: 1. Justify the importance of placing the patient at the centre of care and considering services from a user's point of view. • Compare and contrast models of promoting patient-centred care and how to ensure that the wishes, beliefs, concerns, expectations and needs of patients are respected. • Critique studies that demonstrate the benefits of patients sharing in decision making on their health. • Defend the rights of patients and carers to treatment without discrimination, which includes age, gender, illness, disability, health inequality, cultural and social inequality, diversity. • Critique the evidence base, principles and practice of patient-centred interviewing and examination, including the patient perspective. • Explain and justify why it is important to develop and maintain appropriate patient–professional relationships, and evaluate a range of situations that have had a positive and negative impact on those relationships. • Explain and justify why it is important to have a holistic approach to the patient, recognising that there may be social as well as medical aspects to their management. • Summarise local guidelines for responding to complaints from patients and/or carers and evaluate the impact of these systems in promoting patient-centred care. • Recognise the importance of gathering and responding to patient-derived data. • Summarise local guidelines for responding to unacceptable behaviour by patients, carers, or relatives, including harassment, bullying, or violence, and identify the strengths and weaknesses of these guidelines. • Defend the importance of public engagement in science and its role in health and society. 2. Critically evaluate the importance of keeping professional knowledge and skills up to date and work within the limits of personal competence. • Create, interpret and construct new knowledge of scientific, clinical and professional developments in an area of practice. • Justify the rationale for engaging in continuing personal and professional development (CPPD) and critical reflective practice, and evaluate a range of methods for recording, learning, and developing and evaluating action plans. • Critique the evidence base underpinning CPPD with respect to the Consultant Clinical Scientist, the clinical service and	1.1.1 1.1.9 1.1.10 1.2.1

Topic	Professional Practice	GSP reference
	the patient. • Recognise the limits of their own competence and scope of practice in order to make informed and reasonable decisions. • Recognise the limits of competence and scope of practice for those for whom they are responsible and evaluate methods for managing difficult and sometimes unpredictable situations. • Critique methods for evaluating audit and review information on performance of self and those for whom they are responsible. 3. Critique the ethical, legal and governance requirements arising from working at the level of Consultant Clinical Scientist across a range of complex situations. • Evaluate the principles, guidance and law with respect to medical ethics, patient confidentiality, informed consent, equality and diversity, child protection, use of chaperones. • Justify the role of the Consultant Clinical Scientist in the definition and monitoring of compliance of standards of practice that are ethical and legal, often involving complex issues. • Defend the purpose of clinical governance and the requirements of the employing organisation. • Evaluate the role of clinical audit in demonstrating compliance with local governance requirements. • Evaluate the effectiveness of the Standards of Proficiency and Standards of Conduct, Performance and Ethics of the Health and Care Professions Council (HCPC). 4. Summarise and critique the evidence to support the high levels of probity required when working at the level of Consultant Clinical Scientist as a clinical leader. • Evaluate the importance of verifying information in reports and documents, including research. • Analyse and justify the HCPC Standards of Conduct, Performance and Ethics. • Appraise approaches to procedures for identifying and reporting critical incidents. • Appraise approaches to procedures for receiving and responding to complaints. • Summarise the procedures to follow if they are cautioned, charged with a criminal offence, suspended, or have restrictions placed on their personal scientific, clinical, or professional practice. 5. Understand the importance of personal health and wellbeing in order to ensure that personal performance and judgement is not affected by their own health. • Responsibilities to the public and how these may be compromised by poor health. • Effects of stress on professional performance. • Role and availability of occupational health and other support services. 6. Analyse NHS organisation, policy and practice as it affects the provision of healthcare, healthcare science and the patients and populations it serves.	1.1.3 1.1.4 1.1.5 1.1.7 1.2.5 3.1.5 3.1.17 1.1.3 1.2.5 3.1.1 3.1.2 3.1.3 3.1.17

Topic	Professional Practice	GSP reference
	• Justify the contribution the NHS makes to assure the health of the nation. • Critically evaluate the current structure of the NHS in the relevant jurisdiction of the UK and compare and contrast with alternative models of health delivery in Europe or internationally. • Evaluate current national and local policy issues as they affect the service provided by Clinical Scientists and the healthcare science workforce. • Justify the role of population screening, shared care and self-care in diagnosing and managing disease from the perspective of the patient and the healthcare provider. • Identify and explain the finance issues facing providers of healthcare at national and local level in general, especially budgetary management and commissioning and the effect on healthcare provision. • Evaluate the effectiveness of the role of central government health regulatory and quality improvement agencies across the devolved NHS. • Explain and analyse the roles and relationships of Health Education England (and equivalents elsewhere in the UK), Modernising Scientific Careers, Academy for Healthcare Science, National School of Healthcare Science, Council of Healthcare Science in Higher Education, Medical Royal Colleges, specialist societies, postgraduate deans and deaneries, and patient organisations in the provision of healthcare science. • Summarise the management structure and key contacts of the employing organisation (including chief executive, medical directors, clinical directors) and evaluate the structure with respect to providing high-quality patient care. • Summarise the management structure of and key contacts with relevant major service users and providers and the contribution to the provision of high-quality patient care. 7. Discuss theories of teaching and learning to underpin the role of the healthcare scientists in education as a teacher or trainer, according to the best contemporary clinical and educational standards. • Critically review the evidence base and apply knowledge of teaching, learning and assessment within the clinical and scientific work base to design, deliver and evaluate education and training programmes that meet the best clinical and educational standards.	1.2.3 1.2.4 1.2.5 1.1.8 1.1.9 1.2.2 1.1.3 3.1.3 1.4.1 1.4.2
Practical skills	By the end of the training period the Clinical Scientist in HSST would be expected to apply in practice a range of clinical skills and critically reflect on their performance and will be able to: 1. Critically apply their understanding of professional practice with conduct that places the patient at the centre of care in a manner that promotes patient wellbeing and self-care through: • Developing and maintaining appropriate patient–professional relationships in practice. • Working with patients and carers in a respectful and non-discriminatory manner. • Taking a clinical history and using the information as part of the clinical decision-making process. • In the context of patient-centred care, giving and receiving feedback sensitively to or from a peer or colleague using an appropriate feedback model.	1.1.2 1.1.10 1.1.11 3.1.10 3.1.11 1.1.4 1.1.5 3.1.5

Topic	Professional Practice	GSP reference
	2. Critically apply their understanding of the role and importance of CPPD to ensure that professional knowledge and skills are being kept up to date through: • Maintaining personal records of CPPD, providing evidence of critical reflection, including action planning, with respect to clinical practice and professional development in a form suitable for audit by a professional body or regulator, and demonstrate continuing fitness to practise. • Recording critical reflective notes justifying how participation in CPPD has contributed to learning and led to improvements in personal and service performance. • Monitoring their own performance by evaluating the outcome of audit and feedback from a range of sources. • Encouraging a culture in which innovation and developments are identified, discussed, evaluated and potentially introduced to improve service delivery. • Encouraging staff and colleagues to recognise learning opportunities in the workplace and where necessary supporting them to obtain and use study leave to participate and contribute to additional learning experiences, including skills training courses and conferences.	1.1.11 3.1.1 3.1.2 3.1.17
	3. Respond to the ethical, legal and governance requirements arising from working at the level of Consultant Clinical Scientist, critically applying accrued knowledge and evidence by: • Recognising the factors influencing ethical decision making, including religion, personal and moral beliefs, cultural practices, making informed decisions and supporting colleagues. • Justifying the use and sharing of information in accordance with the regulations, encouraging such behaviour in other members of the healthcare team and taking action where breaches of the guidelines may have occurred. • Justifying the use and promotion of strategies to ensure confidentiality is maintained, e.g. removal of patient names where appropriate, reviewing and analysing published literature, and considering the impact of such measures on the clinical service. • Recognising the problems posed by disclosure in the public interest, without consent of the patient. • Ensuring patients, relatives and carers are aware of the need for information distribution within members of the immediate healthcare team. • Using appropriate methods of ethical reasoning to justify a decision where complex and conflicting issues are involved. • Performing and evaluating clinical audit to assess compliance with local governance requirements, taking remedial action as required.	1.1.8 1.2.2 1.2.3 1.2.4 1.2.5 5.1.3
	4. At all times act in a manner that demonstrates probity in all aspects of professional practice by: • Working in accordance with GSP with conduct that at all times justifies the trust of patients and colleagues and that maintains public trust in healthcare science. • Writing honest and accurate reports and signing documents appropriately. • Applying honesty and accuracy about personal qualifications, experience and position in the scientific community.	1.1.8 1.1.11

Topic	Professional Practice	GSP reference
	• Acting honestly with respect to written and verbal information provided to any formal or legal enquiry, including recognition of the limits of scientific knowledge and experience. • Creating and justifying open and non-discriminatory professional working relationships with colleagues and using critical reflection to review personal behaviour and response to challenging issues. • Responding in an open, constructive and timely manner to critical incidents or complaints about their own or team performance influencing the response, and using critical reflection to review personal behaviour and response to challenging issues. • Taking appropriate action if they suspect they or a colleague may not be fit to practise, putting patient safety at the forefront of practice. • Practising within the HCPC Standards of Conduct, Performance and Ethics. 5. Make appropriate judgements to ensure they limit their work or stop practising if performance or judgement is affected by their health by: • Recognising when personal health takes priority over work pressures, seeking appropriate advice and support, and taking appropriate action. • Developing and maintaining appropriate coping mechanisms for a range of potential issues, including stress, seeking help if appropriate and evaluating the impact of an intervention. 6. Demonstrate professional practice that is consistent with relevant current NHS policy and practice by: • Identifying and evaluating existing and new NHS policy and advice relevant to the area of practice, the implications of these for personal and team practice, and the impact on patients. • Using a range of communication skills to lead and contribute to discussions and gain agreement in a range of situations, including within the MDT, and steps that need to be taken to align service delivery with the most recent NHS policy and advice. • Sharing information and advice with peers in order to encourage a consistent approach to the implementation of NHS policy and advice. • Evaluating, documenting and justifying any local decisions that are taken that mean that it is not possible to align service delivery with NHS policy and advice. 7. Contribute to the education and training of colleagues planning, delivering and evaluating teaching on the basis of student and peer feedback and active self-reflection by: • Using a range of teaching methods, including lecture-based, small group teaching and practical skills teaching, appropriate to the learners. • Planning, delivering and evaluating a range of assessments appropriate to learning outcomes in the three domains of learning.	1.1.4 1.3.1 2.1.1 2.1.6 1.4.1 1.4.2

Topic	Professional Practice	GSP reference
Attitudes and behaviours	By the end of the training period the Clinical Scientist in HSST would be expected to demonstrate the attitudes and behaviours necessary for the role of a Consultant Clinical Scientist and will be able to:	
	1. Apply evidence-based personal and team professional practice that places the patient at the centre of care.	1.1.9 1.1.10
	• Act in accordance with the principles and practice of patient-centred care, regularly reflecting on personal practice and revising judgements and changing behaviour in light of new evidence. • Critically assess and evaluate personal and team-related performance in the context of evidence-based patient care, identify areas of good practice and make improvements where necessary. • Seek feedback from patients on their own and the team's performance and adapt practice accordingly.	1.1.11 1.1.4
	2. Apply knowledge, experience and deep reflection to identify personal development needs using a range of tools, and develop and update action plans to ensure support CPPD.	1.1.11 1.3.1
	• Apply the skills of deep reflection to identify personal development needs to transform and maintain up-to-date practice. • Act as a self-motivated professional scientist being willing to learn from self and others, responding positively to constructive and meaningful feedback. • Create a culture that values CPPD to enable staff under supervision and supports them in recognising their strengths and identifying areas for improvement.	1.3.6
	3. Display a professional commitment to ethical practice, consistently operating within national and local ethical, legal and governance requirements.	1.1.11 1.2.1
	• Accept professional ethical standards and encourage informed debate and critical reflection within healthcare teams. • Seek advice in the event of ethical dilemmas in areas including disclosure and confidentiality. • Respect requests from patients that information should not be shared, unless this puts the patient or others at risk of harm. • Share information about patient care with the patient unless they have expressed a wish not to receive such information.	
	4. Apply the principles of GSP and the professional standards, performing to the highest standards of personal behaviour in all aspects of professional practice.	1.1.3 1.1.8
	• Recognise the importance of leading by example in setting high standards of personal behaviour, and in acting with openness, fairness and integrity, listening to the views of others. • Accept the requirements for professional regulation. • Promote professional attitudes and values at all times.	1.1.9 1.1.11 1.2.2

Topic	Professional Practice	GSP reference
	• Recognise the need to be truthful and to admit to and learn from errors. • Accept the requirement to inform the statutory regulator if they are cautioned, charged with a criminal offence, suspended, or have restrictions placed on their personal scientific, clinical, or professional practice. 5. Consistently operate in accordance with relevant current NHS policy and practice. • Recognise the need to identify and assess the implications of NHS policy and advice for service organisation and delivery of high-quality services. • Consult with peers and service users as part of obtaining agreement to align services with NHS policy and advice.	1.1.3 1.3.1

Domain 2: Scientific Practice

Topic	Scientific Practice	GSP reference
Learning objective	By the end of this stage of training the Clinical Scientist in HSST will be able to assess, plan, deliver and evaluate high-quality scientific services in a safe and secure working environment.	
Knowledge	By the end of the training period the Clinical Scientists in HSST will be able to: 1. Analyse the strengths and weaknesses of current and new scientific investigations and methods used in the diagnosis, monitoring and treatment of clinical disorders relevant to the area of practice. • Evaluate the scientific basis of investigations and procedures. • Discuss the impact of genomics and personalised medicine on health and healthcare science. • Discuss the impact of clinical bioinformatics on health and healthcare science. • Critique the application of scientific investigations and procedures in protocols and patient pathways. • Summarise the strengths and weaknesses of current service provision, in terms of both performance characteristics and clinical application. • Compare alternative approaches and/or improvements to investigations and procedures. • Use scientific principles and reasoning to assess, plan and design new or improved investigations or procedures. • Analyse the role of peer opinion in refining ideas and plans. • Evaluate new and emerging technologies and their potential to improve healthcare and healthcare science. 2. Critique the application of evidence-based practice to the optimisation of scientific investigations and methods. • Summarise and critically review the scientific literature in the area of expertise. • Evaluate the principles and practice of evidence-based medicine relevant to the area of practice. • Appraise approaches to meta-analyses, systematic reviews, clinical trials, cohort studies and related approaches used in this field. • Critique methods for searching, identifying, ranking and evaluating scientific evidence. • Justify the rationale for the use of methods to evaluate and optimise the performance of scientific investigations. • Defend methods for comparing performance of two or more scientific investigations or procedures. • Appraise relevant statistical measures applied to research publications. 3. Evaluate and apply information and communication technology (ICT) to facilitate service delivery and development in relevant areas of healthcare science. • Justify the application of ICT in the area of practice.	2.1.1 2.1.3 1.1.5 2.1.1 2.2.9

Topic	Scientific Practice	GSP reference
	• Evaluate the impact and development of bioinformatics on the practice of healthcare and healthcare science. • Discuss the requirement for data confidentiality, security and protection. • Evaluate the function and operation of the Hospital Information System. • Evaluate and justify the function and operation of linked information systems (e.g. Laboratory Information System) and middleware linking equipment to information systems. • Identify the benefits and barriers with respect to personal computer hardware and software. • Appraise the appropriate use of electronic mail and social networking technology in the context of professional role. • Summarise how electronic literature searching (e.g. PubMed) and storage can be used within the clinical environment. • Access and judge specialist websites and databases relevant to their professional role. • Appraise the range of statistical packages relevant to the area of expertise, including bioinformatics where appropriate.	
	4. Justify the principles and practice of quality control, external quality assessment and quality management as applied to relevant areas of healthcare science.	
	• Evaluate the purpose and operational requirements of internal quality control and external quality assessment and defend the systems currently in place. • Defend the principles and practice of quality management and, where appropriate, service accreditation. • Critique the required quality standards and monitoring of performance against those standards, and the contribution standards make to the provision of a high-quality service.	2.3.1 2.3.2
	5. Justify the role of audit and the audit cycle and explain how it is used as a tool to facilitate continuous quality improvement.	
	• Evaluate the principles and practice of scientific and technical audit, including examples of audit improving practice. • Identify aspects of service delivery that should be subjected to regular scientific or technical audit and justify the selection. • Appraise audit reports, including recommendations for improvement and the impact on the service when implemented. • Critically review examples of relevant scientific and technical audits performed locally or elsewhere, and the impact on service delivery.	2.2.2 2.3.4 3.1.17
	6. Summarise and interpret health and safety legislation and guidance for the workplace.	
	• Defend the importance of health and safety within the workplace with respect to employees, employers, patients and the public. • Appraise current legislation and guidelines relating to health and safety in the workplace, including, as appropriate to role: biological specimen handling; COSHH; RIDDOR; radioactivity; fire safety; electrical safety; moving and handling;	2.2.6 2.2.7 2.2.8

Topic	Scientific Practice	GSP reference
	display screen equipment. • Justify local health and safety guidance. • Justify the principles and practice of infection control, including the impact of reducing infection rates on patients. • Critically review procedures involved in risk assessment and risk management and the impact on quality and safety. • Summarise the policy and procedures associated with critical incident reporting and the impact on service improvement and the culture of the organisation.	
Practical skills	By the end of the training period the Clinical Scientist in HSST would be expected to apply in practice a range of clinical skills and critically reflect on their performance and will be able to: 1. Develop and evaluate investigative strategies/procedures/processes that take account of relevant clinical and scientific evidence and other sources of information. • Critically appraise the scientific credentials and validity of existing investigations and procedures. • Critically appraise the way in which scientific investigations and procedures are used in strategies and protocols for the diagnosis, monitoring and treatment of defined clinical disorders. • Work in partnership with peers and service users to apply scientific principles and reasoning to plan, develop and assess the scientific validity and clinical effectiveness of new or improved investigations, procedures, strategies, or protocols. 2. Critique the selection and application in practice of scientific investigations in defined clinical situations using quantitative and/or qualitative methods. • Reflect on proficiency in the performance of routine and non-routine scientific and technical procedures used in defined clinical areas of service and develop action plans to improve performance. • Compare their own proficiency with experts in the technical validation of data derived from scientific and technical procedures. • Justify the selection and application of scientific and technical procedures to comply with clinical requests and evaluate the efficacy of this on their own practice. • Apply the principles and practice of evidence-based medicine to critically appraise the effectiveness of scientific and technical investigations and procedures. • Use and evaluate statistical measures such as likelihood ratio, AUC-ROC, number needed to treat/harm. 3. Master the use of ICT in relevant areas of healthcare science. • Use ICT for all applications in the area of practice. • Justify the rationale and conform to requirements for data confidentiality, protection and security.	2.1.1 2.1.3 2.2.2 2.1.2 2.1.3 2.1.4 2.2.1 2.2.3 2.2.4 2.2.5 2.2.9

Topic	Scientific Practice	GSP reference
	• Use and apply the Hospital Information System, appropriate linked information systems, middleware and instrumentation hardware and software. • Master the use of personal computers and relevant programmes, including word processing, databases, PowerPoint, internet and email, electronic literature searching and storage. • Use relevant statistical packages for data handling, including methods for assessing clinical effectiveness and, where appropriate, basic bioinformatics, and interpret the results/outcomes.	
	4. Set, apply and maintain quality standards and related quality control, assessment and management techniques to assure the validity of scientific and technical investigations, adapting and developing systems as required. • Critically appraise relevant internal quality control and external quality assessment data and draw conclusions about quality performance. • Present and actively participate in meetings that review quality performance criteria, justifying and defending solutions for improvement, and adapting and implementing corrective action as required. • Contribute to quality management, justifying the definition of standards and monitoring of performance against those standards, and adapting and developing systems as required. • Prepare and review regular quality management reports, including, where appropriate, linkage with service accreditation, adapting and developing systems as required.	2.1.6 2.3.1 2.3.2 2.3.3
	5. Perform scientific and technical audit to determine that investigations and methods are fit for purpose, justifying and monitoring the impact of recommendations. • Perform scientific and technical audit of the performance and effectiveness of scientific investigations and service delivery in accordance with local guidelines. • Identify, critically review and communicate the outcomes of scientific and technical audits performed by others in relevant areas of scientific investigation and service delivery, making recommendations for changes and monitoring the impact of those recommendations. • Devise, develop, perform and evaluate scientific and technical audits in their own area of expertise, reporting the outcomes, including learning, modifications and the impact on service delivery resulting from the audit.	2.2.2 2.3.4 3.1.17
	6. Promote the importance of health and safety standards in the workplace and identify and justify actions that will improve health and safety and reduce the risk of infection. • Perform workplace role complying with current legislation and guidelines relating to health and safety in the workplace. • Adhere to local health and safety guidance. • Perform workplace role in accordance with the control of infection regulations. • Perform risk assessment and risk management of health and safety in the workplace, make recommendations and	2.2.6 2.2.7 2.2.8

Topic	Scientific Practice	GSP reference
	monitor the impact of the recommendations. • Comply with requirements for critical incident reporting, reflecting on and learning from the occurrence and outcome of critical incidents, adapting practice as necessary. • Investigate and respond to reported health and safety incidents in the workplace.	
Attitudes and behaviours	By the end of the training period the Clinical Scientist in HSST would be expected to demonstrate the attitudes and behaviours necessary for the role of a Consultant Clinical Scientist and will be able to: 1. Evaluate current debates in the field and critically appraise scientific developments in the area of expertise. • Understand and utilise a range of approaches to identify, critically review and learn from new and emerging scientific literature in the area of expertise. • Make appropriate judgements in order to search and archive scientific literature. • Engage in critical dialogue on the latest scientific developments (e.g. journal clubs). • Develop planning and critical appraisal skills in self and clinical team through peer review, shared exercises and case review. 2. Apply evidence-based scientific practice as a means of improving patient investigation and care, where necessary revising judgements and changing behaviour in light of new evidence. • Critically evaluate the application of the principles of evidence-based medicine across areas of expertise. • Apply rigorous scientific critiques to the evaluation of data related to clinical practice in the support of clinical decision making and patient management. 3. Evaluate and use ICT to improve service quality and delivery. • Use new ICT, changing practice and behaviour as appropriate. • Justify the need to balance data confidentiality, security and protection, and the sharing of data with relevant stakeholders, including patients, to ensure high-quality, patient-centred care. 4. Listen, influence and lead continuous quality improvement in scientific services. • Justify the importance of continuous quality improvement using the available evidence base. • Influence, lead and support staff in the department/organisation to create a culture that recognises the importance of quality and quality improvement in the delivery of scientific services. • Justify the importance of quality control and quality assessment of all investigations and services influencing and shaping the views of others. • Create opportunities for staff to receive training in quality management by justifying the impact of training on service	1.1.5 2.1.6 3.1.5 1.1.5 2.1.5 2.1.6 2.2.9 2.3.2 2.3.3

Topic	Scientific Practice	GSP reference
	delivery and personal development. 5. Understand and utilise audit as a tool to evaluate and optimise scientific services. • Defend scientific and technical audit as a valid tool to improve scientific investigation and service delivery. • Identify training needs of self and others and develop training plans to enable audit to proceed. • Communicate outcomes of scientific and technical audits with peers, managers and other interested parties, persuading others to implement and/or adapt recommendations in their area of practice. 6. Establish and influence the culture of health and safety in the workplace. • Create a culture of health and safety awareness, identification and resolution of issues, and modification of systems to enhance health and safety. • Review and report on health and safety issues, sharing good practice with individuals, the team and wider organisation. • Identify, justify and create opportunities for staff to receive health and safety and first aid training, and monitor the learning and impact of the training on the individual and service.	2.2.2 2.3.4 3.1.17 2.2.6 2.2.7 2.2.8

Domain 3: Clinical Practice

Topic	Clinical Practice	GSP reference
Learning objective	By the end of this stage of training the Clinical Scientist in HSST will be able to assess, plan, deliver, interpret, report and evaluate high-quality clinical services that are targeted to meet the needs of individual and groups of patients.	
Knowledge	By the end of the training period the Clinical Scientist in HSST will be able to:	
	1. Analyse the strengths and weaknesses of the procedures required to deliver high-quality clinical practice in the investigation and management of patients.	3.1.1
	• Justify the requirement for patient consent for investigation, including patients who lack capacity, and provide advice to others.	3.1.2 3.1.3
	• Summarise the requirement to maintain patient confidentiality and respect for a patient's privacy, involving the patient appropriately, and the circumstances when disclosure is allowed.	3.1.4 3.1.5
	• Justify the rationale of clinical coding and the need for accuracy and use of medical terminology.	3.1.6
	• Analyse and justify the wider clinical consequences of clinical investigations performed and clinical advice provided.	3.1.15
	• Relate understanding of setting clinical priorities and time management for patient investigation.	3.2.1
	• Interpret emerging evidence and knowledge that adds to the clinical evidence base underpinning services provided in order to make informed judgements.	3.2.2
	• Justify the requirements for accurate record keeping and data security.	
	• Summarise the role of standard operating procedures, clinical protocols and clinical guidelines to promote a safe, patient-centred environment and underpin high-quality scientific services.	
	• Identify common sources of error, identification of risk and critical incident reporting, and analyse how this information can be used to improve services and reduce incidents and risk.	
	• Justify the importance of adopting a no blame culture for identification and investigation of error.	
	2. Relate understanding of the aetiology of relevant clinical disorders as a means of developing appropriate clinical investigations across the full range of patients accessing the clinical services of personal area of practice.	3.1.5
	• Describe the detailed causation of clinical disorders in the area of expertise and apply knowledge when selecting investigative strategies.	3.1.6 3.1.7
	• Analyse the strengths and weaknesses of existing clinical investigations and identify and critically appraise potential strategies to improve or develop new clinical investigations in the best interests of patients.	
	3. Discuss and evaluate how the results of clinical investigations may be related to defined disorders and patient	3.1.4

Topic	Clinical Practice	GSP reference
	management strategies across the full range of patients accessing the clinical services of their personal area of practice.	3.1.12
	• Summarise the use of normal limits and describe the levels of uncertainty in the outcome of clinical investigations.	3.1.13
	• Analyse patterns of data and results obtained from clinical investigations linked to defined clinical disorders.	3.2.4
	• Evaluate and justify the use of statistics and predictive values in clinical practice, recognising potential limitations.	
	• Evaluate the effectiveness of relevant clinical guidelines and patient pathways, recognising potential limitations and seeking alternatives.	
	4. Evaluate the role of the MDT in optimising clinical outcomes for individual and groups of patients.	1.3.2
	• Discuss the role of the MDT and evaluate the effectiveness of the team.	1.3.3
	• Summarise the range of MDTs supported by healthcare science and analyse the role of each team.	3.1.14
	• Justify the operational requirements for individual MDTs, evaluate the clinical effectiveness of the team and suggest areas for improvement.	3.1.16
	5. Discuss and evaluate the principles and practice of clinical audit as a tool to evaluate the effectiveness of services provided.	2.2.2
	• Principles and practice of clinical audit.	3.1.17
	• Resources available in local organisation to support clinical audit.	
	• Examples of relevant clinical audits performed locally or elsewhere.	
Practical skills	By the end of the training period the Clinical Scientist in HSST would be expected to apply in practice a range of clinical skills and critically reflect on their performance, and will be able to:	
	1. Apply in practice consistent high standards of clinical practice in the investigation and management of patients and critically reflect on their performance.	1.1.1
	• Explain and justify the recommended clinical investigations, involving the patient wherever possible.	1.1.11
	• Explain and justify the procedures for preparing samples for clinical investigation.	3.1.1
	• Master a range of clinical investigations relevant to the area of practice, complying with relevant standard operating procedures, clinical protocols and clinical guidelines in accordance with best practice.	3.1.2
	• Produce and maintain clear, accurate and legible records in accordance with the regulations/guidelines governing patient consent, confidentiality and data security.	3.1.3
	• Analyse the outcome of clinical investigation and give immediate feedback in accordance with agreed protocol.	3.1.4
	2. Plan, develop, perform, evaluate, interpret and report a range of clinical investigations to assist with the diagnosis,	3.1.5

Topic	Clinical Practice	GSP reference
	monitoring and treatment of patients, making informed judgements as necessary.	3.1.6
	• Comply with quality standards in the performance of routine and non-routine clinical investigations in the area of practice.	3.1.7 3.1.8
	• Identify and critique opportunities to develop and/or improve clinical investigations to improve patient experience and/or to add certainty to the outcome following relevant governance procedures, acting on advice and feedback from patients.	3.1.10 3.1.11 3.1.15
	• Plan, develop and critically evaluate modified or improved clinical investigations, producing valid comparative data with the existing procedure, involving the views of patients or service users.	3.2.1 3.2.2
	• Discuss outcomes, modifications, or improved clinical investigations with patients or service users before agreeing on whether to implement a change in procedure in adhering to governance processes.	3.2.3
	3. Provide advice on the clinical significance of the results of investigations, including, where appropriate, follow-up and further investigation, and reflect on the process and justify the advice given.	3.1.12
	• Interpret and report the outcomes of routine and non-routine clinical investigations in the context of the clinical presentation of individual patients, justifying the conclusions.	3.1.13 3.1.14 3.2.3
	• Provide clear and accurate written and/or verbal clinical advice on the clinical significance of investigations, having regard to the importance and urgency for patients and the underpinning evidence base.	3.2.4
	• Discuss with relevant medical and other healthcare practitioners the follow-up, further investigation and/or appropriate treatment of individual patients based on the outcomes of clinical investigations and current best practice/evidence.	
	4. Actively participate in MDT meetings that review clinical outcomes for individual and groups of patients, challenging decisions/recommendations when necessary.	
	• Use the evidence base to identify MDTs in their area of expertise that would benefit from input from a senior healthcare scientist and make arrangements for participation to influence the judgements of the team.	
	• Participate in a proactive manner in the conduct of MDTs, identifying opportunities to prepare and present clinical material, and offering and defending expert opinion and advice.	
	• Contribute to the preparation and adoption of clinical protocols and clinical guidelines, and analyse the impact on clinical practice.	
	5. Perform systematic clinical audit to critically evaluate the performance and suitability of investigations offered, share the outcome of each audit and, where appropriate, justify a modification to practice based on the audit findings.	1.3.1 1.3.2
	• Initiate, perform and communicate the outcomes of clinical audits of the effectiveness of routine and non-routine clinical investigations, considering national and local audit priorities and in accordance with the governance regulations.	3.1.14 3.1.16

Topic	Clinical Practice	GSP reference
	• Identify, critically evaluate and communicate the outcomes of clinical audits performed by others in relevant areas of clinical practice and justify a decision to adapt practice as appropriate. • In partnership with service users devise, develop, perform and critically evaluate clinical audits in their own area of expertise to identify areas of good practice and areas for improvement. • Analyse and report the outcomes of clinical audits, including learning points and modifications introduced as a result of the clinical audit.	3.2.4 1.1.11 2.2.2 3.1.17
Attitudes and behaviours	By the end of the training period the Clinical Scientist in HSST would be expected to demonstrate the attitudes and behaviours necessary for the role of a Consultant Clinical Scientist and will be able to: 1. Commit to and provide leadership in the provision of high standards of clinical practice, taking account of the political, social, technical, economic, organisational and professional environment, and act as a positive role model. • Perform the role to high standards of clinical practice, applying knowledge and evidence, making decisions and evaluating the impact of those decisions. • Monitor, evaluate and maintain clinical practice standards. • Share data on clinical practice standards with service users and managers to encourage dialogue and debate. 2. Evaluate and use new research findings and new technology to plan, develop and deliver improved clinical investigations. • Analyse and use research findings and new technology in bringing about quality improvements in clinical investigation. • Use and critically review a range of sources of information to keep up to date with clinical and scientific developments in their area of expertise. • Share ideas on improvements to clinical investigations with peers and service users, setting out the context for change and evaluating the impact of any resulting change. 3. Engage in two-way clinical liaison between those who request and those who provide clinical investigations for individual patients, using the skills of team members effectively. • Lead and promote a culture of interaction with service users and patients. • Analyse, critically review, generate and revise clinical protocols and guidelines, and evaluate how protocols and guidelines contribute to standards of clinical practice. • Train and empower colleagues to participate in two-way clinical liaison. • Initiate an audit of effectiveness of clinical liaison, identifying areas for improvement and collaborating with colleagues to bring about change. 4. Promote the importance of active participation by Clinical Scientists in MDT meetings to advise and provide a scientific	3.1.1 3.1.2 3.1.3 3.1.14 3.1.5 3.1.6 3.1.9 1.3.1 3.1.4 3.1.12 3.1.13 3.1.14 3.2.4 1.3.2

Topic	Clinical Practice	GSP reference
	perspective. • Recognise the importance of the MDT and take responsibility for ensuring appropriate and effective decision-making processes are in place. • Support and contribute to the development of multidisciplinary clinical team working and work with the team to determine scientific service priorities. 5. Advocate clinical audit as a tool to evaluate and optimise clinical services and communicate ideas and aspirations. • Support the role of clinical audit as a valid tool to improve clinical effectiveness and patient care. • Commit to training of self and others to enable clinical audit to proceed. • Share the outcomes (both positive and negative) of clinical audits with service users and peers, having regard for clinical governance consequences.	3.1.16 1.1.11 1.3.6 2.2.2 3.1.17

Domain 4: Research, Development and Innovation

Topic	Research, Development and Innovation	GSP reference
Learning objective	By the end of this stage of training the Clinical Scientist in HSST will be able to generate ideas, assess, plan, conduct, supervise, critically evaluate, interpret and report research and innovation projects, which includes original research, translational research and innovation, and the adoption and diffusion of the findings/output.	
Knowledge	By the end of the training period the Clinical Scientist in HSST will be able to: 1. Justify the stages of the research and innovation process from conceptualisation to dissemination and, if appropriate, translation into practice. • Describe the stages of the innovation pathway (Invention, Evaluation, Adoption and Diffusion). • Critically evaluate the literature/evidence base to identify the research question or create a new approach, technique, etc. • Evaluate the clinical importance of any proposed research project and recognise its potential impact on patients and carers. • Recognise the priorities and factors affecting research and innovation in the area of study, and the practical and financial criteria and constraints affecting research. • Appraise healthcare research and innovation funding policy and strategy. • Evaluate the organisation's research, development and innovation policy and strategy, and how this aligns to national policy of the NHS, higher education sector, research councils and charities. • Summarise the organisation's policy with respect to research ethics and regulatory requirements from conception to archive, and justify how this protects the researcher, research subjects and the organisation. • Summarise the sources of funding/grants and provision of expert advice on research funding, how to access them and when to use them. • Identify and evaluate sources of information and expert advice. 2. Justify the rationale for research governance and ethical frameworks when undertaking research or innovation as a principal investigator or supervising others. • Describe the regulatory requirements, including the Research Governance Framework, Ethical Framework and intellectual property that must be considered in the area of study to ensure good clinical practice. • Conform to the requirements of data protection and confidentiality guidelines. • Identify and evaluate the possible risks associated with the research or innovation project, appraising the options in terms of benefits and risks and judging how to manage these.	1.1.5 4.1.1 4.1.2 3.1.7 4.1.3 4.1.4

Topic	Research, Development and Innovation	GSP reference
	• Recognise the right of pressure groups and others who may oppose the research to present the justification for their views.	2.1.6
	• Justify the benefits of using project management techniques and tools and how to apply them at strategic level.	3.1.12
	• Describe the scope, objectives and implications of the specific research programme.	3.1.13
	• Define the roles and responsibilities of those involved in the research programme and clearly set out the relevant lines of communication and authority for the research programme.	3.1.14
	• Summarise the monitoring and reporting procedures relevant to the research or innovation project and the importance of these procedures as part of the quality assurance programme.	4.1.5 4.1.6
	3. Critically appraise the results of a research and development project, draw conclusions in the correct clinical context and, where appropriate, use them to plan follow-up research and development.	4.1.7
	• Critically appraise the literature review and determine that the conclusions drawn from the evidence supports the hypothesis to be tested.	3.1.16
	• Evaluate the research plan and its ability to confirm or refute the hypothesis, and address the ethical issues and the extent to which patients/service users/experts have been involved in the design of the study.	4.1.9
	• Evaluate criteria/metrics for assessing and grading research data and publications in the scientific, NHS and Higher Education sectors.	4.1.10
	• Summarise and apply the criteria for assessing diagnostic accuracy (e.g. Standards for Reporting of Diagnostic Accuracy, STARD).	
	• Critique methods of capturing and storing data relevant to the research programme, including the ethical issues relating to access to and use of information.	
	• Compare and contrast the range of formats and modes of presentation of data, and defend the methods selected.	
	• Apply relevant methods and techniques to analyse results, ensuring the integrity of the data.	
	• Critically appraise the data analysis strategy, including power calculations, and apply relevant statistical methods, seeking advice from experts when required. Defend personal role and responsibilities in respect of interpretation and analysis of research results and levels of authority in respect of interpretation and analysis of research results.	
	4. Appraise the ways in which research and development findings can be disseminated among the scientific community, including peers and other stakeholders in interested parties.	4.1.5 4.1.10
	• Compare and contrast methods of presenting research (written and oral) and identify the strengths of each method with respect to the target audience.	
	• Identify and, if necessary, seek expert advice with respect to potential intellectual property issues that did not arise in the planning stage, and the implications for publishing.	

Topic	Research, Development and Innovation	GSP reference
	• Summarise the requirements for publications submitted to scientific, education and similar journals, including the current conventions in respect of bibliography and referencing of information, and the implications of open-access publishing. 5. Appraise and justify the process of translating research findings into service in the interests of patient care. • Identify the likely impact of research and innovation in service design, delivery and clinical effectiveness, including reverse innovation, i.e. stopping doing something that no longer adds value. • With respect to pilot and field studies, identify possible risks, evaluate methods and techniques, and predict the expected outcomes, ensuring compliance with the relevant ethical codes and regulatory requirements. • Identify and evaluate sources of expert advice. • Appraise their own role and responsibilities within the testing process and clearly define the levels of authority and decision making within the testing process. • Describe methods of cost-benefit and cost-effectiveness analysis and how they can be applied to aid decision making with respect to introducing research findings or innovation into service. • Summarise the relevance of the Research Governance Framework to translating research or adopting and diffusion of innovation into practice.	
Practical skills	By the end of the training period the Clinical Scientist in HSST would be expected to apply in practice a range of clinical skills and critically reflect on their performance and will be able to: 1. Create the initial new idea, approach, or technique and plan a research and development or innovation project, critically evaluating the research proposal and drawing on expert advice where necessary and involving patients and service users. • Search for and critically appraise relevant publications in the scientific literature, relating ideas to current thinking, knowledge and research. • Identify the potential for innovation in service design and delivery to enhance clinical effectiveness. • Evaluate objectively and critically the feasibility and implications of investigation of the ideas and assessing the potential output, utility and impact of future study. • Identify potential intellectual property (IP) associated with the ideas and the steps to be taken to register IP. • Develop and maintain networks and identify potential collaborators and competition. • Clearly define and prioritise the aims and objectives of the research. • Specify the detailed components and proposed outputs of the research. • Identify methods, tools, techniques and approaches that are capable of achieving the required outcomes. • Establish evaluation criteria and methods. • Identify criteria and issues affecting funding sources at a level of detail sufficient to aid decision making. • Access relevant expert advice regarding sources of funding.	1.1.4 1.1.5 1.3.1 3.1.7 4.1.1 4.1.2 4.1.3 1.3.1 4.1.3 4.1.4 4.1.5

Topic	Research, Development and Innovation	GSP reference
	• Target appropriate sources of funding for research and innovation. • Incorporate compliance with relevant ethical and regulatory requirements. • Prepare and present the plan to all relevant people, in the appropriate format and by the designated deadline.	4.1.8
	2. Conduct and/or supervise a research and development or innovation project.	
	• Manage relationships with stakeholders and those involved to maximise effectiveness of the research programme.	
	• Provide clear strategic direction and motivation to those involved in the research programme.	4.1.5
	• Ensure that all members of the research team understand their role and responsibilities, including lines of communication and reporting, and that appropriate training is provided.	4.1.6 4.1.7
	• Specify clearly the levels of authority and decision making within the research programme.	4.1.10
	• Ensure availability of and access to technical and administrative support at the appropriate level of expertise.	
	• Conduct investigations in line with the research plan.	
	• Document investigations and results to comply with good research practice and good clinical practice.	
	• Document and report fully any unexpected outcomes of incidents and modify investigation accordingly.	
	• Report any delays or problems experienced to all interested parties, giving a full explanation.	
	• Pay proper attention to adverse events arising from investigations and take appropriate action to minimise risks.	
	• Provide clear and timely guidance to deal with contingencies and factors influencing progress of the research programme.	
	• Ensure compliance with the Research Governance Framework, including continuous review and quality assurance of the research and development programme, adherence to the data archive process and requirement to provide access to the data for regulatory inspections.	
	3. Critically appraise the results of a research and development project, draw conclusions in the correct clinical context and, where appropriate, use them to plan follow-up research and development.	
	• Select the type and range of data to be collected in line with the research plan, including primary and secondary sources.	4.1.9 4.1.10
	• Ensure that records comply with relevant legal, ethical and organisational requirements.	
	• Ensure that records of research data are complete and accurate.	
	• Assess the research information collected for its validity and reliability.	
	• Select techniques of analysis and evaluation that are valid, reliable and appropriate to the research design and purpose.	
	• Collate, record and analyse information accurately to produce justifiable results.	

Topic	Research, Development and Innovation	GSP reference
	• Verify the analysis using accepted and valid techniques, including statistical tests. • Assess the results of research against the original objectives. • Assess the clinical significance and impact of the research. • Where the research has failed to achieve its objectives, investigate the reasons and provide a clear explanation. • Draw conclusions from results and explain the rationale for those conclusions. 4. Report and communicate research, development, or innovation to peers and other interested parties, including patients and service users. • Report and endeavour to publish all research, including negative findings. • Define the key purpose and objectives of the research programme and match results to these objectives. • Produce findings in a format appropriate to purpose and in line with relevant legal, ethical and organisational requirements. • Record accurately issues of copyright, declaration of interest and intellectual property rights. • Present findings in a format, language and style suitable for the target audience. • Include all relevant bibliographic references in line with current conventions. • Make a clear distinction between the results and the interpretation placed on them. • Support the presentation with sufficient information to clarify key points. • Support presentation conclusions with reasoned argument and sufficient evidence. • Make recommendations that are realistic, relevant and clearly defined. • Acknowledge collaborators, contributors and funding sources. • Effectively respond to questions and critical comments. • Observe time limitations for oral presentations and deadlines for written presentations. 5. Translate research findings or innovation solutions into service and provide examples of where this has been achieved • Realign research findings or innovative approaches to create a service development or change plan. • Assess the impact of research on innovation in service design and delivery. • Complete pilot and field studies in line with the plan. • Identify and report potential risks associated with the conduct of pilot and field studies. • Maintain records of all pilot and field studies in accordance with the plan. • Present documentation and provide verbal feedback as required by the plan. • Document and report any unexpected outcomes or incidents.	4.1.5 4.1.10

Topic	Research, Development and Innovation	GSP reference
	• Report any delays or problems experienced to authorised personnel with the relevant degree of urgency. • Report on cost-benefit analysis of implementation.	
Attitudes and behaviours	By the end of the training period the Clinical Scientist in HSST would be expected to demonstrate the attitudes and behaviours necessary for the role of a Consultant Clinical Scientist and will be able to: 1. Evaluate current debates and information and identify opportunities for research, development and innovation, identifying and solving problems. • Understand the impact of current clinical outcomes on patients and carers in their research area. • Accept the need to mitigate factors that limit current clinical outcomes and patient experience in their research area. • Explore areas of clinical practice where significant improvements could contribute to better clinical outcomes and/or patient experience. • Recognise the opportunities for innovation in service design and/or delivery. • Use examples from the literature and their own experience where research, development and innovation have contributed to better clinical outcomes and/or patient experience. 2. Apply rigorous standards to the conduct of research, development and innovation. • Adhere to and accept and work within current research ethics and research governance requirements applicable within the organisation, raising concerns when necessary. • Promote methods for defining and demonstrating compliance with relevant research ethics and research governance requirements. • Adhere to and accept methods for external assessment of compliance with research ethics and research governance requirements, and learn from the process. • Critically reflect on and use examples of problems encountered by others when compliance with research ethics and research governance requirements was inadequate, and apply learning to all aspects of research, development and innovation. 3. Commit to and lead collaborative research in the interests of improving clinical outcomes and/or patient experience. • Accept and value the knowledge and experience that each research collaborator can bring to the planning, implementation and evaluation of a research project, listening to and evaluating the views of others. • Promote the importance of the MDT in setting practice standards and in auditing outcome against those standards. • Identify and promote the benefits to their own specialism by being a partner in collaborative research. 4. Commit to sharing and disseminating research findings and the outcome and learning from innovation projects with peers. • Accept the benefits and constraints of patents and confidentiality in research outcomes and innovation opportunities.	4.1.1 4.1.2 4.1.4 4.1.3 4.1.10

Topic	Research, Development and Innovation	GSP reference
	• Collaborate with a group of peers with an interest in improving clinical outcomes and/or patient experience in the same area of research to create opportunities for research, development and innovation. • Facilitate peer discussions on the value of current research and the opportunities for new research, be open to challenge and revise views in response to discussion when necessary. • Promote opportunities to present research findings to peers and critically appraise the research findings of others. 5. Actively seek opportunities to translate research findings and the diffusion and adoption of innovation into clinical practice. • Challenge and influence to mitigate current barriers to the translation of research findings or new, innovative ways of working into clinical practice across the organisation and, where appropriate, nationally. • Promote opportunities to undertake targeted translational research and innovation, encouraging the contribution of the healthcare team. • Identify examples of where the translation of research findings into practice has resulted in improved clinical outcomes and/or patient experience to influence the translation, adoption and diffusion of new findings, negotiating, questioning and challenging where necessary. • Promote the importance of innovation in service design and/or delivery, including the contribution of research and innovation in healthcare to business and the UK economy. • Engage service users, patients and the public to promote the positive impact of research and innovation on clinical outcomes and/or patient experience.	4.1.6 4.1.7 4.1.9 4.1.9 4.1.10

Domain 5: Clinical Leadership

Topic	Clinical Leadership	GSP reference
Learning objective	By the end of this stage of training the Clinical Scientist in HSST will be able to critically appraise the evidence base underpinning clinical leadership frameworks and operate as a clinical leader involved in the planning, delivery and transformation of health and social care services.	
Knowledge	By the end of the training period the Clinical Scientist in HSST will be able to:	
	1. Evaluate the personal qualities required of a clinical leader and critically reflect on performance to identify their own personal qualities, including values, principles and assumptions, developing action plans to adapt personal behaviour as necessary.	1.1.2
	• Critically appraise models of leadership, including the shared or distributed model for organisations where tasks are more complex and highly interdependent.	1.1.3 1.1.5
	• Evaluate a range of tools that enable exploration of the ways in which individual behaviours impact on others.	1.1.6 1.1.7
	• Evaluate a range of feedback models to obtain and respond to feedback from others.	5.1.1
	• Review and justify the use of a range of tools and techniques for managing stress, including occupational health and other support networks.	1.3.1 1.3.2
	• Recognise the importance of best practice, transparency and consistency.	1.3.5
	• Summarise the professional, legal and ethical codes of the HCPC and other relevant bodies.	5.1.2
	• Evaluate a range of tools to identify personal preferences and prejudices and those within others, society and cultures.	5.1.4
	2. Evaluate the importance of working with others in teams and networks to deliver and improve services.	5.1.5
	• Discuss the role of team dynamics in the way a group, team, or department functions.	5.1.7
	• Evaluate a range of team structures and the structure, roles and responsibilities of the MDTs within the broader health context relevant to the specialism, including other agencies and the impact of different structures on the delivery of care.	5.1.1
	• Critique a range of techniques and methods that facilitate effective and empathic communication and the evidence base underpinning them.	5.1.6
	• Evaluate a range of models to facilitate conflict resolution.	
	• Critically explore a range of leadership styles and approaches and identify the applicability, strengths and weakness of each to different situations and people.	
	3. Critically evaluate methods by which services may be planned and people and resources managed effectively.	

Topic	Clinical Leadership	GSP reference
	• Summarise the structure, financing and operation of the NHS and its constituent organisations and compare this with other systems of healthcare. • Analyse and justify the ethical and equality aspects relating to management and leadership, e.g. approaches to use of resources/rationing and approaches to involving services users in decision making. • Discuss business management principles: priority setting and basic understanding of how to produce a business plan. • Identify the requirements of running a department, unit, or practice relevant to their specialism. • Justify the allocation of funding to scientific services and evaluate how clinical resources to provide high-quality care should be allocated, considering the financial constraints of the NHS and local organisations. • Summarise the commissioning, funding and contracting arrangements relevant to their specialism, including education, training and CPPD. • Critique relevant legislation (e.g. equality and diversity, health and safety, employment law) and local human resources policies and the impact of these policies on people and the organisation. • Discuss the duties rights and responsibilities of an employer and of a co-worker. • Justify the role of individual performance review, considering its purpose, techniques and processes, including the difference between appraisal, assessment and revalidation. • Compare and contrast methods to measure and manage the performance of the organisation. • Analyse the source of complaints, and review and reflect on how complaints are managed and the learning that is fed back into the organisation to improve the patient and staff experience. • Critically evaluate how clinical leadership can support the delivery of high-quality services and service improvements and the methods by which these may be achieved. Evaluate risk management issues pertinent to the area of practice and wider organisation, identifying potential sources of risk and risk management tools, techniques and protocols. • Summarise how healthcare governance influences patient care, research, innovation and educational activities at local, regional and national level. • Summarise key government reports on maintaining professional standards and discuss the mechanism for raising issues where you consider that standards are being compromised ('whistleblowing'). • Appraise quality improvement methodologies, including a range of methods obtaining feedback from users, staff, patients and the public, and explore the impact on patients, services and the organisation. • Discuss the principles and processes of evaluation, audit, research and development, innovation, clinical guidelines and standard setting in improving quality, and identify barriers to the adoption and success of each measure in practice. • Identify a variety of methodologies for developing creative solutions to improving services. • Explore the implications of change on systems and people, and methods to minimise the negative effects of change, including strategies for motivating people to change and the effect of organisational culture.	1.1.12 2.2.2 2.3.2 2.3.2 2.3.3 2.3.4 3.1.17 5.1.8 5.1.10 5.1.11

Topic	Clinical Leadership	GSP reference
	• Describe project management methodology and how it can be used during change. 4. Justify the importance of strategic planning in line with the aspirations of the organisation. • Summarise the responsibilities of the various Executive Board members and Clinical Directors or leaders. • Summarise the functions and responsibilities of national bodies such as the Department of Health (DH), Care Quality Commission (CQC), NHS Evidence, Medicines and Healthcare products Regulatory Agency (MHRA), Royal Colleges and faculties, specialty organisations, representative bodies, regulatory bodies, educational and training organisations. • Analyse patient outcome reporting systems within the specialism and the organisation, and how these relate to national programmes. • Summarise how research, development and innovation contribute to strategic planning. • Critically review the decision making for individuals, teams and the organisation, and the impact on service delivery and patient care. • Compare and contrast a range of communication strategies and identify the factors that promote effective communication strategies within organisations. • Explore methods of undertaking impact mapping of service change and how this can support the process of change. • Identify barriers to change and how to develop strategies to explore and break down barriers. • Summarise qualitative methods to gather and analyse the experience of users, patients and carers, and utilise the data to recognise areas of good practice/planning and help shape the planning process.	1.3.1 1.3.3 5.1.1 5.1.6 5.1.12
Practical skills	By the end of the training period the Clinical Scientist in HSST would be expected to apply in practice a range of clinical skills and critically reflect on their performance and will be able to: 1. Demonstrate through personal example their own personal qualities, including values, principles and assumptions, and critically reflect on personal performance and: • Maintain and routinely practise critical self-awareness, including ability to discuss strengths and weaknesses with their supervisor, recognising external influences and changing behaviour accordingly. • Show awareness and sensitivity to the way in which cultural and religious beliefs affect approaches and decisions, and respond effectively. • Recognise the manifestations of stress on self and others and know where and when to look for support. • Balance personal and professional roles and responsibilities, prioritising tasks and having realistic expectations of what can be completed by self and others. • Use a reflective approach to practice with an ability to learn from previous experience. • Use assessment, appraisal, complaints and other feedback to discuss and develop an understanding of their own development needs.	1.1.12 1.2.3 5.1.1 5.1.2 5.1.3 5.1.4 5.1.12

Topic	Clinical Leadership	GSP reference
	• Recognise, analyse and know how to deal with unprofessional behaviours in clinical practice, taking into account local and national regulations. • Create open and non-discriminatory professional working relationships with colleagues, including awareness of the need to promote equality of opportunity and to prevent bullying and harassment in the workplace.	
	2. Work with others in teams and networks to deliver and improve services.	1.3.4
	• Work in differing and complementary roles within the different communities of practice within which they work. • Support bringing together different professionals, disciplines and other agencies to provide high-quality healthcare. • Develop effective working relationships with colleagues and other staff through good communication skills, building rapport and articulating their own views. • Communicate effectively in the resolution of conflicts, providing feedback and identifying and rectifying team dysfunction. • Facilitate, chair and contribute to meetings within the department, the organisation, national societies/professional bodies. • Encourage staff to develop and exercise their own leadership skills. • Enable individuals, groups and agencies to implement plans and decisions. • Identify and prioritise tasks and responsibilities, including delegation and safe supervision.	1.3.5 1.3.6 5.1.1 5.1.2 5.1.3 5.1.4 5.1.10
	3. Manage services effectively, using critical reflection to evaluate and improve personal performance.	1.4.1-1.4.6 5.1.5
	• Develop and implement protocols and guidelines. • Analyse feedback and comments and integrate them into plans for the service. • Use clinical audit with the purpose of highlighting resources required. • Manage time and resources effectively in terms of delivering services to patients. • Prepare rotas, delegate, organise and lead teams. • Contribute to the recruitment and selection of staff. • Contribute to staff development and training, including mentoring, supervision and appraisal. • Use and adhere to clinical guidelines and protocols, relevant reporting systems and complaints management systems. • Improve services following evaluation/performance management.	5.1.6 5.1.8 5.1.9 5.1.10 5.1.11
	4. Contribute to continuous service improvement, developing improvements to service and reflecting on experience to ensure the delivery of high-quality services.	
	• Report clinical incidents in accordance with reporting procedures. • Assess and analyse situations, services and facilities, implementing recommendations to minimise risk to patients and the public. • Monitor the quality of equipment and safety of the environment relevant to the specialism, acting swiftly to resolve	

Topic	Clinical Leadership	GSP reference
	issues. • Design and undertake an audit project, present the results and develop an implementation and re-evaluation plan as appropriate to the audit. • Contribute to meetings that cover audit, critical incident reporting, patient outcomes challenges, justifying and influencing as appropriate. • Question and challenge existing practice in order to improve services. • Apply creative thinking approaches (or methodologies or techniques) to propose solutions to service issues. • Provide clinical expertise in evolving situations. • Present written and verbal information in a clear, concise way, using language appropriate to the audience. 5. Contribute to and undertake strategic planning in line with the aspirations of the organisation and its impact on service quality and delivery. • Discuss the local, national and UK health priorities and how they impact on the delivery of healthcare relevant to the specialism. • Identify trends, future options and strategy relevant to the specialism and delivering patient services. • Compare and benchmark healthcare services. • Use a broad range of scientific and policy publications relating to delivering healthcare services. • Prepare for meetings – reading agendas, understanding minutes, action points and background research on agenda items. • Work collegiately and collaboratively with a wide range of people outside the immediate clinical setting. • Evaluate outcomes and re-assess the solutions through research, audit and quality assurance activities. • Evaluate the wider impact of implementing change in healthcare provision and the potential for opportunity costs.	1.1.11 1.4.4 1.4.5 1.4.6 5.1.3 5.1.7 5.1.8 5.1.1 5.1.12
Attitudes and behaviours	By the end of the training period the Clinical Scientist in HSST would be expected to demonstrate the attitudes and behaviours necessary for the role of a Consultant Clinical Scientist and will be able to: 1. Operate consistently within a sphere of personal capability and level of authority, managing personal workload and objectives to achieve quality of care. • Adopt a patient-focused approach to decisions that acknowledges the right, values and strengths of patients and the public. • Comply with relevant legislation to recognise and show respect for diversity and differences in others. • Be conscientious, able to manage time and delegate responsibly. • Recognise personal health as an important issue in maintaining personal capability. • Accept responsibility for their own actions. • Commit to CPPD, which involves seeking training and self-development opportunities, learning from colleagues and accepting constructive criticism.	 1.1.3 1.1.4 1.1.6 5.1.1 1.3.1 1.3.2

Topic	Clinical Leadership	GSP reference
	• Accept professional regulation and ensure compliance with relevant standards. • Promote appropriate professional attitudes and values. • Act with probity and be willing to be truthful and admit to and learn from errors.	
	2. Actively seek to encourage and work within a team environment, including MDTs.	
	• Interact effectively with professionals in other disciplines and agencies. • Respect the skills and contributions of colleagues. • Recognise good advice and continuously promote value-based, non-prejudicial practice. • Use authority appropriately and assertively, being willing to follow when necessary. • Use authority sensitively and assertively to resolve conflict and disagreement. • Take full part in MDT meetings. • Show recognition of a team approach and willingness to consult and work as part of a team. • Respect colleagues and other healthcare professionals.	1.3.1 1.3.5 5.1.2 5.1.6 5.1.11
	3. Manage resources effectively in the interests of improving patient services, promoting equity in healthcare access and delivery.	
	• Use public money appropriately and take action when resources are not used efficiently or effectively. • Recognise that in addition to patient-specific clinical records, clinical staff also have responsibilities for other records (e.g. research). • Supervise the work of less experienced colleagues, supporting them to develop. • Use communication skills and inspire confidence and trust. • Respond constructively to the outcome of reviews, assessments, or appraisals of performance. • Recognise the needs of all staff in the clinical team.	1.1.12 1.2.2 3.1.17 5.1.6 5.1.7 5.1.8 5.1.10 5.1.11
	4. Engage in continuous service improvement in the interests of better patient outcomes.	
	• Actively seek advice/assistance whenever concerns about patient safety arise. • Take responsibility for clinical governance activities, risk management and audit in order to improve the quality of the service. • Listen to and reflect on the views of users, patients and carers, dealing with complaints in a sensitive and cooperative manner. • Act as an advocate for the service. • Be open-minded to new ideas. • Adopt a proactive approach to new technologies and treatments. • Support colleagues to voice ideas. • Be positive about improvement and change.	5.1.10 5.1.11 5.1.12

Topic	Clinical Leadership	GSP reference
	• Strive for continuing improvement in delivering patient care services. 5. Contribute to articulating the aspirations of the organisation and be willing to align strategic planning with these aspirations to improve service quality and delivery. • Comply with national guidelines that influence healthcare provision. • Articulate ideas and use effective influencing skills. • Identify and reflect on issues and potential solutions before acting. • Understand the importance of involving service users, the public and communities in developing health services. • Participate in decision-making processes beyond the immediate clinical care setting. • Implement proven improvements in clinical practice and services. • Obtain and analyse the evidence base before declaring effectiveness of changes. • Support the dissemination of good practice.	

SECTION 3: STAGE 1: SPECIALTY-SPECIFIC TRANSFUSION SCIENCE SYLLABUS

Stage 1 Module 1: The Immunological basis of Transfusion

Topic	Stage 1 Module 1 The Immunological basis of Transfusion	Assessment methods	GSP reference
Learning objectives	By the end of the training period, trainees will, in respect of Immunology, be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • principles of immunology, cellular and humoral immunity, innate and adaptive immunity • the structure and function of major histocompatibility complex (MHC), including the role of MHC molecules in the immune response • the structure and role of myeloid and lymphoid components of the immune system • the role of key accessory molecules including cytokines and cell adhesion molecules • the structure, function and production of immunoglobulins • the complement cascade • tolerance and loss of tolerance resulting in autoimmune conditions • the intravascular and extravascular destruction of red cells • the immunology of pregnancy • the pathogenesis of haemolytic disease of the fetus and newborn (HDFN) including placental transfer of IgG • the relationship between diagnostic assays used in blood transfusion and the pathogenesis of autoimmune and alloimmune haematological disorders including the immune destruction of red cells • the pathogenesis of:	FRCPath Part 1 WPBA	1, 3

Topic	Stage 1 Module 1 The Immunological basis of Transfusion	Assessment methods	GSP reference
	○ HDFN ○ immunological reactions to blood transfusion ○ autoimmune disorders affecting red cells and platelets • the relationship between diagnostic assays used in blood transfusion and the pathogenesis of autoimmune and alloimmune haematological disorders including the immune destruction of red cells		
Technical and Clinical skills	By the end of the training period, with respect to Transfusion Science, trainees will be able to apply their expert knowledge of immunological theory to the performance of the clinical skills necessary to: • perform a range of clinical skills necessary to examine and interpret specimens in a systematic way.	WPBA	

Stage 1 Module 2: Basic Haematology

Topic	Stage 1 Module 2 Haematology	Assessment methods	GSP reference
Learning objectives	By the end of the training period the trainee will, in respect of Transfusion Science, be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the origin, structure and function of the cellular components of blood
	• haemoglobin synthesis in the fetus, neonate and adult including haemoglobin 'switching'
	• the role of haemopoietic growth factors and cytokines
	• the origin, structure and function of plasma proteins
	• haemostatic pathways, clotting factors and principles of coagulation
	• common coagulation disorders and their management
	• common platelet disorders and their management
	• common malignant and non-malignant haematological disorders and their management
	• normal and abnormal ranges of haematological parameters
	• the pathogenesis and/or aetiology of:
	  ○ HDFN
	  ○ adverse reactions to blood transfusion
	  ○ autoimmune disorders affecting red cells and platelets
	  ○ haematological malignancies and other bone marrow failure syndromes
	  ○ inherited and acquired platelet and red cell disorders
	• the relationship between diagnostic assays used in blood transfusion and the pathogenesis of common haematological disorders
		FRCPath Part 1
		WPBA
			1, 3

Topic	Stage 1 Module 2 Haematology	Assessment methods	GSP reference
	• the clinical significance of reference range data and implications for transfusion therapy.		
Technical and Clinical skills	By the end of the training period with respect to Transfusion Science, trainees will be able to apply their expert knowledge of immunological theory to the performance of the clinical skills necessary to: • perform a range of clinical skills necessary to examine and interpret specimens in a systematic way.	WPBA	1, 3

Stage 1 Module 3: Blood Group Systems

Topic	Stage 1 Module 3 Blood Group Systems	Assessment methods	GSP reference
Learning objectives	By the end of the training period the trainee will, in respect of Transfusion Science, be able to: • analyse, synthesise, evaluate and apply knowledge • perform a range of clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the basis of inheritance
	• the range of blood group antigens expressed on red cells including:
	  ○ Major and minor blood groups and their clinical significance, prevalence and racial variation
	  ○ The inheritance, biosynthesis, structure, function and expression of red cell blood group antigens, in particular the ABO, Rh and Kell systems
	• the structure and function of the normal red cell membrane
	• ISBT nomenclature of red cell genes and antigens
	• the structure, function, expression and clinical significance of antigens expressed on platelets, neutrophils and other cells and tissues including:
	  ○ HLA
	  ○ HPA
	  ○ HNA
	• the principles underpinning diagnostic assays relevant to pre-transfusion testing and the investigation of adverse reactions to transfusion therapy
	• the testing algorithms deployed for compatibility testing and cross-matching
		FRCPath Part 1
		WPBA
			1, 3

Topic	Stage 1 Module 3 Blood Group Systems	Assessment methods	GSP reference
Technical and Clinical skills	By the end of the training period with respect Transfusion Science trainees will be able to perform the clinical skills necessary to manage: • pre-transfusion testing and the diagnosis of a range of disorders typically referred to a transfusion laboratory for investigation • critically appraise the likely clinical significance of blood group antigens and antibodies in the context of their structure, function and expression and provide advice to colleagues and the multi-disciplinary team • identify and discuss the clinical significance of anti-HLA, anti-HPA and anti-HNA antibodies in a range of clinical settings	WPBA	1

Stage 1 Module 4: The Principles of Blood Group Serology

Topic	Stage 1 Module 4 The Principles of Blood Group Serology	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the principles of blood group serology, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical and clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge Selection and validation of appropriate tests. Scientific quality assurance of test procedures. Validity and reliability of test results and their application.	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • serological techniques for red cell blood grouping: manual, automated and semi-automated • serological techniques for red cell antibody detection and identification • the relevance of antibody class, subclass and thermal amplitude • the mechanism of haemagglutination and factors affecting assay sensitivity and specificity. • factors affecting the sensitivity, specificity and error rate of the IAT • the DAT and its diagnostic applications and limitations • the selection of appropriate controls for serological tests • molecular genetic tests for low throughput and high throughput testing • the principles and application of flow cytometry for phenotyping and evaluation of feto-maternal haemorrhage • enhanced antibody detection and identification techniques • the use of antibody inhibition, adsorption and elution techniques • the specification and use of reagents for blood grouping and antibody identification • the key standards and guidelines relevant to transfusion laboratory testing	FRCPath Part 1 WPBA	1, 2, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge of blood group serology and will: • critically appraise the scientific basis for blood group phenotyping and genotyping including	WPBA	

Topic	Stage 1 Module 4 The Principles of Blood Group Serology	Assessment methods	GSP reference
	the benefits and constraints of alternative technologies in different clinical settings • critically appraise the scientific basis for antibody detection and identification including the benefits and constraints of alternative technologies in different clinical settings • critically appraise and formulate plans to assess new platforms and/reagents for laboratory testing and where appropriate introduce and evaluate the new methodologies • distinguish the benefits and constraints of genotyping and phenotyping based on an understanding of inheritance and biosynthesis of ABO and Rh antigens		
Clinical skills	By the end of the training period with respect to blood group serology, trainees will perform a range of clinical skills and will be able to: • evaluate and appraise the diagnostic value of test results based on an understanding of the basis and limitations of different technologies in different clinical settings • formulate, propose and evaluate testing and patient investigation algorithms based on a critical assessment of the utility of different tests and technologies • recognise the relationship between blood groups and regular and irregular antibodies and • provide advice to colleagues and the multi-disciplinary team with respect to genotyping results including D variants, DAT-positive cases, and samples containing transfused red cells, matching patient and donor types for 'bespoke' transfusion	WPBA MSF	

Stage 1 Module 5: Transfusion Laboratory Practice: Routine Haematology Tests and Pre-Transfusion Testing

Topic	Stage 1 Module 5 Transfusion Laboratory Practice: Routine Haematology Tests and Pre-Transfusion Testing	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to routine haematology tests and pre-transfusion testing, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical procedures and clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• routine haematology tests including:
	  ○ the full blood count
	  ○ reticulocyte count
	  ○ erythrocyte sedimentation rate
	  ○ blood film examination
	  ○ clotting screen
	  ○ management of anticoagulant dosage
	  ○ haemoglobinopathy screening
	  ○ bone marrow examination
	• standards and guidelines for pre-transfusion testing
	• the acquisition and interpretation of historical clinical and laboratory observations
	• criteria for acceptable patient identification, sample labelling, sample condition and timing of samples in relation to requests for components
	• the particular issues and risks associated with neonatal samples including patient identification, twins and other multiple births, small samples and test prioritisation
	• laboratory protocols for:
	  ○ routine blood group and antibody screening
		FRCPath Part 1
		WPBA
			1, 2, 3

Topic	Stage 1 Module 5 Transfusion Laboratory Practice: Routine Haematology Tests and Pre-Transfusion Testing	Assessment methods	GSP reference
	○ detection of red cell alloantibodies in complex cases ○ selection and use of reagent cell panels for confirmation of specificity and exclusion of further antibodies ○ crossmatching in addition to ABO and RhD typing of patient and donation ○ IAT to confirm compatibility ○ documentation of tests and labelling of units ○ system and patient criteria for electronic issue of units • minimum testing required before issue of group-specific blood in urgent situations. • the selection of safe and appropriate components in emergencies • the investigation of acute and delayed haemolytic transfusion reaction • the differentiation between delayed haemolytic transfusion reaction and delayed serological transfusion reactions • the identification and exclusion of underlying alloantibodies in cases of autoimmune haemolytic anaemia • the investigation of neonatal and paediatric samples, including cases of HDFN • the significance of a positive DAT		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of the following technical procedures and laboratory skills and will be able to: • perform and master a range of routine haematology tests • formulate and evaluate testing algorithms and protocols in light of a patient's transfusion history, including the recent transfusion of blood components • perform unsupervised the laboratory procedures required to safely and efficiently select and cross-match blood components for individual patients including: ○ ABO and RhD phenotyping recognising anomalous results ○ extended red cell phenotyping through direct and indirect haemagglutination, including samples positive by the DAT	WPBA	1, 2, 3

Topic	Stage 1 Module 5 Transfusion Laboratory Practice: Routine Haematology Tests and Pre-Transfusion Testing	Assessment methods	GSP reference
	○ red cell antibody screening and identification including the use of the IAT ○ the selection and use of procedures to identify and exclude antibody specificities ○ the selection of appropriate controls for tests above ○ the analysis and interpretation of results of blood grouping tests, antibody screening and identification tests, and the DAT ○ the identification of suitable units for crossmatching ○ the performance of crossmatching ○ the proper completion of all documentation for safe laboratory practice and audit. ○ the assessment and resolution of technical issues and anomalies ○ the identification and assessment of potential risks including inadequately completed or non-corresponding request forms and sample labels ○ the identification of patients suitable for electronic issue of units ○ performance of a range of flow cytometric procedures including analysis of cell subpopulations and quantitation of cell-bound immunoglobulins • formulate diagnostic approaches for individual patients with an adverse reaction to blood transfusion • evaluate the performance and limitations of auto and allo-adsorption, elution and identification of antibody(s) remaining or eluted		
Clinical skills	By the end of the training period the trainee will apply a broad knowledge of pre-transfusion testing procedures and demonstrate the clinical skills required to perform under supervision and will be able to: • provide routine haematology test results, blood films and/or biopsies for review by a consultant haematologist as appropriate • assess donor/recipient compatibility for blood transfusion including the interpretation of the clinical significance of incompatibilities • provide clinical advice on the significance of test results • identify patients at risk of developing red cell antibodies	WPBA MSF	1, 2, 3

Topic	Stage 1 Module 5 Transfusion Laboratory Practice: Routine Haematology Tests and Pre-Transfusion Testing	Assessment methods	GSP reference
	• identify patients with special transfusion requirements • share patient data with other clinical teams, including through electronic systems adhering to confidentiality and governance regulations • provide advice to clinical colleagues on the selection of units for transfusion including where crossmatch compatible rather than antigen negative units would be suitable • select safe and appropriate components in an emergency		

Stage 1 Module 6: Transfusion Laboratory Practice: Haemolytic Disease of the Fetus and Newborn

Topic	Stage 1 Module 6 Transfusion Laboratory Practice: Haemolytic Disease of the Fetus and Newborn	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to Haemolytic Disease of the Fetus and Newborn, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical procedures and demonstrate a range of clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the standards and guidelines applicable to antenatal testing
	• routine blood grouping and red cell antibody screening in pregnancy
	• sample acquisition and scheduled repeat testing in individual pregnancies including women with anti-D, anti-c and antibodies of the Kell blood group system
	• standards and specifications for reagents
	• the clinical significance of blood group antibodies based on:
	  ○ antibody specificity
	  ○ antibody strength by quantitative and semi-quantitative methods
	  ○ ethnicity
	• complications of distinguishing between immune and prophylactic anti-D
	• quantification of anti-D and anti-c
	• titration of non-anti-D and non-anti-c
	• blood group phenotyping of partners' samples
	• fetal genotyping in high risk pregnancies and screening for RhD positive fetuses in RhD negative women
	• the principles, methodology and limitation of assessment of fetomaternal haemorrhage by acid elution and flow cytometry
		FRCPath Part 1
		WPBA
			1, 2, 3

Topic	Stage 1 Module 6 Transfusion Laboratory Practice: Haemolytic Disease of the Fetus and Newborn	Assessment methods	GSP reference
	• administration of anti-D immunoglobulin for patient use: storage, traceability, routine prophylaxis programme, dosing • obstetric procedures in high risk pregnancies		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of technical procedures and laboratory skills and will be able to: • schedule and apply routine and specialist blood grouping methods to antenatal samples • assess antibody strength, by titration or quantification, of current and archived samples	WPBA	1, 2, 3
Clinical skills	By the end of the training period trainees will perform the clinical skills required to manage haemolytic disease of the fetus and newborn, under supervision and will be able to: • manage the interpretation and reporting of test results, providing clinical advice and recommending further tests where required on the basis of: o antibody identification o antibody titration and quantification, including interpretation of archived sample results. o partners' phenotype(s) and possible genotype(s) o fetal genotype o assessment of fetomaternal haemorrhage and recommendation for the dose of prophylactic anti-D immunoglobulin required for treatment • lead communication among the multi-disciplinary healthcare professions involved in the management of alloimmunised pregnant women • lead and evaluate education and training for nursing and medical staff involved in obstetric care to optimise the recognition and referral of high risk pregnancies	WPBA MSF	1, 2, 3

Stage 1 Module 7: Transfusion Therapy: Administration of Red Cells to Adult Patients

Topic	Stage 1 Module 7 Transfusion Therapy: Administration of Red Cells to Adult Patients	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to administration of red cells to adult patients, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform and master a range of technical procedures and demonstrate a range of clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • BSH guidelines relevant to red cell transfusion in adults • clinical indications for red cell transfusion • special requirements, including irradiation and CMV-negative red cells • transfusion protocols in major haemorrhage and trauma • selection of red cell components for patient with: o antibodies to high prevalence or low prevalence red cell antigens o a history of haemolytic transfusion reaction or hyper-haemolysis o autoimmune haemolytic anaemia o a haemoglobinopathy o a coagulation disorder o an increased risk of alloimmunisation • the effective storage, tracking and management of blood stocks	FRCPath Part 1 WPBA	1, 2, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of the following technical procedures and laboratory skills and will be able to: • critically evaluate the benefits and risks of administering red cells in different clinical settings	WPBA	1, 2, 3

Topic	Stage 1 Module 7 Transfusion Therapy: Administration of Red Cells to Adult Patients	Assessment methods	GSP reference

	• identify, assess and critically appraise relevant clinical and laboratory factors in order to select red cell units for patients with different clinical conditions including:
	  ○ patients with a high risk of alloimmunisation due to long-term dependence on transfusion therapy
	  ○ patients with existing antibodies to high prevalence and low prevalence antigens
	  ○ patients with red cell antibodies including multiple antibodies
	  ○ major haemorrhage and trauma
	  ○ patients with a haemolytic transfusion reaction or hyper-haemolysis
	  ○ autoimmune haemolytic anaemia
	  ○ haemoglobinopathies
	  ○ coagulation disorders
	• critically evaluate the evidence that underpins the effective management of blood stocks, minimising wastage and optimising the availability of red cells units of different blood groups		

Clinical skills	By the end of the training period with respect to the administration of red cells to adult patients, trainees will, be able to perform a range of clinical skills and will be able to: • advise clinical colleagues on the transfusion requirements of patients with a wide range of clinical conditions, including where it is appropriate to use red cells which have been further selected or processed (e.g. CMV-negative or irradiated) • advise, in collaboration with clinical and laboratory colleagues, on action to be taken when the need for transfusion is urgent • advise on the transfusion requirements of patients to whom sensitization to red cell antibodies presents a clinical risk (e.g. women of child -bearing potential, sickle cell disease patients) • interpret complex red cell antibody investigations to determine the antigen status of suitable units • operate procedures to obtain blood donations with rare blood groups • advise on the provision of suitable blood components where the ideal match is not possible, in emergency and routine situations to ensure patient safety	WPBA MSF	1, 2, 3

Stage 1 Module 8: Transfusion Therapy: Administration of Red cells in the Antenatal and Neonatal Periods

Topic	Stage 1 Module 8 Transfusion Therapy: Administration of Red Cells in the Antenatal and Neonatal Periods	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the administration of red cells during the antenatal and neonatal periods, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge. • perform a range of technical procedures and demonstrate a range of clinical skills. • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level.		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • BSH guidelines relevant to transfusion therapy in the fetus, neonate and young children. • selection of units and special requirements for: o Intrauterine transfusion o Exchange transfusion of neonates o Top-up transfusion o Transfusion of neonates and older children • the role of maternal antibodies in HDFN, and in the choice of units for transfusion • the particular requirements of red cell units for transfusion to neonates and infants [irradiation, CMV status] and use of pedipacks to reduce donor exposure • the transfusion of premature infants • paediatric transfusion issues: intensive transfusion, long term survival, acute side effects • T activation and its management	FRCPath Part 1 WPBA	1, 2, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • identify, assess and critically appraise relevant clinical and laboratory factors in order to select red cell units for patients with different clinical conditions including:	WPBA	1, 2, 3

Topic	Stage 1 Module 8 Transfusion Therapy: Administration of Red Cells in the Antenatal and Neonatal Periods	Assessment methods	GSP reference
	○ intrauterine, exchange and top up transfusions ○ premature infants • develop, implement and evaluate processes to ensure accurate sample identification • develop, implement and evaluate policies and processes to manage information governance issues that may arise from the investigation of antenatal and neonatal cases		
Clinical skills	By the end of the training period with respect to the administration of red cells in the antenatal and neonatal periods, trainees will be able to: • advise clinical colleagues on the laboratory investigation of maternal, neonatal and infant samples and the interpretation of results to inform the selection of units suitable for transfusion • advise on the particular requirements of red cell units for prenatal, perinatal and neonatal transfusion including criteria such as CMV status, PCV, blood group and antigen profile • advise on the selection of phenotyped units for transfusion in cases of Haemolytic Disease of the Fetus and Newborn (HDFN)	WPBA MSF	1, 2, 3

Stage 1 Module 9: Transfusion Therapy: Selection and Appropriate use of Blood Components and Plasma Derivatives

Topic	Stage 1 Module 9 Transfusion Therapy: Selection and Appropriate use of Blood Components and Plasma Derivatives	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the selection and appropriate use of blood components and plasma derivatives the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical procedures and demonstrate a range of clinical skills • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the composition, characteristics, specification, storage and labelling requirements of blood components available in the UK, their derivations and secondary products including: o red cell donations o platelet donations (pooled and apheresis) o granulocyte donations o fresh frozen plasma and cryoprecipitate o albumin o coagulation factors o prophylactic anti-D immunoglobulin • BSCH guidelines relevant to the administration of blood components and plasma derivatives including: o red cells, platelets and granulocytes o irradiated blood components o fresh frozen plasma and cryoprecipitate o anti-D immunoglobulin • the special transfusion requirements of patient groups considering age, underlying	FRCPath Part 1 WPBA	1, 2, 3

Topic	Stage 1 Module 9 Transfusion Therapy: Selection and Appropriate use of Blood Components and Plasma Derivatives	Assessment methods	GSP reference
	pathology and vulnerability • the use and availability of specially selected products, including: o IgA negative blood products. o HPA-1a-,5b- platelets. o washed red cells o HLA-matched red cells o blood components from donors at low risk of vCJD		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • select appropriate blood products for the treatment of patients with: o major haemorrhage and trauma o haematological disorders o HLA, HPA or HNA antibodies o refractoriness to random donor platelets o ITP, NAITP or PTP o IgA deficiency with anti-IgA o stem cell or solid organ transplant o disorders of haemostasis and thrombosis • critically evaluate the special requirements of obstetric, antenatal, neonatal and young patients • perform the checks and assurances required for products subjected to secondary processing including washed and irradiated products • critically evaluate and optimise the management of inventories of locally-held stock in order to meet patient requirements in a timely manner	WPBA	1, 2, 3

Topic	Stage 1 Module 9 Transfusion Therapy: Selection and Appropriate use of Blood Components and Plasma Derivatives	Assessment methods	GSP reference
Clinical skills	By the end of the training period with respect to the selection and appropriate use of blood components and plasma derivatives, trainees will be able to: • provide advice to clinical colleagues on safe transfusion support for individual patients, appraising the relevance and significance of the patient's condition, and the availability of different blood components and plasma derivatives • provide advice to clinical colleagues on requirements for secondarily processed blood components	WPBA MSF	1, 2, 3

Stage 1 Module 10: Donor Recruitment, Selection and the Donation Process

Topic	Stage 1 Module 10 Donor Recruitment, Selection and the Donation Process	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to donor recruitment, selection and the donation process the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• JPAC 'Guidelines for Blood Transfusion Services in the UK' (Red Book) and Transfusion Handbook
	• principles and practice of donor recruitment, selection and retention
	• identification of donors and donations at the donor session
	• process for donor interview, donor health check, its purpose and content
	• test for haemoglobin level
	• donation of whole blood including measures to minimise the risk of bacterial contamination.
	• component collection:
	  ○ platelets
	  ○ red cells
	  ○ granulocytes
	  ○ plasma
	• adverse reactions of donors during and after the donation event
	• content of the donor questionnaire, its use and limitations
	• the procedure when the selection criteria for donation are not met
	• donation procedures for whole blood and blood component and by apheresis
		FRCPath Part 1
		WPBA
			1, 2, 3

Topic	Stage 1 Module 10 Donor Recruitment, Selection and the Donation Process	Assessment methods	GSP reference
Technical and Clinical skills	By the end of the training period with respect to donor recruitment, selection and donation processes, trainees will have the clinical skills necessary to manage the donor recruitment process including: • the challenges of recruiting and retaining blood donors from black, Asian and ethnic minority groups • donor selection and health checks aimed at reducing transfusion-associated risks • the process to distinguish between suitable and unsuitable donors • the actions taken to manage donors experiencing an adverse reaction to donation	WPBA	1, 2, 3

Stage 1 Module 11: Preparation, Testing, Labelling and Storage of Blood Components

Topic	Stage 1 Module 11 Preparation, Testing, Labelling and Storage of Blood Components	Assessment methods	GSP reference
Learning objectives	By the end of the training with respect to the preparation, testing, labelling and storage of blood components, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge Selection and validation of appropriate tests. Scientific quality assurance of test procedures. Validity and reliability of test results and their application.	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the preparation of standard and non-standard blood components • donation phenotyping and testing for microbiological markers • specifications for blood components including labelling • storage and transport requirements for all blood components • storage lesions and their clinical significance • bacterial monitoring of blood components • mandatory and additional testing of donations • the treatment of donations which test positive for microbiological markers • the benefits of universal leucodepletion • the elements of blood component labels	FRCPath Part 1 WPBA	1, 2 , 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of technical procedures and laboratory skills and will be able to: • prepare standard and non-standard blood components • test blood donations – mandatory and additional testing	WPBA	1, 2 , 3

Topic	Stage 1 Module 11 Preparation, Testing, Labelling and Storage of Blood Components	Assessment methods	GSP reference
	• perform quality assurance checks and assure the safety of component preparation and donation testing • perform confirmatory testing of donations testing positive for microbiological markers		
Clinical skills	By the end of the training period with respect to the preparation, testing, labelling and storage of blood components, trainees will have a range of clinical skills and will be able to manage the: • processes for the preparation, testing, labelling and storage of products collectively to assure the safety and efficacy of blood transfusion therapy • consequences of testing failures and actions necessary • processes for microbiological “look back” for components suspected of transmitting infection • processes for product recall	WPBA MSF	1, 2 , 3

Stage 1 Module 12: Role of Information Technology and Laboratory Automation

Topic	Stage 1 Module 12 Role of Information Technology and Laboratory Automation	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the role of information technology (IT) and laboratory automation the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the standards required of transfusion laboratory automation and laboratory information management systems with reference to BSH specifications on the use of information technology systems in blood transfusion practice • requirements of a national system for the management of donors, donations, integration of test results from linked automated analysers and traceability of products • the integrity of patient records • The range of diagnostic platforms for blood grouping, antibody screening and crossmatching • the advantages of full automation/electronic data transfer in reducing manual error • IT systems for the ordering of blood and for stock management • the concept and practice of 'vein to vein' traceability, including blood tracking systems and the use of 'smart' fridges • uses of and requirements for electronic issue and remote issue • IT and patient specific requirements for electronic issue • electronic systems for the ordering, monitoring and reporting of tests • IT systems to capture and record fate of blood and wastage • IT systems for reporting to haemovigilance schemes	FRCPath Part 1 WPBA	1, 2

Topic	Stage 1 Module 12 Role of Information Technology and Laboratory Automation	Assessment methods	GSP reference
	• how a hospital computer system supports patient identification and the integration of laboratory results with the patient record • how the component parts and modules of IT systems for managing laboratory data, stock and patients • the standards required of IT systems		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to technical procedures and laboratory skills and will be able to: • compare the technical and performance characteristics of different laboratory platforms for pre-transfusion testing • use laboratory IT systems for: o ordering blood, including the need for special requirements, such as CMV-, irradiated. o stock management o electronic and remote issue o tracking units o reporting haemovigilance incidents • configure IT system settings and algorithms to best support the safety, quality and traceability of laboratory operations including the use of flags, warnings and data entry checking and validation	WPBA	1, 2
Clinical skills	By the end of the training period with respect to the role of information technology and laboratory automation trainees will be able to: • evaluate service contingency plans in the event of failures in IT systems and in automated testing and make recommendations • provide advice in the event of failures in IT systems and in automated testing	WPBA MSF	1, 2

Stage 1 Module 13: Quality Systems and the Management of Clinical Incidents in Transfusion Practice

Topic	Stage 1 Module 13 The Role of Quality Systems in Transfusion Practice	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the role of quality systems in transfusion practice, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • principles of a quality management system • principles and practice of quality assurance and quality control • principles and practice of external quality assurance schemes • the role of accreditation, standards and guidelines in transfusion • the principles and practice of quality audit • the investigation and recording clinical incidents • reporting of incidents to relevant authorities • the role of the Hospital Transfusion Committee • the sources and content of relevant legislation, guidelines, standards and product specifications	FRCPath Part 1 WPBA	1, 2, 3, 4
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of technical procedures and laboratory skills and will be able to: • assess compliance of relevant processes and policies with relevant legislation, guidelines, standards and product specifications • perform procedures in accordance with the principles of a quality management system	WPBA MSF	2, 3, 4

Topic	Stage 1 Module 13 The Role of Quality Systems in Transfusion Practice	Assessment methods	GSP reference
	• adopt Good Documentation Practice and maintain audit trails where appropriate • adopt Good Manufacturing Practice and maintain audit trails where appropriate • critically evaluate the significance of actual and potential clinical incidents and recommend changes in practice • undertake a root cause analysis through the acquisition, collation and appraisal of relevant evidence and information and recommend changes in practice • report and escalate findings and recommendations both internally and externally as appropriate		
Clinical skills	By the end of the training period with respect to the role of quality systems in transfusion practice, trainees will have a range of clinical skills and will be able to: • identify, investigate and report quality incidents in accordance with local policies recommending corrective and preventative actions • interpret laboratory and clinical findings in relation to post-transfusion incidents • interact with internal and external authorities as appropriate • initiate the recall of products and initiate other preventative actions	WPBA MSF	1, 3, 4

SECTION 4: STAGE 2 SPECIALTY-SPECIFIC TRANSFUSION SCIENCE SYLLABUS

Stage 2: Developing independent practice

Objective

Throughout their training, trainees are given increasing responsibility and independence appropriate for their demonstrated level of competence and professional development, as judged by their clinical and educational supervisors. The purpose of this stage of training is to take such graded responsibility further, to enable the transition to the independent practice required of an FRCPath holder.

Demonstration of the skills required for independent practice is a requirement of the curriculum, and the relevant competencies must be assessed and achieved prior to completion of the training programme.

Currently, the most appropriate context in which to train for and achieve the competencies for independent practice is out-of-hours working, in an 'on-call' setting. However, there may be practical alternatives to this training context. If a training programme does not offer the opportunity to develop and demonstrate these skills through out-of-hours working, there must be alternative arrangements agreed by the relevant individual overseeing training.

Since the trainee will have reduced supervision during this form of training, to ensure patient safety and to optimise the benefits of this training, the following criteria must be met before it starts:

- the trainee must have been assessed by clinical and educational supervisors to be capable of safe practice with reduced supervision in relevant areas of the curriculum. They must therefore be in full compliance with the educational processes of the Annual Progression Review, i.e. ready to start more independent practice.
- before starting this training, the trainee must have a formal induction to ensure that they are familiar with the aspects of the work to be performed. This induction must be relevant to the time at which the work is to be performed, and for the organisations for which it is to be performed. It will include relevant local policies.
- the supervisor must ensure that the trainee understands the professional obligations of this form of practice, including availability and confidentiality.
- the trainee must have demonstrated to clinical and educational supervisors through previous directly supervised practice, competence in managing common clinical and laboratory problems of the kind likely to be encountered in the clinical transfusion service, relevant to the setting in which the trainee will undertake this form of practice.
- arrangements for 'handover' of clinical responsibility during this form of practice must be explicit.

Arrangements for cover by clinical supervisor

The ultimate responsibility for the quality of patient care and the quality of training lies with the clinical supervisor. However, the trainee will be expected to exercise professional judgement in recognising the limits of their capabilities and in involving senior colleagues in complex or challenging issues/decisions. The arrangements for obtaining such help and advice, at any time during this training period, must be formal and explicit. Although the purpose of this training is to enable independent working, the trainee must not be discouraged from asking for help from a clinical supervisor during this period at any time.

After a period of independent practice, the trainee must be debriefed by the clinical supervisor. The purpose of this debrief is to ensure that patients are being managed safely, and that prompt feedback is provided on the trainee's performance against the relevance competencies for this form of training (see below) and other competencies in the curriculum. The debriefing session may take the form of 'handover' to colleagues.

Topic	Professional practice	Assessment methods	GSP reference
Learning objective	By the end of the training period trainees will have achieved sufficient knowledge of professional practice to offer basic advice on the interpretation of results and will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures. • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level.		
Knowledge Independent practice and working out of hours	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice with respect to • laboratory and clinical aspects of laboratory transfusion • dealing with urgent specimens/issues and prioritising work appropriately	FRCPath Part 2	1, 2, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance, adaptation and mastery of the following technical procedures and laboratory skills: • recognise and work within own limitations in knowledge • liaise and communicate with a wide range of healthcare workers involved in relevant patient care • communicate effectively in person and by telephone • refer to more experienced colleagues as appropriate • provide continuity of care • prioritise work according to urgency • deal with difficult situations independently • recognise and analyse the overall effects of competing pressures on healthcare resources, e.g. availability of laboratory tests, availability of beds • collect, analyse and interpret information from a variety of sources • make safe decisions when clinical or laboratory information is incomplete or evolving • work with clinical and laboratory colleagues under pressure.	FRCPath Part 2 WPBA MSF	1, 2, 3
Clinical skills	By the end of the training period the trainee will have mastered the clinical skills necessary to: • manage and lead laboratory and clinical work within the transfusion laboratory • prioritise work appropriately	FRCPath Part 2 WPBA	1, 2, 3

Stage 2 Module 1: Haemopoiesis in Disease

Topic	Stage 2 Module 1 Haemopoiesis in Disease	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to haemopoiesis in disease, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the perturbation of normal haemopoiesis in malignant and non-malignant disease states • the physiological aspects of abnormal haemopoiesis • the aetiology of the haemoglobinopathies • the therapeutic options available for this group of patients	FRCPath Part 2	1, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • interpret and act upon haematological laboratory results, especially in relation to transfusion related issues	FRCPath Part 2 WPBA	1, 2, 3
Clinical skills	By the end of the training period with respect to haemopoiesis in disease, the trainee will be able to perform, adapt and master the clinical skills necessary to: • provide expert advice on the transfusion of patients with haematological conditions • select and provide blood for transfusion	FRCPath Part 2 WPBA MSF	1, 2, 3

Stage 2 Module 2: Haemostasis and Transfusion Therapy

Topic	Stage 2 Module 2 Haemostasis and Transfusion Therapy	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to **h**aemostasis and transfusion therapy ,the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge Selection and validation of appropriate tests. Scientific quality assurance of test procedures. Validity and reliability of test results and their application.	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the appropriate use of blood components and products to manage congenital and acquired disorders of haemostasis including those due to: o inherited coagulation factor deficiencies o autoimmune conditions o thrombotic thrombocytopenic purpura o heparin-induced thrombocytopenia o bone marrow failure and/ suppression o major trauma o surgical and obstetric bleeding o disseminating intravascular coagulation • congenital and acquired qualitative and quantitative platelet disorders • the pathophysiology and diagnosis of coagulation disorders • the indications for, and adult and paediatric doses of, components and products used to achieve / maintain haemostasis in the conditions above including: o platelet concentrate o fresh frozen plasma o cryoprecipitate o albumin	FRCPath Part 2	1, 3

Topic	Stage 2 Module 2 Haemostasis and Transfusion Therapy	Assessment methods	GSP reference
	○ intravenous immunoglobulin ○ coagulation factor concentrates ○ fibrin sealants ○ Desmopressin acetate (Desamino--d arginine vasopressin , DDAVP). ○ tranexamic acid and other fibrinolytic inhibitors • clinical contraindications / cautions for using blood components and products in specific conditions such as TTP, HIT and IgA deficiency with anti-IgA • the value and limitations of laboratory and 'near patient' tests used to monitor haemostasis and guide transfusion support		
Technical skills and procedures	At the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance, adaptation and mastery of a range of technical procedures and laboratory skills and will be able to: • interpret laboratory results in relation to the investigations into cases of disorders of haemostasis	FRCPath Part 2 WPBA	1, 2 , 3
Clinical skills	By the end of the training period with respect to haemostasis and transfusion therapy, trainees will be able to perform, adapt and master the clinical skills necessary to: • provide expert advice on the use of blood components and products for the treatment of disorders of haemostasis	FRCPath Part 2 WPBA MSF	1, 2, 3

Stage 2 Module 3: Transfusion Therapy for Patients with Anaemia and Common Haematological Disorders

Topic	Stage 2 Module 3 Transfusion Therapy for Patients with Haematological Disorders	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to transfusion therapy for patients with haematological disorders, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• common malignant and non-malignant haematological disorders, their pathophysiology, presentation and treatment
	• the pathophysiology of anaemia including:
	  ○ iron deficiency
	  ○ megaloblastic anaemia
	  ○ congenital and acquired haemolytic anaemia
	  ○ haemoglobinopathies
	  ○ anaemia of chronic disorders
	  ○ neonatal anaemia
	• the biochemistry of haemoglobin breakdown
	• the laboratory techniques required for the investigation of anaemia
	• the use of blood product and component support, and the complications of long-term transfusion in these disorders
	• post-transfusion haemolysis
		FRCPath Part 2	1, 3

Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to a range of technical procedures and laboratory skills and will be able to:	FRCPath Part 2	1, 2 , 3

Topic	Stage 2 Module 3 Transfusion Therapy for Patients with Haematological Disorders	Assessment methods	GSP reference
	• master the performance of and interpret serological and biochemical tests to investigate the causes of anaemia and other haematological disorders	WPBA	
Clinical skills	By the end of the training period with respect of transfusion therapy for patients with haematological disorders, trainees will be able to perform, adapt and master a range of clinical skills and will be able to: • select and direct the use of clinical laboratory methods in the diagnosis and monitoring of haematological disorders • advise on transfusion support for patients with haematological disorders, including patients after allogeneic stem cell transplantation • provide expert advice on the transfusion of patients with haemolysis	FRCPath Part 2 WPBA MSF	1, 2, 3

Stage 2 Module 4: Advanced Blood Group Serology

Topic	Stage 2 Module 4 Advanced Blood Group Serology	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to Transfusion Science, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• genetic background, prevalence, ethnic variations of antigens, and the clinical significance of corresponding antibodies, including but not limited to the following systems: ABO and H, MNS, P1PK, Rh, LW and RHAG, Lutheran, Kell and Kx, Duffy, Kidd, Diego, Dombrock, Colton, Chido/Rogers, Gerbich, Cromer, Knops, Indian, JMH, I, 'Globoside', JR, Lan, and Vel
	• ABO and H, sub-groups of A, variants of A and B, Bombay phenotype
	• the effects of age, disease and transplantation on ABO antigens and antibodies
	• Rh, LW and RHAG. Most probable haplotypes, compound and low prevalence antigens, effect of RHAG genes, Rhnull
	• Kell and Kx. Ko and anti-Ku, Kmod and McLeod phenotypes
	• Kidd and the anamnestic response of anti-Jka
	• associations between blood groups and disease, including:
	  ○ Duffy and malaria
	  ○ Auto-anti-I and cold haemagglutinin disease
	  ○ Anti-P and paroxysmal cold haemogobinuria
	• the role of molecular genotyping in elucidation of blood groups
	• the investigation and transfusion of auto-immune haemolytic anaemias (drug induced, warm, cold and mixed type) including the use of:
		FRCPath Part 2	1, 2, 3

Topic	Stage 2 Module 4 Advanced Blood Group Serology	Assessment methods	GSP reference
	○ adsorption and elution techniques ○ the use of monospecific antiglobulin reagents ○ the Donath-Landsteiner test for PCH • impact of exogenous immunoglobulin on laboratory tests • blood group changes following allogeneic stem cell transplantation		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • perform a full range of advanced techniques for the elucidation of blood grouping and red cell antibody problems • undertake the laboratory investigation of autoimmune haemolytic anaemias • evaluate the performance and limitations of advanced serological techniques including adsorption and elution procedures to reveal underlying antibodies • interpret results from advanced laboratory techniques including the interpretation of adsorption procedures • interpret of molecular genotyping results, noting the multiple genetic backgrounds for some blood group phenotypes	FRCPath Part 2 WPBA	1, 2 , 3
Clinical skills	By the end of the training period trainees will, in respect of advanced blood group serology, be able to perform, adapt and master a range of clinical skills and will: • report on all serologically complex cases, including AIHA and post-transfusion reactions, advising the transfusion requirements of individual patients taking due account of the clinical setting	FRCPath Part 2 WPBA MSF	1, 2, 3

Stage 2 Module 5: Histocompatibility and Immunogenetics in Blood Transfusion

Topic	Stage 2 Module 5 Histocompatibility and Immunogenetics (H and I)in Blood Transfusion	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to **h**istocompatibility and immunogenetics in blood transfusion, the trainee will be able to: • critically analyse, synthesise, evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge Selection and validation of appropriate tests. Scientific quality assurance of test procedures. Validity and reliability of test results and their application.	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the principles of HLA and HPA typing, antibody detection and cross-matching techniques recognise the role of HLA, HPA and HNA typing in the selection and provision of blood components the principles of tests used for post-transplant monitoring • the criteria for test selection and application to clinical speciality • the limitations and clinical relevance of available tests • the relevance and application of in-silico matching algorithms • the relevance of blood transfusion to the development of HLA, HPA and HNA antibodies • the role of H&I laboratory in the investigation of complications of blood transfusion and the provision of compatible blood components • appropriate H&I tests required for the investigation of complications of blood transfusion and the provision of compatible blood components • the process for selection of blood products for transfusion in the presence of HLA, HPA and HNA antibodies		1, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance, adaptation and mastery of H&I in blood transfusion. Specifically the trainee will:		1, 3

Topic	Stage 2 Module 5 Histocompatibility and Immunogenetics (H and I)in Blood Transfusion	Assessment methods	GSP reference
	• express laboratory findings using appropriate HLA, HPA and HNA nomenclature. • select and request appropriate H and I tests for t he pre-transfusion and post-transfusion workup of patients sensitised to blood products • select and request appropriate H and I tests for the investigation of transfusion reactions, e.g. transfusion-associated acute lung injury • report results and provide relevant clinical commentary and advice where necessary		
Clinical skills	By the end of the training period the trainee will be able to apply knowledge of H and I in blood transfusion to perform, adapt and master the clinical skills necessary to: • advise on the diagnostic value of H and I test results relating to blood transfusion therapy • participate at relevant multi-disciplinary team meetings, acting as a liaison between the transfusion laboratory, the H and I laboratory, and the transfusion team • advise the clinical team with regard to the selection and compatibility of patient and blood products • advise the clinical team with regard to the outcome of investigations for transfusion reactions		1, 3

Stage 2 Module 6: Thrombocytopenia and Neutropenia in the Fetus, Neonate and Adult

Topic	Stage 2 Module 6 Thrombocytopenia and Neutropenia in the Fetus, Neonate and Adult	Assessment methods	GSP reference
Learning objectives	By the end of the training with respect to thrombocytopenia and neutropenia in the fetus, neonate and adult, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the presentation and pathogenesis thrombocytopenias caused by platelet-specific antibodies including:
	  ○ neonatal alloimmune thrombocytopenia
	  ○ post-transfusion purpura
	  ○ thrombocytopenia after stem cell transplantation
	  ○ autoimmune thrombocytopenia
	  ○ drug induced thrombocytopenia including heparin-induced thrombocytopenia
	• the presentation and pathogenesis neutropenias caused by granulocyte-specific antibodies including:
	  ○ neonatal alloimmune neutropenia
	  ○ neutropenia after stem cell transplantation
	  ○ transfusion-related alloimmune neutropenia
	  ○ adult autoimmune neutropenia
	  ○ autoimmune neutropenia of infancy
	  ○ drug induce neutropenia
	• isoimmune conditions including:
			1, 3

Topic	Stage 2 Module 6 Thrombocytopenia and Neutropenia in the Fetus, Neonate and Adult	Assessment methods	GSP reference
	○ thrombasthenia ○ FcγRIII deficiency. • laboratory detection and identification of platelet and granulocyte-specific antibodies including: ○ flow cytometric assays ○ monoclonal antibody immobilisation of platelet or granulocyte antigens ○ use of immobilised recombinant antigens • fetal genotyping from fetal and maternal blood samples		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of the following technical procedures and laboratory skills: • the detection and relevance of platelet-specific or granulocyte-specific antibodies to the differential diagnosis of autoimmune and alloimmune thrombocytopenia and neutropenias affecting the fetus, neonate and adult		1, 2, 3
Clinical skills	By the end of the training period the trainee will be able to apply knowledge of the pathogenesis and laboratory diagnosis of thrombocytopenia and neutropenia to perform, adapt and master a range of clinical skills and will • recommend to clinical colleagues an investigative approach to patients presenting with thrombocytopenia or neutropenia • propose strategies to clinical colleagues to optimise the recognition and management of rare but clinically important disorders affecting subsequent pregnancies. including neonatal alloimmune thrombocytopenia • advise clinical colleagues on the selection of compatible blood components for intra-uterine, neonatal and adult transfusion • lead and evaluate education and training for nursing and medical staff involved in obstetric care to optimise the recognition and referral of high risk pregnancies		1, 2, 3

Stage 2 Module 7: Non-infectious Adverse Reactions to Red Cell Transfusion Therapy

Topic	Stage 2 Module 6 Non-infectious Adverse Reactions to Red Cell Transfusion Therapy	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to non-infectious adverse reactions to red cell transfusion therapy, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the pathogenesis and presentation of immune-mediated transfusion reactions including:
	  ○ Acute and delayed haemolytic reactions
	  ○ Febrile transfusion reactions
	• the pathogenesis and presentation of non-immune-mediated transfusion reactions including
	  ○ Volume overload
	  ○ Hypotensive reaction
	  ○ Citrate toxicity
	  ○ Hyperkalemia
	  ○ Hypothermia
	  ○ Non-immune haemolysis (eg hypotonic solutions, pumps)
	• the investigation and diagnosis of the above disorders
	• guidelines on the investigation and management of transfusion reactions
	• anaphylactic and severe (anaphylactoid) reactions, including to IgA
			1, 3

Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance,		1, 2, 3

Topic	Stage 2 Module 6 Non-infectious Adverse Reactions to Red Cell Transfusion Therapy	Assessment methods	GSP reference
	adaptation and mastery of non-infectious adverse reactions to red cell transfusion therapy. Specifically the trainee will: • select, direct and interpret laboratory tests to support the diagnosis of adverse reactions to blood transfusion therapy		
Clinical skills	By the end of the training period the trainee will be able to apply their expert knowledge of adverse reactions to red cell transfusion therapy to perform, adapt and master the clinical skills necessary to: • provide expert advice on the selection of blood components and blood products and for patients who have reacted adversely to transfusion and on the contraindications of transfusion • provide expert advice on patients at risk of adverse reactions to blood products and on component selection and/or secondary processing to avoid haemolytic transfusion reactions, transfusion- associated graft *versus* host disease, and transfusion-associated circulatory overload		1, 2, 3

Stage 2 Module 8: Adverse Reactions to Platelet and Granulocyte Transfusion Therapy.

Topic	Stage 2 Module 8 Adverse Reactions to Platelet and Granulocyte Transfusion Therapy	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to adverse reactions to platelet and granulocyte transfusion therapy, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the presentation and pathogenesis of:
	  ○ refractoriness to random donor platelet transfusion
	  ○ post-transfusion purpura
	  ○ transfusion-associated graft-versus host disease
	  ○ transfusion-related acute lung injury
	  ○ disseminated intravascular coagulation
	• the investigation and diagnosis of the above disorders
	• the maintenance of an HLA-typed platelet donor panel
	• the selection and provision of HLA-selected platelets
			1, 3

Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance, adaptation and mastery of the adverse reactions to platelet and granulocyte transfusion therapy and will: • select, direct and interpret laboratory tests to support the diagnosis of adverse reactions to blood transfusion therapy		1, 2, 3

Topic	Stage 2 Module 8 Adverse Reactions to Platelet and Granulocyte Transfusion Therapy	Assessment methods	GSP reference
Clinical skills	By the end of the training period the trainee will be able to apply their expert knowledge of the adverse reactions to platelet and granulocyte transfusion therapy to perform, adapt and master the clinical skills necessary to provide advice to clinical colleagues on: • the selection of blood, blood products and components for patients who have reacted adversely to transfusion and • the contraindications of transfusion, provide advice on patients at risk of adverse reactions to blood products and • on component selection and/or secondary processing to avoid transfusion- associated graft *versus* host disease, and transfusion-associated circulatory overload		1, 2, 3

Stage 2 Module 9: Infectious Complications of Transfusion Therapy.

Topic	Stage 2 Module 9 Infectious Complications of Transfusion Therapy	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to the infectious complications of transfusion therapy the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• disease associations, significance, incidence, pathophysiology, presentation, prevention, donor screening and management of:
	• viral infections (although this may not be an exhaustive list) including:
	  ○ Hepatitis B virus
	  ○ Hepatitis C virus
	  ○ HIV I/II
	  ○ HTLV I/II
	  ○ West Nile Virus
	  ○ CMV
	  ○ Epstein Barr virus
	• bacterial infections
	  ○ Syphilis
	• parasitic infections
	  ○ Malaria
	  ○ Babesia
	  ○ Chagas Disease
	• prion diseases
			1, 3

Topic	Stage 2 Module 9 Infectious Complications of Transfusion Therapy	Assessment methods	GSP reference
	○ Creutzfeldt-Jakob disease ○ Variant Creutzfeldt-Jakob disease		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance, adaptation and mastery of the infectious complications of transfusion therapy. Specifically the trainee will: • recognise and appraise the potential risks of infectious complications following blood transfusion, and the measures taken to reduce risks as far as possible		1, 2, 3
Clinical skills	By the end of the training period the trainee will be able to apply expert knowledge of the infectious complications of blood transfusion therapy to perform, adapt and master the clinical skills necessary to: • provide advice and tuition to clinical colleagues on the rationale for infectious disease screening and on the relative risks to blood transfusion therapy		1, 2, 3

Stage 2 Module 10: Transfusion Support for Organ Transplantation

Topic	Stage 2 Module 10 Transfusion Support for Organ Transplantation	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to transfusion support for organ transplantation, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the Red Book and BSH guidelines on the use of irradiated blood components.
	• the selection of HLA-matched red cells and platelets to avoid pre-transplant sensitization.
	• strategies to overcome ABO incompatibility including:
	  ○ plasma exchange
	  ○ immunosuppression
	  ○ immunoadsorption
	  ○ quantitation of anti-A and anti-B in prospective transplant recipients
	• immune haemolysis as result of passenger lymphocyte syndrome and treatment
	• ABO group after organ transplantation and effect on transfusion requirements
	• the role of CMV
	• transfusion support for immunosuppressed patients
	• the role of HLA in selection of donors for organ transplantation
			1, 3

Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • adapt and master transfusion support for organ transplantation		1, 2, 3

Topic	Stage 2 Module 10 Transfusion Support for Organ Transplantation	Assessment methods	GSP reference
	• select, perform and interpret laboratory tests to assess and monitor ABO antibody levels		
Clinical skills	By the end of the training period with respect to Transfusion Science, trainees will be able to perform the clinical skills necessary to: • provide expert advice on significance of ABO incompatibility and anti-A and anti-B antibody concentrations in ABO incompatible organ transplantation • provide expert advice on the transfusion support for patients undergoing organ transplantation including the provision of HLA-matched red cells		1, 2, 3

Stage 2 Module 11: Haemopoietic Stem Cell Collection, Processing, Storage and Use

Topic	Stage 2 Module 11 Haemopoietic Stem Cell Collection, Processing, Storage and Use	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to **h**aemopoietic stem cell collection, processing, storage and use, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge
 	
Selection and validation of appropriate tests.
 	
Scientific quality assurance of test procedures.
 	
Validity and reliability of test results and their application.
	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the application of autologous and allogeneic (related and unrelated) stem cell transplantation for the treatment of malignant and non-malignant disorders
	• immunological and haematological reconstitution post-transplant
	• international standards for cellular therapy, product collection, processing and administration
	• ethical and regulatory aspects of stem cell transplantation including appropriate consent and the role of the Human Tissue Act
	• selection criteria for related and unrelated adult donors and cord blood including the role of HLA matching and cell dose
	• the collection and transport bone marrow and mobilised peripheral blood stem cells
	• principles of cell purification, enrichment, depletion and cryopreservation
	• use of flow cytometry to measure stem cell dose and viability
	• the main causes of post-transplant mortality and morbidity including:
	  ○ relapse
	  ○ infection
	  ○ graft versus host disease
	• immunological consequences of allogeneic stem cell transplantation including:
			1, 3

Topic	Stage 2 Module 11 Haemopoietic Stem Cell Collection, Processing, Storage and Use	Assessment methods	GSP reference
	○ graft versus leukaemia effect ○ graft versus host disease • graft rejection • testing, manipulation and cryogenic storage of stem cell donations including the measures taken to avoid product contamination		
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • adapt and master the collection, processing, storage and use of haemopoietic stem cells • select and provide blood components as required for stem cell processing • manage the safe handling of stem cell donations and products, including the use of dry shippers		1, 2, 3
Clinical skills	By the end of the training period trainees will, in respect of Transfusion Science, be able to perform a range of clinical skills and will be able to: • advise on the clinical significance of red cells in ABO incompatible stem cell transplants		1, 2, 3

Stage 2 Module 12: Patient Blood Management

Topic	Stage 2 Module 12 Patient Blood Management	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to patient blood management, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• guidelines for the appropriate use of blood
	• alternatives to allogeneic blood transfusion including:
	  ○ intra- and post-operative cell salvage
	  ○ synthetic blood and blood substitutes
	  ○ pre-deposit autologous blood donation in exceptional circumstances
	• optimisation of patient haemoglobin level, including use of erythropoietin, tranexamic acid and iron therapy
	• the use of IT-based decision support to optimise the appropriate use of blood
	• the use of clinical audit to monitor blood usage
	• the value of pre-operative and inter-operative assessment including coagulation and point of care testing
	• blood tracking and management systems
	• the clinical management of patients who decline blood transfusion
		CBD	1, 3

Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to:		1, 3

Topic	Stage 2 Module 12 Patient Blood Management	Assessment methods	GSP reference
	• adapt and master patient blood management • propose and adapt IT solutions to support the appropriate use of blood transfusion therapy • commission and support clinical audits of blood usage and implement and evaluate changes made as a result of audit • schedule and support (as appropriate) pre-deposit of patient blood and intra- and post-operative cell salvage procedures		
Clinical skills	By the end of the training period with respect to Transfusion Science the trainee will be able to perform the clinical skills and will: • propose and implement measures to improve the appropriate use of blood and evaluate the impact of the measures • liaise with other healthcare workers to champion the appropriate use of blood and to drive on-going improvements in transfusion safety and efficacy		1, 3

Stage 2 Module 13: Therapeutic Apheresis

Topic	Stage 2 Module 13 Therapeutic Apheresis	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to therapeutic apheresis, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		

Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to:
	• the range of therapeutic apheresis procedures including:
	  ○ therapeutic plasma exchange
	  ○ red cell exchange
	  ○ peripheral blood stem cell collection
	  ○ granulocyte collection
	  ○ platelet depletion
	  ○ leukocyte depletion
	  ○ low density lipid removal
	  ○ extracorporeal photopheresis
	  ○ adsorption of ABO and HLA antibodies
	• the primary indications for therapeutic apheresis:
	  ○ apheresis as accepted first line therapy (eg Guillian-Barre syndrome, myasthenia gravis, thrombotic thrombocytopenic purpura)
	  ○ apheresis as accepted second line therapy (eg. extracorporeal photophoresis for chronic graft *versus* host disease)
	• apheresis prescribed on an individualised basis
			1, 2, 3

Topic	Stage 2 Module 13 Therapeutic Apheresis	Assessment methods	GSP reference
Technical and Clinical skills	By the end of the training period the trainee will be able to apply knowledge of therapeutic apheresis to perform, adapt and master the clinical skills necessary to: • advise clinical colleagues on the use of a range of therapeutic apheresis procedures in patients and donors	WPBA MSF	1, 2, 3

Stage 2 Module 14: Transfusion Regulations, Standards and Guidelines

Topic	Stage 2 Module 14 Transfusion Regulations, Standards and Guidelines	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to transfusion regulations, standards and guidelines, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • All relevant regulations, guidelines and standards relating to blood transfusion, including: o European Blood Safety Directives 2002/98/EC and 2004/33/EC as enshrined in UKBSQR 2005 (or superseding legislation) o BSH guidelines relating to blood grouping, pre-transfusion testing, clinical practice, use of blood products and components o JPAC 'Guidelines for Blood Transfusion Services in the UK' (Red Book) and Transfusion Handbook o UK Transfusion Laboratory Collaborative standards o MHRA guidance o UKAS standards and ISO15189 o CQC standards o principles of good manufacturing practice o CPA recommendations.		1, 2, 3
Technical skills and procedures	By the end of the training period the trainee will be able to demonstrate a critical understanding of current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to: • apply all regulations, standards and guidelines to the activities of a transfusion laboratory	MSF	1, 2, 3

Topic	Stage 2 Module 14 Transfusion Regulations, Standards and Guidelines	Assessment methods	GSP reference
	• evaluate the impact of any new guidelines and regulations, and propose and implement measures to achieve compliance		
Clinical skills	By the end of the training period the trainee will be able to apply knowledge of transfusion regulations, standards and guidelines to perform, adapt and master the clinical skills necessary to: • oversee laboratory compliance in ensuring the accuracy, reliability and efficacy of laboratory performance • advise clinical and other colleagues on the the clinical benefits of compliance in terms of patient safety and outcomes	WPBA MSF	1, 2, 3

Stage 2 Module 15: Advanced Quality Management and Clinical Governance

Topic	Stage 2 Module 15 Advanced Quality Management and Clinical Governance	Assessment methods	GSP reference
Learning objectives	By the end of the training period with respect to advanced quality management and clinical governance, the trainee will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of technical and clinical skills and procedures • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • the criteria and process for accreditation and licensing standards applicable to a transfusion laboratory including: o Blood Safety and Quality Regulations o CPA standards o ISO15189 o *In vitro* diagnostic device (IVDD)/CE marking • the role of regulatory bodies including o MHRA o CQC o Human Tissue Authority o National Institute for Health and Care Excellence (NICE) • change management including validation processes • internal and external quality assessment schemes • risk management including risk identification, assessment, avoidance and control • the principles and application of clinical governance		1, 2, 3, 4
Technical skills and	By the end of the training period the trainee will be able to demonstrate a critical understanding of		2, 3, 4

Topic	Stage 2 Module 15 Advanced Quality Management and Clinical Governance	Assessment methods	GSP reference

procedures	current relevant research, theory and knowledge and its application to the performance of a range of technical procedures and laboratory skills and will be able to:
	• exercise the key components of good clinical governance including:
	  ○ clinical audit
	  ○ education, training and continuing professional development
	  ○ risk management
	  ○ evidence-based care and effectiveness
	  ○ patient-oriented care and involvement
	• perform audits against defined standards identifying non-conformances and proposing and implementing remediation plans and evaluating the impact of the changes made
	• maintain robust procedures for quality assurance and quality control.
	• critically review quality incidents and near misses, and develop and implement corrective and preventative actions
	• undertake and evaluate trend analyses
	• interpret and respond to outcomes of external quality assessment schemes
	• implement and manage change to improve practice in accordance with change management principles without compromising safety or compliance
	• commission and perform clinical audits, deriving plans to improve patient outcomes
	• report incidents internally and externally including MHRA SABRE and SHOT		

Clinical skills	By the end of the training period the trainee will be able to apply knowledge of advanced quality management and clinical governance to perform, adapt and master the clinical skills necessary to: • take risk-based decisions • deliver clinical advice in the context of conflicting and changing evidence without compromising compliance • explain the impact of changes to testing strategy and/or service delivery	WPBA	3, 4

Stage 2 Module 16: Leadership and management

Topic	Module 16 Leadership and Management	Assessment methods	GSP reference
Learning objective	By the end of the training period trainees, with respect to leadership and management, will be able to: • analyse, synthesise, critically evaluate and apply knowledge • perform, adapt and master a range of skills and • demonstrate the attitudes and behaviours necessary for professional practice as a consultant clinical scientist dealing with the complexities, uncertainties and tensions of professional practice at this level.		
Knowledge	By the end of the training period the trainee will be able to demonstrate the ability to analyse, critically evaluate and synthesise relevant knowledge and its application to their professional practice in relation to: • Leadership and team working models • Good Laboratory Management: • the concepts of good laboratory practice • the process of management and being managed • the criteria and process for laboratory accreditation – quality system management and accreditation (UKAS, ISO) – test validation and verification and related quality assurance processes • how the appraisal process works • the process of clinical audit • the importance of clinical governance and delivery of high-quality standards in transfusion science: • the concept of clinical risk management and procedures designed to minimise risks • the importance of patient consent to use data or specimens for ethically approved research or teaching • the current organisation of NHS and allied organisations • healthcare structures – the role of the Care Quality Commission (CQC) the roles of 'arm's length bodies' involved in health protection including the Public Health England (PHE), Food Standards Agency (FSA), MHRA and NICE – laboratory data entry and retrieval and surveillance systems • the Data Protection Act • patient confidentiality and the Caldicott principles • employment law	FRCPath Part 2 WPBA	1, 2, 3, 5

	• staff appointment procedures • related issues including equality and diversity legislation • European working time directive requirements • career progression • remuneration scales and banding of laboratory scientific staff.		
Technical and Clinical skills	By the end of the training period the trainee will be able to apply knowledge of leadership and management to perform, adapt and master the skills required to manage and lead the • laboratory diagnostic repertoire and research and innovation programmes to maintain a cutting edge diagnostic service • the organisation and structure of a transfusion laboratory including: – staffing and financial issues – planning – implementation of policies and rotas. • implement these criteria • use constructive listening, mentoring, and appraisal skills • use personal appraisal constructively • audit and evaluate: – personal and departmental activities – existing and new tests, techniques or clinical services • present information utilising presentation and public speaking skills • organise teaching • search electronic databases and use the Internet as a learning and communication resource: – perform, adapt and master the use of database, word processing and statistics programmes – define how to undertake searchesapply the principles of confidentiality and their implementation in terms of clinical practice. –	WPBA MSF	1, 2, 3, 5

SECTION 5: VERTICAL STRAND – GENERIC HELATHCARE SCIENCE

(i) Innovation in Healthcare Science

Topic	Innovation in Healthcare Science	Assessment methods	GSP reference
Learning objectives	Innovation is defined as an idea, product, or service new to the NHS or applied in a novel way that has the potential to significantly improve the quality of health and care wherever it is applied (Innovation Health and Wealth: Accelerating Adoption and Diffusion in the NHS, 2011). By the end of this module the Clinical Scientist in HSST will be able to analyse and synthesise their understanding of service development and improvement and the role of innovation as creative and enterprising researchers, entrepreneurs and problem solvers. They will apply their expert scientific knowledge to improve or develop new clinical services, identifying opportunities to innovate and creating a culture where innovation flourishes. They will work with colleagues and patients as they plan, evaluate and deliver new services or diagnostic approaches. The Clinical Scientist in HSST will be expected to disseminate their innovative work, evaluating the impact on patients and health services as applicable. In some healthcare science specialisms, the Clinical Scientist in HSST will be expected to develop a plan to market successful, regulatory-compliant devices and diagnostics products or service innovation. The Clinical Scientist in HSST will also be expected to be able to keep up to date and analyse and synthesise their understanding of key and emerging technologies that underlie recent innovations in healthcare science. The Clinical Scientist in HSST will be expected to demonstrate the ability to critically reflect on their performance and evaluate their own response to both normal and complex situations. They will consistently demonstrate the professional attitudes and behaviours expected of a Consultant Clinical Scientist and place the patient and their safety at the centre of care.		
Knowledge	By the end of the training period the Clinical Scientist in HSST will be able to analyse, synthesise and critically apply their expert scientific knowledge with respect to the contribution of innovation in improving and developing healthcare and the steps required to identify innovative solutions and methods within their specialism, and will: • identify recent successful innovation projects that have been implemented within the specialism that have improved patient outcomes, and critically evaluate the enablers and barriers to successful innovation in healthcare;		4.1.1 4.1.2 4.1.3

Topic	Innovation in Healthcare Science	Assessment methods	GSP reference
	• evaluate how technology and innovation are managed within the NHS, comparing and contrasting this with the private sector; • discuss the legal principles governing law and intellectual property, patents and trademarks, and evaluate the options that are available to protect new ideas, concepts, written material, images, or designs in the context of health and healthcare science; • assess market opportunities, including specifying the unmet need, describing the market space, competitors, etc., funding sources for new technology and the regulatory framework within which new technologies must be developed; • critically evaluate proposals that consider each of the key aspects of introducing a new technology to the NHS or an alternative organisation, including dealing with issues around intellectual property rights, patenting, professional codes of practice and the establishment of appropriate economic, legal and social frameworks; • describe and evaluate a range of methods/tools and frameworks that underpin: o the identification of ideas for service development and innovation; o the exploration of ideas and solutions; o the promotion of individual and group creativity; o the evaluation of ideas to transform an idea into something useful; o the development of a structured approach to problem solving and delivering solutions; o the development of a business case for the provision of a new service, including a cost-benefit analysis; o the promotion of effective collaboration while working with colleagues, patients and other people and organisations, and the value of the contribution from all partners; o the communication and discussion of information in a timely and effective manner; o effective communication with a variety of audiences, including lay and nonscience; o strategies to secure success attracting support;		

Topic	Innovation in Healthcare Science	Assessment methods	GSP reference
	○ leadership in innovation; ○ the implementation of a new technology/enterprise; o evaluating innovation; ○ dissemination of innovative solutions to promote the uptake of new methods of service delivery, new technology, etc., across healthcare.		
Practical skills	By the end of this module the Clinical Scientist in HSST will be expected to critically reflect and apply in practice a range of skills to identify potential ideas for service development and innovation, exploring ideas and solutions at all stages of an innovation pathway (i.e. create, refine, evaluate, appraise, use) to secure success and will: • identify potential ideas for service development and innovation, exploring ideas and solutions; • use a range of tools to promote creativity to: ○ promote individual creativity; ○ promote group creativity; ○ evaluate ideas ○ transform an idea into something useful • solve problems using a structured approach to problem solving by: ○ defining problems; ○ managing problems; ○ framing problems; ○ delivering solutions; • write a plan to introduce a new technology to the NHS or an alternative organisation spanning the key aspects that must be considered, including intellectual property rights, patenting, professional codes of practice and the establishment of appropriate economic, legal and social frameworks; • develop a business case for the provision of the new service, including a cost benefits analysis; • work with colleagues, patients and other people and organisations: o valuing others; o collaborating effectively; o keeping up to date; o communicating in a time and effective manner;		4.1.1 4.1. 4.4.1 4.1.4 4.1.5 4.1.6 4.1.7 4.1.8 4.1.9

Topic	Innovation in Healthcare Science	Assessment methods	GSP reference
	• utilise a range of strategies to secure success, including: o taking the initiative; o testing the water; o attracting support; o leading a new enterprise; • communicate effectively with a variety of audiences, including lay and nonscience.		
Behaviours and attitudes	By the end of this module the Clinical Scientist in HSST will be expected to evaluate their own response to both normal and complex situations, demonstrating the professional attributes and insights required of a Consultant Clinical Scientist working within the limits of professional competence, referring as appropriate to senior staff, and in the context of research and innovation will: • promote a sustainable, engrained culture of innovation in an individual, department and organisation; • solve problems; • take the initiative and provide leadership for the promotion and implementation of innovation; • keep up to date with developments in healthcare and healthcare science; • approach unfamiliar tasks and problems with an open and creative outlook; • use effective questioning techniques; • develop professional networks; • make and maintain connections; • explore opportunities and solutions to problems; be resilient and resourceful.		4.1.2 4.1.10 5.1.1 5.1.2 5.1.3 5.1.4 5.1.6 5.1.7 5.1.8 5.1.9 5.1.11 5.1.12

(ii) Clinical Bioinformatics, Genomics and Personalised Medicine

Topic	Clinical Bioinformatics, Genomics and Personalised Medicine	Assessment methods	GSP reference
Learning objective	Diseases and disease processes are complex and involve many interactions within the genome, across metabolic pathways and between the individual and the environment. Such considerations are important if the consequences of variations observed within an individual's genome are to be effectively assessed. Rapid advancements in areas such as functional genomics and systems biology are now providing new insights into such processes. This module builds and extends the knowledge of the Clinical Scientist in HSST with respect to the epidemiology and genetic basis of disease while introducing and developing areas such as clinical bioinformatics, personalised medicine, ehealth, health informatics and genomics applied within a healthcare science specialism. By the end of this module the Clinical Scientist in HSST will be able to analyse and synthesise their understanding of clinical bioinformatics, genomics and personalised medicine, and apply their knowledge to the practice of their HSST specialism. They will be able to identify opportunities to apply their learning to develop and improve services and the information provided to patients and critically evaluate their own response to both normal and complex situations using the professional attributes and insights required of a Consultant Clinical Scientist.		
Knowledge	By the end of the training period the Clinical Scientist in HSST will be able to analyse, synthesise and critically apply their expert knowledge with respect to genomics and personalised medicine and health informatics applied to their specialism, including: • governance and ethical frameworks in place within the NHS and how they apply to bioinformatics; • fundamental bioinformatic principles, including the scope and aims of bioinformatics and its development; • how bioinformatic tools and resources and genetic information can be integrated into the interpretation and reporting of test results from patients; • the use of personalised medicine in health and delivery of medical care and rehabilitation services; • functional genomics and systems biology strategies and the ways in which they can be applied in their HSST specialism for improved patient care;		1.1.4 1.1.5 2.1.6 2.2.5 3.1.5 4.1.5 4.1.6

Topic	Clinical Bioinformatics, Genomics and Personalised Medicine	Assessment methods	GSP reference
	• e-health developments in healthcare science and the wider healthcare setting; • supporting computer principles, e.g. hardware and software requirements for large datasets, cloud computing, network management, etc.		
Technical and clinical skills and procedures	By the end of this module the Clinical Scientist in HSST will be expected to critically reflect and apply in practice a range of clinical and communication skills with respect to genomics in order to advise and communicate effectively with patients, relevant clinicians, patients and the public, and other healthcare professionals, and will utilise and apply, as appropriate, knowledge of genomics and clinical bioinformatics within clinical practice, keeping abreast of developments that apply to their area of specialist practice as a Consultant Clinical Scientist.		1.1.3 1.1.4 1.1.5 1.1.6 1.1.7 1.1.8 1.2.4 1.2.5 1.3.1 1.3.2 1.4.1 1.4.6 2.1.1 2.1.2 2.1.3 2.1.4 2.1.5 2.1.6 2.2.1 2.2.6 2.2.9 2.3.1

			5.1.1 5.1.7 5.1.12

Topic	Clinical Bioinformatics, Genomics and Personalised Medicine	Assessment methods	GSP reference
Attitudes and behaviours	By the end of this module the Clinical Scientist in HSST will be expected to evaluate their own response to both normal and complex situations, demonstrating the professional attributes and insights required of a Consultant Clinical Scientist working within the limits of professional competence, referring as appropriate to senior staff and will: • work within data governance regulations; • support colleagues to promote the understanding of data governance regulations; • work within a multidisciplinary setting, transferring data appropriately; • keep up to date with advances in genomics, clinical bioinformatic and personalised medicine and other emerging technologies.		1.1.1 1.1.2 1.1.9 1.1.10 1.1.11 1.3.3 1.3.4

(iii) Doctoral-level Research

Topic	Doctoral-level Research	Assessment methods	GSP reference
Learning objective	The Clinical Scientist in HSST will be expected to undertake doctoral-level research that either (i) meets the research requirements of the doctoral-level training programme or (ii) results in a coherent body of papers that reaches the standard suitable for publication in peer-reviewed journals, undertaken during the HSST programme. They will also be expected to contribute to the preparation and submission of a grant proposal and present and defend their research at national/international scientific conferences. All research undertaken must comply with current ethical and governance requirements.		
Knowledge	By the end of this module the Clinical Scientist in HSST will be able to create and interpret new knowledge through original research and will systematically acquire and understand a substantial body of knowledge that is at the forefront of scientific, clinical, or professional practice, together with a detailed understanding of applicable techniques for research.		1.1.4 3.1.5 4.1.1 4.1.6 4.1.7
Technical and clinical skills and procedures	By the end of this module the Clinical Scientist in HSST will be expected to conceptualise, design and implement a research project(s) that leads to the generation of significant new knowledge in areas such as the development of new techniques, new approaches to service delivery and organisation, or the generation of ideas or approaches and/or understanding within the appropriate healthcare science HSST specialism, adjusting the project design in the light of unforeseen problems. The Clinical Scientist in HSST will be expected to demonstrate the ability to contribute to the writing and submission of grant applications, lead research and to present and disseminate their research orally and in writing appropriate to both specialist and non-specialist audiences, including patients and the public.		1.1.1 1.1.2 1.1.3 1.1.5 1.1.6 1.1.7 1.2.3 1.2.4 1.3.1 2.3.1 4.1.2 4.1.3 4.1.4

Topic	Doctoral-level Research	Assessment methods	GSP reference
			4.1.5 4.1.8 4.1.9
Attitudes and behaviours	By the end of this module the Clinical Scientist in HSST will be expected to evaluate their own response to both normal and complex situations with respect to research, from inception to dissemination, demonstrating the professional attributes and insights required of a Consultant Clinical Scientist working within the limits of professional competence, referring as appropriate to senior staff, and will: • exercise personal responsibility and largely autonomous initiative in complex and unpredictable situations, in professional or equivalent environments; • work within a multiprofessional research setting, optimising input and contributions from the whole of the research team; • make informed judgements on complex issues in specialist fields; • be innovative and resilient in their approach to tackling and solving problems; • communicate ideas and conclusions clearly and effectively to specialist and nonspecialist audiences.		1.1.1 4.1.10 5.1.2 5.1.3 5.1.7

(iv) Teaching, Learning and Assessment

Topic	Teaching, Learning and Assessment	Assessment methods	GSP reference
Learning objective	This module introduces key theories of teaching, learning and assessment to underpin the role of the Consultant Clinical Scientist as a teacher/trainer/leader, according to the best contemporary clinical and educational standards. The Clinical Scientist in HSST will acquire an understanding of the theoretical basis of teaching, learning and assessment, and will be expected to demonstrate the practical application of these skills in the work base. The Clinical Scientist in HSST will be expected to apply their knowledge, skills and experience of teaching, learning and assessment in their specialist area and the wider healthcare setting.		
Knowledge	By the end of this module the Clinical Scientist in HSST will be able to critically evaluate, analyse and synthesise their understanding of teaching, learning and assessment, and will be expected to apply their knowledge to plan, deliver and evaluate a range of teaching, learning and student support processes, including: • contemporary theories and the evidence base underpinning student-centred adult learning; • teaching, learning and assessment within the clinical and scientific work base to design, deliver and evaluate education and training programmes that meet the best clinical and educational standards; • models of supervision, mentoring and coaching; • the importance of feedback and methods of student-centred feedback.		1.4.1 1.4.2 1.4.3 1.4.4 1.4.5 1.4.6 2.3.1 2.3.2 3.1.1
Technical skills and procedures	By the end of this module the Clinical Scientist in HSST will be expected to critically reflect and apply in practice a range of teaching, learning and assessment skills. They will also be expected to supervise, mentor and coach colleagues using advanced communication skills and will: • critically evaluate information to enable the provision of evidence-based teaching, learning and assessment in a healthcare setting; • plan, deliver and evaluate teaching (individual sessions and/or a programme/module) using a range of teaching methods (including, where applicable, bedside teaching) and incorporating the principles of active learning, including lecture-based, small group teaching, practical skills teaching, problem-based learning, simulation, e-learning; • develop and extend generic capabilities, including communication skills, giving and receiving		1.1.1 1.1.2 1.1.3 1.1.10 1.1.11 2.3.1 2.3.2 3.1.3 4.1.6

	feedback, questioning techniques and peer, student and personal review of teaching;		
Topic	**Teaching, Learning and Assessment**	**Assessment methods**	**GSP reference**
	• critique a range of assessment methods; • plan, deliver and evaluate a range of assessments appropriate to the learning outcomes in each of the domains of knowledge, skills and attitudes/behaviour; • maintain a professional development portfolio to underpin individual personal development and life-long learning; • provide mentorship to healthcare scientists earlier in their career; • critically reflect and evaluate personal performance as part of a continuing professional development plan.		
Critical skills	By the end of this module the Clinical Scientist in HSST will be expected to critically reflect and apply in practice a range of clinical and communication skills with respect to teaching, learning and assessment, and support colleagues and students in supervision, mentoring and coaching situations: • plan, deliver and evaluate communication skills teaching; • evaluate the use of portfolios in clinical education and methods of assessing portfolios; • evaluate a range of methods for teaching and assessing critical reflection; • master a range of techniques for giving and receiving meaningful feedback; • master a range of communication skills, including listening, observing, motivating; • identify personal conflict style and use that information to develop and demonstrate skills in negotiating and mediating in conflict situations; • support team members using a range of tools, including coaching, mentoring and supervision; • prioritise the safety of patients during clinical teaching.		1.1.1 1.1.2 1.1.3 1.1.10 1.1.11 2.3.1 2.3.2 2.3.3 2.3.4 3.11 3.1.3 3.1.5 4.1.6

Topic	Teaching, Learning and Assessment	Assessment methods	GSP reference
Attitudes and behaviours	By the end of this module the Clinical Scientist in HSST will be expected to evaluate their own response to both normal and complex situations that arise during teaching, learning and assessment situations, demonstrating the professional attributes and insights required of a Consultant Clinical Scientist working within the limits of professional competence, referring as appropriate to senior staff, and will: • prioritise the safety of the patient and learner in teaching, learning and assessment situations; • recognise different types of learner and acknowledge that not all learners are made equal; • recognise and reflect on the learning needs of a range of healthcare professionals; • critically reflect on strategies to promote teaching, learning and assessment; • critically reflect on personal progress and assess personal learning needs with support from a personal or work-based mentor; • communicate effectively in writing and orally, listening actively and using appropriate questioning techniques; • support colleagues, students and trainees, etc., as required; • solve problems and recognise the implications of findings, referring to colleagues as required; • maintain confidentiality appropriate to the range of teaching, learning and assessment situations encountered.		1.1.1 1.1.2 1.1.3 1.1.4 1.1.5 1.1.6 1.1.7 1.1.8 1.1.9 1.1.11 2.2.9 2.3.1 2.3.2 5.1.3

(v) Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science

Topic	Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science	Assessment method	GSP reference
Learning objective	Involving patients, service users, carers and the public across the NHS and social care in healthcare and healthcare science is essential. Patients and the public should be involved in developing guidance, advice and quality standards, and supporting their implementation. There are a number of initiatives to support this aim, including: • Health and Social Care Act (DH, 2012) • NHS Constitution (DH, 2012) • 'Putting People at the Heart of Care' (DH, 2009) • 'Essential Standards of Quality and Safety' (CQC, 2010) The aim of this HSST module is therefore to ensure that the Clinical Scientist in HSST understands the importance and relevance of involving patients and the public, and organisations representing their interests in health and healthcare science. Patient and public involvement also includes providing opportunities for patients and the public to contribute to the development, accreditation, implementation and monitoring of education and training programmes for healthcare science and the wider healthcare community, e.g. by contributing to: curriculum development, teaching, learning and assessment activities, the accreditation of education and training programmes, recruitment to programmes and posts, developing guidance, advice and quality standards, and supporting their implementation. The Clinical Scientist in HSST will be expected to critically appraise the underpinning academic evidence base and gain experience of working with patients and the public and evaluating the impact on service delivery, education, research and innovation.		
Knowledge	By the end of this module the Clinical Scientist in HSST will comprehend, apply, analyse, synthesise and evaluate the evidence base underpinning the involvement of patients and members of the public across a range of areas and activities within healthcare and healthcare science. They will also be expected to be aware of the key areas where changes in healthcare will provide patients/carers and the public with access to their data, including medical records and test results, and how healthcare science services can optimise the positive impact of involving patients/carers and the public.		

Topic	Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science	Assessment method	GSP reference

	• patient involvement and engagement in terms of individuals as patients, citizens and tax payers;
	• current NHS strategies and policies to promote patient and public involvement in healthcare and the development of public policies;
	• different perspectives of engagement and involvement in health and healthcare;
	• incorporation of the patient and public interest to ensure that matters affecting patient safety are not overlooked;
	• patient involvement in commissioning services;
	• evidence base underpinning the involvement of patients and the public in health and healthcare;
	• barriers to effective patient involvement and potential solutions;
	• design, implementation and evaluation of patient pathways and services;
	• role and impact of patients and the public in NHS governance structures;
	• the importance of agreeing principles around the roles and responsibilities of patients who are involved in these areas;
	• how patients use information resources of varying backgrounds, e.g. those developed by the NHS and healthcare professionals; those developed by charities and advocacy groups; peer support and social networks; commercial sites; and wikis (notably Wikipedia*)*;
	• online health-related resources supporting:
	  ○ provision of information on healthcare interventions (treatments, operations and procedures);
	  ○ public health and patient advisory/support resources;
	  ○ patient engagement and involvement solutions (such as Patient Opinion, Patients Like Me, etc.);
	• impact of new technology that enables patient/public involvement in their own health;
	• issues and standards relating to the design and implementation of technology solutions to be used by members of the public;
	• implications of patient access to records and clinical information for interprofessional		

Topic	Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science	Assessment method	GSP reference
	practice and multidisciplinary care; • access to medical records and test results online and the benefits and challenges; • governance implications for individuals and organisations of information sharing and communication between professionals and patients. **Patient and Public Involvement (PPI) in Research** Involving patients and members of the public in research can lead to better research, clearer outcomes and faster uptake of new evidence. The Clinical Scientist in HSST will therefore be expected to discuss and evaluate PPI in: • the role of the Collaborations for Leadership in Applied Health Research and Care (CLARCHs), Academic Health Science Networks (AHSNs) and other relevant organisations and their approach to PPI; • commissioning and reviewing of research proposals; • identifying the important questions that health and social care research needs to answer as part of setting research priorities; • giving their views on research proposals alongside clinical scientists, clinicians, methodologists, scientists, and public health and other professionals; • helping assess proposals for funding; • taking part in clinical trials and other health and social care research studies, not just as subjects but as active partners in the research process; publicising and contextualising the results. **Patient and Public Involvement in Education and Training** Recent years have seen a shift in expectations of the public in the delivery of healthcare, perhaps best captured by the NHS's *No Decision About Me Without Me* maxim, along with the introduction of the Choice agenda. Involving patients and the public in the education and training of the current and future workforce is important to ensure that there is a shared understanding of the expectations of the patients and public and the roles and responsibilities of healthcare science and healthcare staff. The Clinical Scientist in HSST		

Topic	Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science	Assessment method	GSP reference

	will be expected to critically evaluate the impact of PPI across a range of teaching and learning activities, including:
	• role of patients and the public with respect to:
	  ○ programme design and curriculum development;
	  ○ course management and quality assurance;
	  ○ recruitment, training and support of patients and the public;
	  ○ recruitment and selection of students/trainees;
	  ○ teaching;
	  ○ student/trainee feedback;
	  ○ assessment;
	  ○ patient feedback as part of staff appraisal;
	• influencing resourcing to support teaching, learning and assessment;
	• evidence base underpinning the involvement of patients and the public in education and training.		

Technical and clinical skills and procedures	By the end of this module the Clinical Scientist in HSST will be expected to critically reflect on the current level of patient and public engagement and involvement in their own practice and the services they lead. They will be expected to apply in practice a range of skills to work in partnership with patients and will: • review current national and local strategies, including that of the local employer, with respect to patient engagement and partnership and identify where this can be strengthened; • in partnership with patients, use the outcome of the review to develop, implement and evaluate a new initiative to strengthen patient involvement in your area of work and disseminate the findings. The Clinical Scientist in HSST will be expected to reflect on the challenges of involving patients and the public in healthcare and healthcare science and applying research to practice, building on a critique of available evidence.		

Topic	Patient and Public Involvement, Engagement and Partnership in Healthcare and Healthcare Science	Assessment method	GSP reference
Attitudes and behaviours	By the end of this module the Clinical Scientist in HSST will be expected to consistently demonstrate the values and behaviours required of a Consultant Clinical Scientist working in partnership with patients and the public to ensure staff and services meet the needs of patients, and will: • respect the contribution the patient and public to healthcare and put the quality of the patient experience at the centre of personal practice and service design and delivery; • engage and work in partnership with individuals who are or who have been patients/carers, not always actively seeking the view of the 'well public'; • be creative in the approaches to engaging the population, particularly those groups whose voices are not always heard; • lead services with a culture that seeks and values the views of patients and the public and enables patients and the public to influence decisions in an open, transparent and evidence-based way.		

(vi) Science Communication

Topic	Science Communication	Assessment methods	GSP reference
Learning objective	By the end of this module the Clinical Scientist in HSST will be able to analyse and synthesise their understanding of how scientific and technical information and advice is best communicated within the healthcare organisation and more widely for the benefit of patients and the public. They will be expected to apply their knowledge to influence the direction of policy, standards and guidance, and to provide effective, concise and appropriate advice on scientific and technical issues to management, clinical staff, patients and other stakeholders. Additionally the Clinical Scientist in HSST will be expected to identify effective channels of communication and develop networks of contacts to keep abreast of trends in policy, standards and guidance, and to communicate effectively with the aim of influencing the development of these.		
Knowledge	By the end of this module the Clinical Scientist in HSST will be able to analyse, synthesise and critically apply their expert knowledge with respect to scientific and technical communication, including: • the role of effective communication in influencing policy direction in relation to scientific and technical issues within and outside a healthcare organisation; • the wide range of stakeholders involved in influencing policy direction, standards and guidance development; • the range of channels of communication available and the appropriate format of communication; • how to engage with the media and the wider public to provide effective communication of scientific and technical issues affecting health services.		

Technical and clinical skills and procedures	By the end of this module the Clinical Scientist in HSST will be able to demonstrate a critical understanding of the skills of effective science communication and will: • summarise complex information at an appropriate technical level for the intended audience; • write effective position papers, business cases, technical and scientific notes, papers and grant applications; • influence opinion formers.		
Topic	**Science Communication**	**Assessment methods**	**GSP reference**
Attitudes and behaviours	By the end of this module the Clinical Scientist in HSST will be expected to evaluate their own response to both normal and complex situations, demonstrating the professional attributes and insights required of a Consultant Clinical Scientist working within the limits of professional competence, referring as appropriate to senior staff, and will: • lead and champion innovative proposals for policy, regulation, standards and guidance; • proactively engage with the wider scientific and technical community in an area of activity.		1.1.1 1.1.2 1.1.3 1.2.1 1.2.3 1.2.4 1.3.1 1.3.2 1.3.4 1.3.6

Appendix A Acronyms and Abbreviations

AHCS	Academy of Healthcare Science
AoMRC	Academy of Royal Medical Colleges
BSH	British Society for Haematology
CBD	Case –based discussion
CCHST	Certificate of Completion of Higher Scientific Training
COSHH	Control of Substances Hazardous to Health
CPA	Clinical Pathology Accreditation
CMV	Cytomegalovirus
CPPD	Continuing Personal and Professional Development
CGC	Care Quality Commission
CSO	Chief Scientific Officer
DAT	Direct Antiglobulin Test
DOPS	Directly observed practical skill
ECE	Evaluation of clinical/management events
FRCPath	Fellowship of the Royal College of Pathologists
GMC	General Medical Council
GSP	Good Scientific Practice
H&I	Histocompatibility and Immunogenetics
HCPC	Health and Care Professions Council
HDFN	Haemolytic Disease of the Fetus and Newborn
HEE	Health Education England
HEIs	Higher Education Institutes
HLA	Human Leukocyte Antigen
HNA	Human Neutrophil Antigen
HPA	Human Platelet Antigen
HSST	Higher Specialist Scientific Training
IAT	Indirect Antiglobulin Test
ISO	International Organisation for Standards
IT	Information Technology
IVDD	*In-vitro* Diagnostic Devices
JPAC	Joint United Kingdom Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee
MHC	Major Histocompatibility Complex
MHRA	Medicines and Healthcare products Regulatory Agency
MSC	Modernising Scientific Careers
MSF	Multi-source feedback
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NSHCS	National School of Healthcare Science
NHSSTN	National Higher Specialist Training Number
OLAT	On-line Learning and assessment Tool
PD	Professional Doctorate
RCPath	Royal College of Pathologists
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
R&D	Research and Development
RRAA	Race Relations Amendments Act
SABRE	Serious Adverse Blood Reactions and Events
SACs	Specialist Advisory Committees
SHOT	Serious Hazards of Transfusion
STARD	Standards for Reporting of Diagnostic Accuracy
STP	Scientific Training Programme
UKAS	United Kingdom Accreditation Service
UK BSQR	United Kingdom Blood Safety & Quality Regulations 200