National School of Healthcare Science

NHS
Health Education England

Modernising Scientific Careers Practitioner Training Programme BSc (Hons) Healthcare Science

Cardiovascular, Respiratory and Sleep Sciences 2016/17

Developing people for health and healthcare

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CONTENTS

SECTION 1: INTRODUCTION TO THE PROGRAMME

READERSHIP

The Practitioner Training Programme (PTP) is an integrated academic and work-based undergraduate BSc (Hons) degree which may be undertaken through an on-site academic programme or through an apprenticeship. This document provides the curriculum (both academic and work-based) for the PTP and will be of interest to:

- academic and administrative staff, including external examiners within Higher Education Institutions (HEIs) which are accountable for the delivery of the curriculum;
- employers who may wish to support apprentices or employees in undertaking the PTP degree programme;
- learners, host departments and managers of services that employ healthcare science (HCS) staff;
- work-based trainers, including all those involved in supervising, mentoring, co-ordinating, assessing and delivering PTP education and training;
- Health Education England (HEE) Local Education and Training Boards (LETBs) and all HCS education and training commissioning organisations in the UK;
- National School of Healthcare Science (NSHCS);
- Academy for Healthcare Science (AHCS);
- patients and the public.

A list of abbreviations and glossary of terms used is provided in the appendices.

Introduction to Modernising Scientific Careers (MSC) and the Practitioner Training Programme (PTP)

1.1 Healthcare Science and the MSC Education and Training Programme

1. The HCS workforce plays a central role in safe and effective patient care across all pathways of care from health and wellbeing to end of life. There are approximately 55,000 employees in the HCS workforce in the NHS in the UK, and approximately 80% of all diagnoses can be attributed to their work.
2. Healthcare science involves the application of science, technology and engineering to health. *Good Scientific Practice* (GSP)[1] sets out the principles and values on which good practice within healthcare science is founded. It makes explicit the professional standards of behaviour and practice that must be achieved and maintained by all those who work in healthcare science. GSP and the Academy for Healthcare Science's (AHCS) Standards of Proficiency[2] and Standards of Education and Training[3] form the basis for all MSC training curricula that contextualise the Standards of Proficiency set down by the Health and Care Professions Council (HCPC) in a way that is accessible to the profession and the public.
3. The HCS workforce and services are grouped into four broad areas called divisions, namely: Life Sciences, Physical Sciences, Physiological Sciences and Clinical Bioinformatics. Within each division there are a number of HCS specialisms. With advances in scientific technology, changes to the delivery of healthcare scientific services and the development of MSC, the boundaries between these divisions have been shifting. MSC recognises this important change and to date has identified seven PTP themes (groupings of specialisms within a HCS division), which define training across a total of 19 HCS specialisms.

1.2 Introduction to the Practitioner Training Programme (PTP)

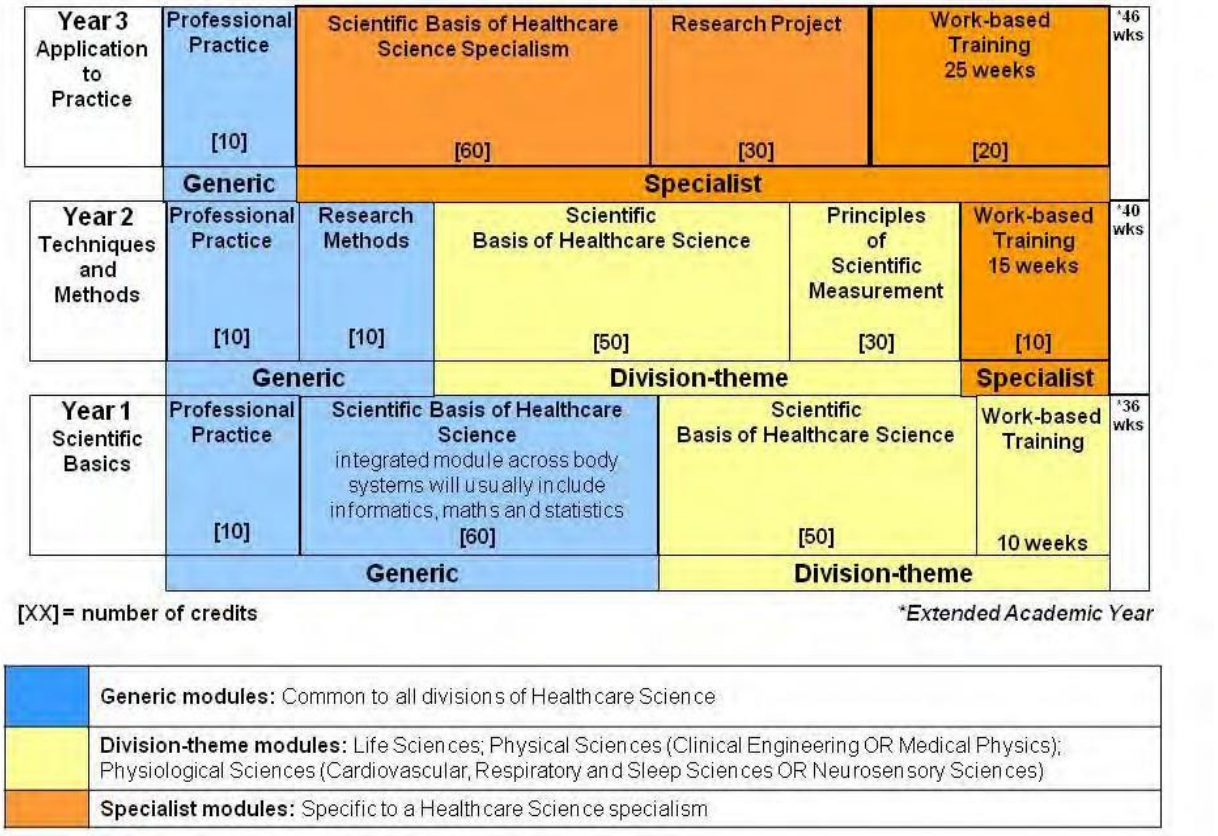
4. The HCS Practitioner Training Programme (HCS PTP) is a degree programme that has 2 routes of delivery:
   i. *On-site academic route:* an academic degree programme in which the learner[4] undertakes work-based placements but is not employed
   ii. *Apprenticeship route:* an in-service degree where the apprentice is employed whilst undertaking the PTP
5. The PTP typically will take a minimum of 3 years (but may be longer depending on the learner and the requirements of the employer and/or HEI to complete. It leads to a BSc Honours degree qualification that is contextualised for workplace occupational competency as a Healthcare Science Practitioner (HCSP) who provides HCS scientific and technical services within the HCS divisions and

[1] http://ahcs.flinthosts.co.uk/wordpress/wp-content/uploads/2013/09/AHCS-Good-Scientific-Practice.pdf
[2] http://www.ahcs.ac.uk/wordpress/wp-content/uploads/2014/07/AHCS_StandardsofProficiency.pdf
[3] http://www.ahcs.ac.uk/wordpress/wp-content/uploads/2014/08/AHCS_PTPStandardsOfEducationAndTraining.pdf
[4] the term *learner* is generally used to include both students undertaking the PTP through the on-site academic route and the apprenticeship route, except where reference to apprentices is specifically required.

specialisms of Life Science, Physiological Science, or Physical Science.

6. The BSc (Hons) PTP is designed to provide the HCSP with a strong science-based, patient-centred education and training in a specialist area of HCS. The overall aim of this HCSP education and training programme is to prepare the learner to fulfil the function of a HCSP working in a clinical HCS setting. The programme combines and integrates both academic and work-based learning and has a strong patient and technical scientific focus. Within the first year learners will experience of number of short placements or 'tasters' within the chosen PTP theme and gain some exposure to other aspects of the patient pathways, for example through clinics, patient education programmes, medical records and other area in which HCS contributes to patient care. This will give the learner a wide appreciation of the many related specialisms within HCS and a more holistic view of the areas that contribute to high-quality patient-centred care.
7. The diagram below depicts the broad framework and credit structure around which all PTP BSc (Hons) degree programmes in HCS are structured. The divisions within the MSC Programme (Life Sciences, Physical Sciences, Physiological Sciences and Clinical Bioinformatics)[5] have interpreted and adapted this framework to fit the range of HCS specialisms within the division/theme. Further refinement has been undertaken by each HEI to develop and deliver BSc (Hons) programmes that enable learners to meet the learning outcomes of the course. There is a strong generic programme that emphasises professional practice, research and the scientific basis of HCS.

High-level framework for the integrated BSc (Hons) in Healthcare Science



[5] Although at the current time there is no PTP in Clinical Bioinformatics.

8. Once employed as a HCSP a range of career development options will be available, including structured in-post programmes of continuous personal and professional development (CPPD), provided through Accredited Scientific Practice programmes.[6]
9. PTP degrees can be delivered either as an on-site academic programme with clinical placements, or through an apprenticeship[7], in which the learner is employed whilst the degree is undertaken. HEIs offering the degree apprenticeship must join the Skills Funding Agency's (SFA) Register of Apprenticeship Training Providers (RoATP)[8].
10. HEIs can choose to deliver the degree apprenticeship inclusive of the mandatory end-point synoptic assessment (EPA)[9] through an "integrated" degree, or may choose to only deliver the academic component of the apprenticeship and without including the EPA in its assessment programme – a "non-integrated" degree. Where employers choose the non-integrated degree for an apprentice, they will be required to ensure that the apprentice undertakes the EPA once the degree is obtained through an appropriately accredited Assessment Organisation (AO) that is on the SFA Register of Apprenticeship Assessment Organisations (RoAAO), in order that the apprenticeship is completed.[10] Whichever options are chosen, the PTP will develop the technical, scientific, interpersonal and behavioural skills and knowledge of learners so that they can operate effectively in HCS as a HCSP.

1.3 Practitioner Training Programme Outcomes

11. Graduates of the BSc (Hons) will possess the essential knowledge, skills, experience values, behaviours and attitudes required of a newly qualified HCSP. They will have the necessary expertise in applied scientific techniques underpinned by theoretical knowledge within a division or related specialism and will work in a range of healthcare settings. Many will work directly with patients but all HCSPs will work in roles that will have an impact on patient care and outcomes. Learning, therefore, must be in the context of the patient and patient-centred care.
12. On successful completion of the BSc (Hons) (academic and work-based learning outcomes) all graduates should be able to demonstrate the outcomes of the AHCS's Standards of Proficiency for HCSPs,[11] which will enable them to register on its Professional Standards Authority (PSA) accredited register. In addition, Life Science graduates should also be able to demonstrate the outcomes of the HCPC Standards of Proficiency for Biomedical Scientists, which will enable them to register with the HCPC as Biomedical Scientists. Degree programmes must align to the Quality Assurance Agency's (QAA)[12] level 6, but which will have been extended and contextualised to the NHS job role for HCSP.

13. The AHCS Standards of Proficiency cover three key areas:

[6] http://hee.nhs.uk/2015/03/26/modernising-scientific-careers-accredited-scientific-practice-asp/
[7] Less commonly, some individuals will be employed by a trust and undertake the degree on a part-time basis.
[8] https://www.gov.uk/government/collections/register-of-apprenticeship-training-providers
[9] described more fully in Section 1.8
[10] Of significance, it should be noted that the employer will be responsible for the costs attached to the EPA. Employers and HEIs should be aware that the funding cap for this programme is fixed at £27,000. This may therefore require employers to fund the EPA outwith the apprenticeship levy and be an additional cost to the overall apprenticeship.
[11] http://www.ahcs.ac.uk/wordpress/wp-content/uploads/2014/07/AHCS_StandardsofProficiency.pdf
[12] http://www.qaa.ac.uk/en

- professional autonomy and accountability;
- skills required for practice as a HCS Practitioner;
- knowledge of healthcare science.

14. **Entry routes:** Entry into BSc (Hons) on-site academic HCS programmes is through the UCAS application process.[13] Increasingly, employers and patients are expected to be part of and contribute to the selection process, with HEIs using values-based recruitment[14] as an underpinning principle of their selection processes. Those seeking to undertake the PTP through an apprenticeship will be competitively appointed by employers who will involve their local HEIs in the appointment process.
15. **Award titles and mode of delivery:** These degree programmes can be delivered either as on site academic programmes or as in-service apprenticeship programmes. The title of the degree programme should be consistent with current HCS terminology.[15] See http://www.nshcs.org.uk/for-trainees/accreditation/134-accreditation-for-heis for further details.
16. **Apprenticeship Standard:** where employers appoint apprentices to undertake the degree, the apprenticeship standard for HCSPs (Level 6)[16], the PTP degree and the End-point Assessment (EPA) demonstrating achievement of the standard must be achieved, either through an integrated or non-integrated degree.[17]
17. **Relevant Quality Assurance Agency (QAA) Code(s) of Practice:** HEIs must adhere to the current QAA Code of Practice for the Assurance of Academic Quality and Standards in Higher Education.
18. **Accreditation:** A BSc (Hons) HCS programme must hold accreditation from HEE's NSHCS to confirm that it meets the Standards of Accreditation for the HCS BSc (Hons),[18] reflecting the AHCS Standards of Education and Training and those of the HCPC[19], where appropriate.
19. **Accreditation of prior learning (APL):** A process of APL that conforms to the guidelines below must be defined by each HEI provider. This must clearly describe the minimum and maximum level of APL that will be awarded, the timing, costs and process, and align to statutory requirements for HCS. Good practice supports the view that such prior learning should only be used once; double counting is not recommended. This process will be of particular relevance for apprentices who have previously achieved the Level 4 Diploma in HCS.[20]

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[13] https://www.ucas.com
[14] http://hee.nhs.uk/work-programmes/values-based-recruitment/
[15] In Scotland a 'full-time-equivalent' model is used to train clinical physiology practitioners who are NES employees, with their work-based learning being integral to the award. The programme timescale is identical to a full-time HEI learner (i.e. 4 years in Scotland).
[16] At the time of publication of the 2016 PTP curricula the Level 6 apprenticeship standard was awaiting publication. Once published it should be available via: https://www.gov.uk/government/collections/apprenticeship-standards#healthcare-standards (see Healthcare Science section)
[17] which will involve an AO for the EPA in the case of a non-integrated degree
[18] http://nshcs.org.uk/images/Accreditation/Proforma-BSc-accreditation-standards-July2014.pdf
[19] http://www.hpc-uk.org/aboutregistration/standards/sets/
[20] http://www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/Higher-education-credit-framework-for-England-guidance-on-academic-credit-arrangements-in-higher-education-in-England-Augu.aspx http://www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/Guidelines-on-the-accreditation-of-prior-learning-September-2004.aspx

20. **Progression, compensation, condonation:** Should a clinical placement or the employer in the case of apprentices not deliver the environment/learning that supports a learner in achieving the required learning outcomes, the HEI and employer will need to support the learner/apprentice appropriately. While it is recognised that HEIs are likely to have a wide portfolio of degree programmes that fall under a single set of regulations (ordinances), the following conditions are specific requirements of the PTP BSc (Hons) degree programme accreditation process, irrespective of the HEI's own academic regulations:
    - all modules are mandatory;
    - no condonation or compensation of marks between modules (although there is a measure of compensation within a module) or extended re-sits of modules marks is permitted;
    - multiple assessment components in any single module cannot be aggregated to reach a final module mark;
    - each assessment within a module should be mandatory and passed at the required level.
21. Where learners do not achieve the module requirements for progression they must follow a 'module retrieval plan', which supports them to recover the failed module(s) as soon as possible so that they can progress with minimum delay.
22. **Programme delivery and monitoring:** It is expected that all BSc (Hons) HCSP programmes should be an integral part of the faculty/school and that opportunities for interprofessional learning are maximised. There should be an appropriate balance between academic staff and visiting specialist staff to ensure teaching reflects current NHS practice, which must be evidenced as part of the programme accreditation by the NSHCS.

1.4 Purpose of the BSc (Hons) PTP Curriculum

23. There are three main purposes of this BSc (Hons) curriculum. It:
    i. clearly sets out the expectations of graduates from the programme, including the academic skills, knowledge and understanding, and attitudes and behaviours that each learner will be expected to gain, develop and apply during work-based training;
    ii. signals the importance to employers of the current structure, strategic direction and priorities of healthcare delivery in the UK, e.g. the *NHS Constitution* or equivalent frameworks across the UK, and the requirement to prioritise patients and their care, ensuring that the patient and service provided by HCS is at the centre of all learning, assessment and work-based practice;
    iii. introduces learning in relation to new scientific and technological developments as these become available.
24. **Curriculum development and maintenance:** The first BSc (Hons) curricula in HCS were published in 2010. Recently the NSHCS and the Council for HCS Education in Higher Education and its PTP Special Interest Group, professional bodies and other stakeholders have contributed to updating the scientific and professional content of the curriculum[21], resulting in this 2016 edition of the curricula. Led by the NSHCS, all MSC curricula will be subject to regular review,

[21] including taking into account external feedback on the curricula undertaken by the Institute of Education (IOE)

with all stakeholders given the opportunity to contribute to each review. Current and previous versions of the BSc (Hons) HCS programmes and work-based learning guides can be found on the NHS Networks website.[22]

25. BSc (Hons) HCS programmes leading to an academic award must be aligned to current NHS policy and strategy and equivalent policy documents for the devolved administrations and should be consistent with current professional body guidance. HEIs should ensure they keep abreast of future strategic direction and policy.

1.5 Programme Delivery

26. **Programme delivery:** HEIs and employers are expected to ensure that all teaching, learning and assessment is up-to-date and informed by research to ensure that at graduation HCSPs meet the Framework for Higher Education Qualifications (FHEQ) descriptor at level 6. By undertaking a research project learners should become aware of the major contribution the HCS workforce makes to research and innovation to benefit patients, patient outcomes and the delivery of healthcare.
27. Although HEIs will deliver the programme described in this curriculum according to their local requirements, the key principles of programme delivery that underpin the NSHCS accreditation process[23] involve:
    - programmes must deliver all of the BSc (Hons) PTP learning outcomes (and will, de facto, deliver the outcomes required by the Level 6 HCSP apprenticeship standard which maps to the curricula) and indicative content, which the HEE Education and Training Scrutiny Group (ETSG) has advised meets the requirements of *Modernising Scientific Careers: The UK Way Forward* and the Academy for HCS's *Good Scientific Practice;*
    - wherever possible, delivering the principles and knowledge underpinning practice should occur before the work-based learning;
    - ensuring programmes meet current NHS education quality metrics and current AHCS and HCPC Standards of Education and Training;
    - ensuring that employer host departments, patients and the public are involved in the design, implementation, delivery and review;
    - the use of fair, valid, reliable, and clearly articulated assessment programmes for all modules, and the timing and content of which should consider and complement the work-based assessment programme;
    - the provision of a robust learner support and mentoring system, together with clearly defined arrangements to identify and support learners in difficulty (including the support services in place) clearly defined;
    - delivery of the programme within a high-quality teaching and learning environment with appropriate resources and facilities to support teaching and research;
    - teaching staff who are research active with a track record of undertaking high-quality research of national and potentially international standing that is relevant to the practice of HCS and the NHS.

[22] http://www.networks.nhs.uk/nhs-networks/msc-framework-curricula and https://www.nshcs.hee.nhs.uk/

[23] In Scotland NES is responsible for accreditation of PTP programmes.

28. Good Scientific Practice (GSP) underpins the PTP and the Level 6 HCSP apprenticeship standard and spans both the academic and work-based programmes. Key professional practice learning outcomes are included in the BSc (Hons) programme through its GSP syllabus, thus embedding the standards of professionalism set out in GSP in all aspects of the delivery and assessment of the programme. Learners should be encouraged to develop a range of skills to support their professional life and CPPD spanning communication, leadership, personal reflection, duty of care, duty of candour, critical reflection, giving and receiving feedback, career planning and commitment to lifelong learning, and show development and maturation in these areas through the degree programme.
29. HEIs should ensure that all staff involved in each BSc (Hons) programme have read and are aware of the requirements of *Good Scientific Practice* and the GSP syllabus in the PTP.
30. **Teaching and learning:** It is expected that a blended learning approach will be adopted, based on a model of learner-centred adult learning that balances and integrates face-to-face teaching, e-learning, etc., and considers the broader requirements of each BSc (Hons) programme. It is anticipated that a broad range of teaching and learning activities will be utilised, appropriate to the learning outcomes. Learners should be enabled to gain the skills necessary to manage their own learning, and to exercise initiative and personal and professional responsibility. The learning strategy matrix and proformas outlined in 'Liberating Learning'[24] describe a range of activities that may be appropriate to this BSc (Hons) programme. They are likely to include:
    - Case study/discussions
    - Debate
    - Discussion forums
    - Expert briefings
    - Interactive lectures
    - Individual tutoring
    - Learner-led and tutor-led seminars
    - Library study
    - Personal critical reflection and action planning
    - Problem-based learning
    - Role play
    - Self-assessment
    - Self-directed learning activities
    - Simulation
    - Skills teaching
    - Team projects
    - Tutor-led small group learning
31. It is also expected that e-learning and, where possible, m-learning[25] opportunities will be available to enable to be active participants in a range of learning activities. Work-based learning will also contribute to the academic educational experience of

[24] Liberating Learning, The Report of the Conference of Postgraduate Medical Deans' ad hoc Working Group on the Educational Implications of the European Union Working Time Directive and the subsequent European Working Time Regulations: November 2002 (revised 2009).
[25] JISC TechDis: see **http://www.jisctechdis.ac.uk/technologymatters/mobilelearning** for further information with respect to mobile (m) learning.

the learner through, for example, seminars, journal clubs, local and national scientific and education meetings.

32. All academic and NHS staff leading or contributing to the BSc (Hons) programme should be appropriately qualified to teach and assess within the academic and/or work-based environment and have up-to-date knowledge of the requirements of the programme, GSP and the Standards of Proficiency for HCSPs. Further details can be found in the Accreditation Guidance from the NSHCS.[26]
33. **Interprofessional learning:** Opportunities to enable interprofessional and interdisciplinary learning, within and outside HCS, should be a fundamental part of each programme.
34. **Patient-centred care:** The delivery of high-quality, compassionate, patient-centred care should be an integral part of each degree programme, with the emphasis on the contribution of the HCS workforce to ensure that learners are aware that their actions have an impact on the patient and the patient's family. They should make clear and explicit links to new models of service delivery, care and patient pathways. The responsibility of all staff in the NHS to maximise quality, productivity and efficiency and to continually strive to improve services should be stressed. Equally important is the ability of graduates from the PTP to communicate with the general public with respect to HCS, leading to a better-educated public that is encouraged to take responsibility for its own health and wellbeing and have a greater understanding of the role that science plays in society.
35. **Patient and public involvement:** The HEI programme team must have mechanisms in place to ensure that there is meaningful patient and public involvement in the design, delivery, development and quality assurance of each programme. It is expected that patients will be represented on course committees at all levels and contribute to teaching, learning and assessment.
36. The participation of patients and the public in HCS in all aspects of education and training brings a number of benefits, including:
    - active, constructive lay involvement in the training of healthcare scientists;
    - assisting in the development, monitoring and evaluation of HCS training programmes and their outcomes;
    - operating as lay advisors to all professionals, academics, researchers and others involved in the teaching of healthcare scientist trainees (including the private and charity sector);
    - engaging with professionals, academics, researchers, patients/carers and the general public to promote education/publicity about the work and impact of healthcare scientists on the health of the community;
    - developing protocols and training opportunities that involve lay persons in the delivery, analysis and evaluation of training programmes;
    - initiating and supporting ideas/proposals/research questions about HCS and its impact on patients.

[26] http://www.nshcs.org.uk/for-trainees/accreditation/134-accreditation-for- heis

1.6 Introduction to Work-based Learning

37. The overall aim of the PTP is to prepare the learner to fulfil the function of a HCSP working in a clinical HCS setting. The programme combines and integrates both academic and work-based learning and has a strong patient and clinical focus. Within the first year it is expected that the experiential component will start broad with short 'tasters' across a theme, with some exposure to other aspects of patient pathways, for example a clinic, patient education programme, medical records, or other area of healthcare. This will give the learner a wide appreciation of the many specialisms and a more holistic view of the areas that contribute to high-quality care.
38. The work-based programme is divided into modules, all of which are focused on service need, patient/care and continuous service improvement. Each module follows a standard format. The aim and scope of each module is described followed by the:
    - **Learning Outcomes** – high-level descriptors of the required work-based achievements for the module;
    - **Clinical Experiential Learning** – the learning activities that will facilitate learning and achievement of the stated outcomes;
    - **Competences** – further outcome-based statements for each learning outcome;
    - **Knowledge and Understanding** - as applied to appropriate competences.
39. Both the curricula and the apprenticeship standard are based on GSP[27] and HCPC Standards[28], resulting in a direct relationship between the two, ensuring that the curricula deliver the underpinning knowledge, skills and professionalism required by the standard. The learning outcomes of the curricula are clearly focused on employer and service requirements, reflecting patient care and clinical pathways and continuous improvement in a given area of HCS.
40. The work-based training for all learners has three components, which correspond to the academic programme, all of which are underpinned by the professional practice curriculum:
    - induction;
    - theme training;
    - specialist training.
41. It is anticipated that all learners will have an induction period in each employer/host department at the beginning of the apprenticeship and/or of each placement. The duration and timing of work-based placements will vary, depending on the HEI in which the learner studies.

1.7 Employing and Training Departments

42. The training and work environment is vital for successful training in the BSc and in this context includes each of the employers, training departments and other healthcare settings facilitating work-based training. The success of the training and the learner experience requires the commitment and enthusiasm from

[27] https://www.ahcs.ac.uk/wordpress/wp-content/uploads/2013/09/AHCS-Good-Scientific-Practice.pdf
[28] http://www.hcpc-uk.org/assets/documents/100004FDStandards_of_Proficiency_Biomedical_Scientists.pdf

employers and those in the work environment to provide high quality, well-supervised training, underpinned by work-based formative assessment and a close working relationship with the HEI.

43. Training departments and employers should therefore ensure that they are fully familiar with the components of the BSc (Hons) programme, including the work-based training programme, including the required learning outcomes, competences and assessment processes, and have been trained by the HEI in each work-based assessment method. Additionally, the responsibilities for mentoring and supervision, whilst the learner is on placement should be clear, including access to HEI learner support services.
44. **Induction**: At the start of the training programme learners should be provided with an induction programme by employers and training units. Initial work-based induction should include an overview of the:
    - hospital/employer/healthcare setting and local policies, including health and safety, confidentiality, data protection, etc., relevant to the employment;
    - range of services provided by the department;
    - range of people who use the services provided by the department;
    - function, operation, and routine and corrective maintenance requirements of equipment appropriate to the section(s) of the department in which the trainee will be working;
    - host trust IT systems, including the library and knowledge service as required.
45. **Supervision**: At the core of successful work-based employer training is appropriate educational and clinical supervision, facilitation and feedback. It is recommended that each learner is allocated to a training officer[29] from within the host/employing department. Learners are advised to ensure that a planned schedule of meetings with their training officer is agreed early in training, commencing with a meeting during the first week.
46. BSc educational and clinical supervision should promote learning, reflective practice and action planning. It will need to ensure that the learner becomes proficient in the specific skills and competences required by the curriculum, 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.
47. The first supervision meeting should be set up during the first week of the training programme. At the first meeting the training officer should ensure that the learner is following the agreed induction programme. It is recommended that the following areas should be explored and agreement reached at the first meeting with respect to the:
    - expectations of the training officer and learner;
    - responsibilities of the training officer and learner;
    - confidentiality;
    - boundaries between the training officer and learner;
    - frequency and duration of planned supervision meetings;
    - methods of communication and responsibility for arranging meetings;
    - level of support and arrangements for communications between meetings;

[29] For the purposes of this document training officer has been used; however, the title may vary between departments and may be subject to a title change in England as part of developments for the whole of the professional healthcare workforce.

- models of reflection and action planning;
- record keeping;
- content of the work-based training programme;
- for apprentices, clarity between their employment responsibilities and their learning opportunities (i.e. formal training/learning time)
- the approach to assessment;
- sources of help and support.

48. The HEI and employers are responsible for ensuring that learners have access to training opportunities to enable the achievement of all the learning outcomes of the BSc (Hons) and where required, to meet the apprenticeship standard. In return learners are expected to take responsibility for:
    - ensuring that they fulfil their obligations to the HEI, to employers, to departments providing work base training and to patients (especially with regard to patient safety and confidentiality) as healthcare professionals;
    - engaging as active adult learners by initiating work-based assessments; contributing to learning activities; taking into account feedback received from their trainers and assessors; and giving considered and constructive feedback on their experience of their training.

1.8 Assessment

49. **Purpose of assessment:** The purpose of assessment is to enable the learner to demonstrate that they have the requisite knowledge, skills, values, behaviours and attitudes to work as a HCSP and meet standards of education and training, professional skills, conduct performance and ethics to provide reassurance to the public and the appropriate regulatory bodies. Given the integrated nature of this academic and work-based degree, each HEI's assessment programme must address both academic and work-based assessment (see Section 1.11 below) and must support assessment for learners undertaking the programme through an on-site academic programme or through an apprenticeship.
50. The full BSc (Hons) HCS assessment programme should support both assessment *for* and assessment *of* learning, and in particular:[30]
    - help clarify what good performance is (goals, criteria, standards);
    - encourage 'time and effort' on challenging learning tasks;
    - deliver high-quality feedback information that helps learners to self-correct;
    - encourage positive motivational beliefs and self-esteem;
    - encourage interaction and dialogue around learning (peer and teacher–learner);
    - facilitate the development of self-assessment and reflection in learning;
    - involve learners in decision making about assessment policy and practice;
    - support the development of learning communities;
    - integrate and complement the work-based assessment programme:
    - help teachers adapt teaching to learner needs;
    - for apprentices, facilitate and ensure readiness for the synoptic EPA.

[30] Nicol DJ (2007) Principles of good assessment and feedback. REAP International Online Conference. www.reap.ac.uk/public/Papers/Principles_of_good_assessment_and_feedback.pdf (accessed 2.12.09).

51. The HEI must have in place a clear, overarching strategic and systematic approach to assessment that fits with the curriculum and delivers assessment methods that are valid, reliable/generalisable, feasible, fair, acceptable and defensible, and is led by assessment experts. The approach to the assessment of the BSc (Hons) HCS should also be cognisant of and complement the work-based assessment programme, which is defined by the NSHCS and which is part of all NSHCS accredited BSc (Hons) programmes. In addition, where an integrated degree is offered, enabling those undertaking the degree through an apprenticeship route, the end-point assessment (EPA) must conform to Department for Education (DfE) requirements.[31]
52. The assessment programme should be designed to enable the learner to obtain regular and constructive feedback on progress and achievement. It should encourage critical reflection and action planning, identifying both strengths and areas for development and improvement.
53. The approach to assessment should include and be overseen by a central co-ordinating leadership group or assessment-focused group in the HEI. The role of this group is to advise and scrutinise assessment across modules and years in order to build a consistent approach to assessment across the whole programme, involving module/programme leaders as appropriate. The HEI's overall assessment strategy should be documented in a clear and accessible manner with accountabilities clearly allocated. The strategy should also demonstrate how the approach is based on a sound understanding of the evidence base, academic literature and good practice in assessment.
54. Key areas that are required for NSHCS accreditation and which must be covered by an HEI's Assessment Strategy include:
    - a clear statement of accountabilities, including the governance structure for assessment;
    - the balance between academic and work-based assessment;
    - the balance between formative and summative assessment;
    - clarity on the EPA programme for apprentices and preparation for it;
    - the assessment of each module, including the contribution of individual assessments and examinations within the module;
    - progression criteria;
    - the range of valid, reliable and appropriate assessment techniques that will be utilised across the programme and for each module;
    - the process for providing clear and timely information for learners;
    - how all examiners will be selected and trained (including refresher training) and the guidelines that will be given;
    - the mechanisms in place to ensure comparability of standards and to share good practice, including external examiners;
    - how standard setting is undertaken;
    - how opportunities for learner feedback will be maximised, including time lines and importance of developing learners-centred feedback;

[31] At the time of publication of the 2016 PTP curricula the Level 6 EPA was awaiting publication. Once published it should be available via: https://www.gov.uk/government/collections/apprenticeship-standards#healthcare-standards (see Healthcare Science section)

- the arrangements for assessment of learners with a disability, which should be consistent with the ability to undertake this modified practice in the workplace setting;
- an assessment blueprint demonstrating the relationship between each assessment and the learning outcomes of the programme;
- exemplar criteria and marking scheme, including critical reflective writing;
- the process of appointing external examiners;
- a defined role for external examiners that includes contributing to the review and development of assessment strategies and providing advice from an overarching perspective;

- the role and contribution of patients and the public to the assessment programme.

55. The on-programme assessment of the degree modules will include a range of formative and summative assessment approaches, for example essays, reports, completion of practical tasks and work-based projects as well as formal summative examinations as the degree progresses. In addition, a programme of formative work-based assessments will support progression through the degree, ensuring that for apprentices, there is adequate opportunity to practise scientific skills, and to gain feedback, as preparation for the EPA for apprentices.
56. For those undertaking the degree through an apprenticeship, the learner must achieve the award of the BSc (Hons) and pass the EPA. HEIs will be required to be on the SFA's RoATP and RoAAO. Where the EPA is not integrated as part of the degree programme, the EPA will be delivered following completion of the degree by an organisation on the RoAAO. In the event of failure to pass either the degree course or the EPA, completion of the apprenticeship cannot be achieved. Employers should be assured that HEIs have robust and well-established assessment and quality assurance processes, incorporating internal moderation and external examiners to ensure independence across the degree programme and consistency between HEIs and that these Honours degrees are all approved by the QAA.

1.9 On-programme (work-based) Assessment

57. **Formative assessment** is used to support learners in the workplace by ensuring regular, structured checks on developing competence. The formative assessment tools detailed in Table 1are used by all workplaces to capture evidence of the skills, knowledge, behaviours, attitudes and values required by the apprentice in the workplace, in their enactment of their practitioner role and in their interactions with colleagues, peers, patients and the public (where and as appropriate). Formative assessment helps to uncover performance issues or concerns and the HEI and employer will be able to support the learner and provide extra guidance where such issues might arise to ensure that the learner is fully supported in meeting the outcomes of the degree and the apprenticeship for those required to do so. The delivery of that support is likely to differ across HEIs and workplaces.
58. For apprentices, completion of the formative assessment programme is essential preparation for the synoptic EPA near the end of the programme that is designed to capture evidence of the apprentice's mastery of the skills, knowledge, behaviours and values defined in the standard (see section below for more detail). Table 1 also sets out the arrangements for the summative work based employer assessment

competency log that encapsulates the performance of the HCSP learner in the demonstration of competences that have been achieved.

59. The high level learning outcomes and clinical experiential learning required in each of the areas of HCS are set out in the PTP curricula for HCSPs.[32] These detail the work-based learning outcomes that form an integral part of the degree programme for HCSPs should be used to guide the selection of formative assessments. The curricula also provide the templates for each of the work-based assessment tools to ensure assessment standardisation across the work-based programme (see appendices).
60. This formative work-based assessment programme should find a balance between what is realistic and achievable for employers and learners and what provides sufficient evidence of progress/competence. It is therefore recommended that learners, in consultation with their clinical supervisor, undertake work-based assessments as set out in the table below:

Recommended number of assessments per academic year

Year 1	**Year 2**	**Year 3**
2 DOPs 1 CBD Competence	4 DOPs 1 CPD 1 OCE Competence	4 DOPs 2 CBDs 2 OCEs Competence

[32] and in the Institute of Biomedical Science's (b) Registration Portfolio for those undertaking this degree programme

Table 1 Summary of On-Programme (work-based) formative assessment methods and the Employer based Competency Log[33]

Assessment tool	Direct Observation of Practical skills (DOPs)	Observed Clinical Event (OCE)	Case-based Discussion (CbD)	Work-based/employer based Competency Log
Purpose	Assessment of a practical skill or procedure, including, where relevant, interaction with a patient through direct observation. Learner and assessor feedback is generated, learning needs identified and an action plan agreed	Observation and assessment of a clinical encounter or interaction with colleagues with respect to an aspect of patient care. The format and approach is similar to DOPs but takes place with a patient present or when the learner is working with clinical colleagues	A clinical case is used as the basis for a discussion to assess the learners application of knowledge and understanding of an aspect of an activity they have been part of, e.g. professional practice, communication, leadership, science, the role of healthcare science in patient care	A record of attainment which demonstrates achievement of each work-based competence and clinical experiential learning (CEL) activity, reflecting the performance of the learner, including the demonstration of achievement of aspects of the apprenticeship standard where this is appropriate
Method	The assessor observes a practical activity and facilitates learner- centred feedback either during or immediately following the observation. The learner generates an action plan and agrees this with the assessor.	The assessor observes a clinical activity and facilitates learner-centred feedback either during or immediately following the observation. The learner generates an action plan and agrees this with the assessor.	A discussion between the learner and assessor with respect to any aspect of a case, including professional practice/*Good Scientific Practice*	An assessor reviews the evidence provided by the learner to support achievement of each competence and CEL. The expectation is that as the learner progresses the competency log will demonstrate an evidential base of achievement/progression.

[33] Whilst each individual assessment is formative review of the log as a whole forms part of the summative assessment of the degree and of the EPA.

1.10 Work-based/employer based Competency Log

61. All learners will also be required to provide evidence to demonstrate that they have successfully achieved the competences set out in the curriculum and for apprentices, those competences specifically reflected in the apprenticeship standard, through success in the EPA. The learner is expected to provide evidence to demonstrate achievement of each competence, which should then be reviewed and signed off by the trainer in the competency log. Learners will gain competence at their own pace, but in line with the overall delivery of the relevant modules. Each competence will link directly to a specific work-based learning outcome in the curriculum and some competences may be linked to more than one learning outcome. Successful completion of the curriculum and, for an apprentice the standard, cannot therefore be achieved until achievement of *all* work-based learning outcomes have been demonstrated.
62. On-going completion of a competency log (the high level requirements are set out in Table 1 above) is therefore essential for progression within the programme and as a requirement for achievement of the degree and completion of the apprenticeship. The expectation is that as the learner progresses the competency log will demonstrate an evidence base of their achievement. The achievement of each competence and a record of all on-programme work-based assessments must be recorded using a written log, or the HEI's own electronic system. For those in HCS programmes this should be presented within a Portfolio of Evidence that is accumulated by the learner to demonstrate learning, competence and insight into practice and professionalism.[34]

1.11 End Point Assessment for apprenticeships

63. All apprentices will have to pass the EPA that is designed as a final check on the apprentice's workplace competence and ability to integrate their learning across all elements of the PTP.
64. Where the EPA has been integrated into the degree programme, the degree obtained will provide verification that both the academic part of the standard and the required synoptic assessment have been met and graded. As described above, some HEIs may choose to deliver a non-integrated degree, which will not include the EPA. If an employer chooses to use such a non-integrated degree programme for an apprenticeship, then it will be required to ensure that the synoptic assessment described below is delivered by an appropriately accredited organisation that is on the SFA's RoAAO. In addition the employer will be responsible for the costs attached to the EPA which is delivered by the AO. Although a funding cap for this degree apprenticeship standard has not yet been allocated, employers and HEIs should be aware that if the full amount is used for the delivery of the degree programme, employers will be required to fund the

[34] For those learners studying to become healthcare science practitioners through biomedical science degrees, the IBMS Registration Portfolio provides the framework for education and training. This Portfolio enables biomedical science learners to demonstrate their fitness to practice through evidence of competence that can be independently verified against the HCPC Standards of Proficiency. This supports the biomedical science graduate in registering with the HCPC. A combined portfolio reflecting this Registration Portfolio and the HCS Portfolio of Evidence for those undertaking the PTP programme in the Life Sciences is currently under development.

EPA outwith the apprenticeship levy which will be an additional cost to the overall apprenticeship. For integrated degrees, HEIs are likely to have to pay a small fee to the AHCS to help support and maintain standardisation of the EPA assessment tools (Situational Judgment Test; Professional Discussion and Research evaluation templates).

65. The formative work-based assessment programme described above supports apprentices in acquiring and building the skills, knowledge, behaviours and values defined in the apprenticeship standard. Underpinned by the academic learning and summative assessment provided by the HEI, this will ensure that the learner is prepared and ready to understanding the synoptic assessment, demonstrating these.
66. All apprentices will therefore have to pass the EPA that is designed as a final check on the apprentice's workplace competence and ability to integrate their learning across all elements of the PTP. In integrated degrees, the EPA is delivered towards the end of the three-year programme; in non-integrated degrees, the EPA is undertaken after the degree is achieved and is administered by a registered AO.
67. The EPA is conducted with an independent assessor towards the end of the degree programme and takes approximately two hours. It consists of the following three components, each of which must be passed independently:
    i. one hour written Situational Judgment Test (SJT) set by the HEI;
    ii. face-to-face Professional Discussion, taking approximately 40 minutes, between the apprentice and the trained independent assessor (who has not been involved in the education or training of the apprentice) and based on questions arising from the assessor's scrutiny of the apprentice's portfolio of workplace-based assessments, experiences and critical reflection;
    iii. a presentation of up to 10 minutes to the assessor, in which the apprentice describes the research project undertaken as part of their degree programme. The presentation is followed by a 15 minute question and answer session with the independent assessor on issues raised by the research.

The link to the full version of the Level 6 HCSP Apprenticeship EPA was not available at the time of publication of the 2016 curricula but should be available via: https://www.gov.uk/government/collections/apprenticeship-standards#healthcare-standards

1.12 Learner Support and Mentoring

68. The learner supervision, support and mentoring systems will span the academic and work/employer-based elements of the programme, and the relationship between the two systems must be clear to learners, employers work-based staff and HEI staff. The learner supervision, support and mentoring system must be designed to encourage safe and effective practice, independent adult learning, appropriate professional conduct of the learner, the safety of the patient and quality assurance of all work activities of each learner. Those undertaking the role of supervisor or mentor must have relevant qualifications and experience and have undertaken appropriate and up-to-date training. The HEI will be

expected to have an academic supervisory, support and mentoring scheme in place and to provide access to learner support services.

69. **Fitness to practise:** The HEI must have a clear policy with respect to fitness to practice (FtP), which must clearly articulate how staff and learners are made aware of the policy and how the policy is implemented. The HEI's FtP policy should reflect and be aligned to the FtP policy of the AHCS and the HCPC (for Life Sciences). Alongside this must be a clear policy on how learner whistleblowers are supported. Breaches of professional practice and behaviour identified by the HEI or during HEI activities must be reported and investigated in accordance with this FtP policy and accurate records maintained within the HEI.

1.13 Annual Monitoring of Progress and Equality and Diversity

70. **Annual monitoring of progress:** All on-site academic learners will usually be expected to complete the requirements for the BSc (Hons) HCS award within three years after initial registration, in accordance with the regulations of each HEI. For those undertaking the degree through an apprenticeship, employers and the HEI should ensure that good progress is made, although through agreement between the employer, the apprentice and the HEI, the duration of the degree may take longer than 3 years.
71. Programme governance must include annual monitoring of progress that considers the outcome of the review of each module (including learner and patient evaluation) and the handling and consideration of the external examiner's report. This process should enable the programme leaders to identify and propose changes to the programme in response to feedback.
72. **Equality and diversity:** HEE, the AHCS, HEI's, scientific professional bodies and employers are committed to the principle of equality and diversity in employment, membership, academic activities, assessment, examinations and training.
73. As part of this ethos these groups are committed to inspire and support all those who work, train and provide training in HCS 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, in accordance with the Equality Act 2010[35]. This reflects not only the letter but also the spirit of equality legislation, taking into account current equality legislation and good practice.

1.14 Critical Reflection and Learning

74. **Critical reflection**: Critical reflection on progress and performance is an integral part of both the BSc and of being a professional. Learners should therefore be taught the theoretical models underpinning reflection and required to regularly critically reflect on their progress and performance, enabling them to develop skills in self-evaluation and action planning.

[35] Equality Act 2010. http://www.legislation.gov.uk/ukpga/2010/15/contents

75. This should be used to support the learner as they learn from experiences gained in the workplace. Reflection should help the learner to understand and learn from work-based situations/experience, bridging the gap between theory and practice. Each learner should be taught about the underpinning evidence for the use of reflection and encouraged to reflect regularly on their progress and performance, developing their skills in self-assessment and action planning.
76. Learners should be encouraged to think about what they are doing as they do it (Reflection *in* Action) and retrospectively to reflect on practice (Reflection *on* Action). The reflective practitioner should describe and analyse experience, considering how the situation might have been handled differently and what other knowledge would have been helpful. When critically reflecting on an experience, learners should use a recognised model of reflection.

1.15 Relationships and Partnerships

77. **The National School of Healthcare Science:** The NSHCS is hosted by HEE, West Midlands Local Team. The NSHCS provides a national co-ordinating and oversight function to support the delivery of work-based training for HCS training and education programmes. With respect to the PTPs it is responsible for:
    - holding HEIs to account for the quality, integration, co-ordination and delivery of both the academic programme and work-based training through the accreditation process, ;
    - identification of programme issues that may need to be addressed and resolved and reporting these as part of agreed governance arrangements;
    - liaising with LETBs on local issues and problems and their resolution;
    - providing advice and support to accredited PTP programmes as necessary;
    - overarching review to ensure common standards of delivery and content and recommending ongoing training activities to support the CPD of work-based trainers.

    The School can be contacted at www.nshcs.org.uk

78. **The Academy for Healthcare Science:** The AHCS provides the professional voice for the HCS workforce and quality assurance of HCS training and education.[36] Included in its functions are to:
    - act as a strong and coherent professional voice;
    - be able to influence and inform a range of stakeholders on all matters relating to HCS and scientific services;
    - act as the overarching body for professional issues related to education, training and development in the UK health system, including the provision of UK-wide quality assurance across education and training arrangements[37];
    - provide the infrastructure to support the professional regulation/registration of the HCS workforce, including:

[36] http://www.ahcs.ac.uk/wordpress/wp-content/uploads/2014/08/18th-Feb-2016-AHCSQA-Framework-pdf.pdf
[37] The Institute of Biomedical Science (IBMS) also has a role in approving laboratories for training and accrediting healthcare science degrees in the Life Sciences.

- a system of professional accreditation of education and training programmes for the regulation/registration of the HCS workforce;
- setting the professional standards for the delivery of accredited registers as required by the PSA's for Health and Social Care to ensure consistency and coherence across all HCS education and training programmes;
- taking the central role in the sponsorship of the registers to achieve 'accredited' status as set out by the PSA;
- being a HCPC education provider for the statutory regulation of Clinical Scientists;
- offering a system for equivalence across the HCS workforce to enable those who can demonstrate evidence of training, experience and qualifications equivalent to the required outcomes of HCS training programmes to support entry on to the PSA accredited ACHS register www.academyforhealthcarescience.co.uk/

1.16 Programme Outcomes

79. On completion of the BSc (Hons) all graduates should be able to demonstrate the following outcomes that align to QAA level 6, extended and contextualised to the NHS job role for HCSP.

Professional Practice

i. Professional practice that meets the professional standards of conduct, performance and ethics defined by *Good Scientific Practice*[38] and is safe, lawful and effective, and within the scope of practice for the role undertaken, while maintaining fitness to practice.
ii. Personal qualities that encompass communication skills, self-management, self-awareness, acting with integrity and the ability to take some responsibility for self-directed learning, maintaining their own health and wellbeing, critical reflection and action planning to maintain and improve performance.
iii. The ability to be an independent self-directed learner acting autonomously in a non-discriminatory manner when planning and implementing tasks at a professional level.
iv. The ability to work, where appropriate, in partnership with other professionals, often as part of a multidisciplinary team (MDT), supporting staff, service users and their relatives and carers while maintaining confidentiality.
v. The ability to work with the public, service users, patients and their carers as partners in their care, embracing and valuing diversity.
vi. A range of transferable generic academic skills and capabilities to the exercise of initiative and personal responsibility, decision making in complex and unpredictable contexts spanning study skills, independent learning, reflective practice, communication, team working, research and leadership skills.

[38] and the HCPC in the Life Sciences

vii. A conceptual understanding that enables the learner to devise and sustain arguments and/or to solve problems, using ideas and techniques, some of which are at the forefront of a specialism of HCS.
viii. The ability to apply problem-solving skills, evaluate evidence, arguments and assumptions, to reach sound judgements and to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

Scientific and Clinical Practice

ix. An understanding of a complex body of knowledge, some of it at the current boundaries of an academic discipline, and the ability to apply the scientific principles, method and knowledge to HCS.
x. The ability to apply scientific method and approaches to analytical techniques, HCS research, development and innovation.
xi. The ability to perform technical investigations/skills and technical reporting of quality assured tests, investigations and interventions on patients/samples safely and skillfully, adhering to applicable legislation and in compliance with local, national and international guidelines.
xii. The ability to provide therapeutic interventions, some of which may be specialist, in a number of specialisms.
xiii. A systematic understanding of key aspects of their field of study, including acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of defined aspects of HCS.
xiv. High-quality clinical and scientific practice that applies core scientific knowledge, skills and experience in a healthcare setting, places the patient/public at the centre of care, prioritising patient safety and dignity and reflecting NHS/health service values and the NHS Constitution.

Research, Development and Innovation

xv. An appreciation of the uncertainty, ambiguity and limits of knowledge, the ability to manage their own learning, and to make use of scholarly reviews and primary sources (for example refereed research articles and/or original materials appropriate to HCS).
xvi. To apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding, and to initiate and carry out projects.
xvii. An understanding of the strengths, weaknesses and opportunities for further development of healthcare and HCS as applicable to their own clinical practice, research, audit, innovation and service development, which either directly or indirectly leads to improvements in patient experience, clinical outcomes and scientific practice.

Clinical Leadership

xviii. Scientific and clinical leadership appropriate to the HSCP job role based on the continual advancement of their knowledge, skills and understanding through the independent learning required for CPPD.

1.17 Transferable Skills

80. It is expected that all BSc (Hons) HCS programmes will meet the descriptors for a higher education qualification at level 6 (Bachelor's degree with honours) outlined by the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (FHEQ) and the Scottish Credit and Qualifications Framework (SCQF) Level 10. On graduation all will have gained a range of transferable generic academic skills and capabilities, including study skills, independent learning, problem solving, reflective practice, communication skills, team working, research, innovation and leadership skills. These transferable skills should be embedded in the curriculum developed by each HEI. For those undertaking the apprenticeship programme, employers will be further assured that apprentices have gained the transferable skills required, given the successful completion of the EPA as part of or in addition to the degree programme.

SECTION 2: BSc (Hons) IN CARDIOVASCULAR, RESPIRATORY AND SLEEP SCIENCE

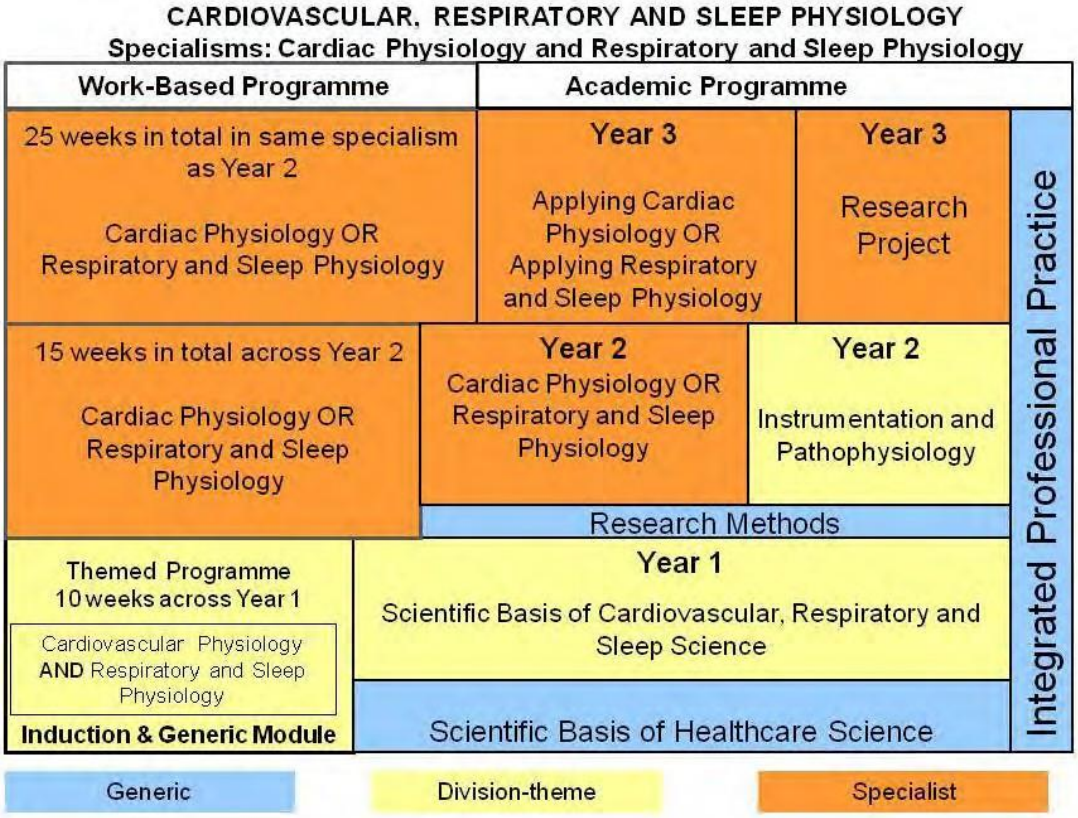
2.1 Details of the PTP Curriculum in Cardiovascular, Respiratory and Sleep Science

The BSc (Hons) in Healthcare Science for the Practitioner Training Programme will begin with an induction programme provided by the academic provider. All HCS students will then complete a generic introductory module entitled 'Scientific Basis of Healthcare Science' and will begin to develop their knowledge and understanding of professional practice and patient-centred care. In the later stages of Year 1 students will be introduced to the scientific basis of cardiovascular, respiratory and sleep science in the context of high-quality, safe, patient-centred services and care. During Year 1 students will undertake 10 weeks of work-based learning in both specialisms.

In Year 2, the students will continue to develop their learning in areas that are common across Cardiovascular, Respiratory and Sleep Science, namely 'Instrumentation, Signal Processing and Imaging' and the 'Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions'. They will also continue to build on their professional practice and complete the generic Research Methods module. By mid-way through Year 2 all students will have specialised in either cardiac physiology or respiratory and sleep physiology. In Year 3, they will continue to build their professional practice, specialist practice and their research skills, including completing a research project in their chosen specialism. During Years 2 and 3 there will be a further 40 weeks of work-based learning. The emphasis will be on developing and building knowledge and skills as they move through the programme, consistently demonstrating the requisite attitudes, behaviours and skills, and treating patients with care and compassion.

The diagram overleaf summarises the framework for the training programme for Cardiovascular, Respiratory and Sleep Science.

Modernising Scientific Careers: Practitioner Training Programme (PTP): Diagrammatic representation of the full-time, three-year, pre-registration, integrated academic and work-based BSc (Hons) in Healthcare Science



This programme can be delivered part-time through employment

2.2 List of Modules

Year	Module Title	Credits
1	Professional Practice	10
1	Scientific Basis of Healthcare Science – integrated module across body systems	60
1	Scientific Basis of Cardiovascular Science, including work-based training	25
1	Scientific Basis of Respiratory and Sleep Science, including work-based training	25
2	Professional Practice	10
2	Research Methods	10
2	Instrumentation, Signal Processing and Imaging	20
2	Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions	20
	CARDIAC PHYSIOLOGY	
2	Cardiac Physiology	50
2	Work-based training	10
3	Professional Practice	10
3	Applying Cardiac Physiology to Practice	60
3	Work-based training	20
3	Research Project in Cardiac Physiology	30
	RESPIRATORY AND SLEEP PHYSIOLOGY	
2	Respiratory and Sleep Physiology	50
2	Work-based training	10
3	Professional Practice	10
3	Applying Respiratory and Sleep Physiology to Practice	60
3	Work-based training	20
3	Research Project in Respiratory and Sleep Physiology	30

SECTION 3: GENERIC GOOD SCIENTIFIC PRACTICE SYLLABUS

Introduction

The Academy for Healthcare Science (AHCS) has set out the principles, values and the standards of behaviour and practice for the HCS workforce in the document *Good Scientific Practice* (GSP). These standards and values must be achieved and maintained in the delivery of work activities, the provision of care and personal conduct. In addition, the AHCS holds a Professional Standards Authority accredited register for Healthcare Science Practitioners (HCSPs) not covered by statutory regulation.[39] The Health and Care Professions Council (HCPC) sets out the Standards of Proficiency, which must be achieved for statutory registration as a Biomedical Scientist on completion of the Life Sciences Practitioner Training Programme (PTP).

Key professional practice learning outcomes are included in the BSc (Hons) programme through its GSP syllabus, thus embedding the standards of professionalism set out in GSP in all aspects of the delivery and assessment of the programme. The GSP syllabus is a common component of all PTP 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.

[39] Practitioners who have completed an HCPC-approved PTP course in Life Sciences are eligible to apply for Statutory Regulation as Biomedical Scientists.

As students progress through the three-year programme they are expected to critically reflect on their performance as they build upon and extend the depth and complexity of the knowledge, skills and experience (spiral learning) that underpins professional practice as a HCSP.

Domain 1: Professional Practice

Topic	Professional Practice	GSP reference
Learning objective	By the end of the course the student will be able to practise as an autonomous professional, usually within the context of the MDT, applying their knowledge appropriately, exercising their own professional judgement, practising within the legal and ethical boundaries of the role of a HCSP and critically reflecting on and developing their professional practice.	
High-level learning outcome(s)	By the end of the course, the student will be able to: • Demonstrate verbally, in written form and in practice, the knowledge and understanding of the professional requirements of a HCSP in the provision of patient-centred care and healthcare service(s) as described in GSP.	
Knowledge	By the end of the course students will know, comprehend and apply their knowledge and will be able to: 1. Discuss the standards of proficiency of the AHCS and the HCPC and the role of regulation for healthcare professions. 2. Explain the importance of placing the patient at the centre of care and consider services from a user's point of view. 3. Explain the importance of keeping professional knowledge and skills up to date, working within the limits of personal competence. 4. Analyse the ethical, legal and governance requirements arising from working as a HCSP across a range of situations. 5. Summarise and evaluate the evidence to support the high levels of probity required when working at the level of HCSP. 6. Justify the importance of personal health and wellbeing in order to ensure that personal performance and judgement are not affected by their own health. 7. Analyse NHS organisation, policy, values and practice as it affects the provision of healthcare, healthcare science, and the patients and populations it serves. 8. Discuss theories of teaching and learning to underpin the role of the HCS workforce in education as a learner, teacher, or trainer, according to the best contemporary clinical and educational standards. 9. Explain a range of strategies to ensure that the voice of patients and the public is embedded in all aspects of healthcare, healthcare science and healthcare science education in the academic and	1.1.1 1.1.4 1.1.5 1.1.6 1.1.7 1.2 1.2.5 1.4.1 1.4.2 2.3.2

Topic	Professional Practice	GSP reference
	work-based setting. 10. Understand the need, where appropriate, to hold indemnity insurance.	
Technical procedures and clinical skills	By the end of the course, the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. They will be able to: 1. Work within their agreed scope of practice. 2. 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 in all academic and work-based activities. 3. Apply their understanding of the role and importance of continuing personal and professional development (CPPD) to ensure that their professional knowledge and skills are kept up to date. 4. Respond to the ethical, legal and governance requirements arising from working at the level of a HCSP, applying and accruing knowledge and evidence. 5. Work in a manner that demonstrates probity in every aspect of professional practice at all times. 6. Make appropriate judgements to ensure they limit their work or stop practising if their performance or judgement is affected by their health and raise any concerns about the performance of colleagues with their supervisor. 7. Maintain records accurately, comprehensively and comprehensibly in accordance with applicable legislation, protocols and guidelines. 8. Raise concerns through appropriate channels if they have evidence to believe that the practice or judgement of colleagues is impaired and is a matter of concern in relation to patient safety. 9. Work in accordance with relevant current NHS policy, guidelines and practice.	1.1.1 1.1.2 1.1.3 1.1.4 1.1.5 1.1.6 1.1.7 1.1.8 1.1.10 1.2.2 2.2.3 2.2.6 2.2.7 2.3.2 3.2.2 4.1.2
Attitudes, values and behaviours	By the end of the course, the student will be expected to demonstrate the attitudes, values and behaviours of a HCSP and will be able to: 1. Apply evidence-based personal and team professional practice that places the patient at the centre of care. 2. Apply knowledge, experience and critical reflection to identify personal development needs using a range of tools, and develop and update action plans to ensure that they keep skills and knowledge	1.1.1–1.1.10 1.2 1.3.1 2.2.3 2.2.6

Topic	Professional Practice	GSP reference
	up to date. 3. Display a professional commitment to ethical practice, consistently operating within national and local ethical, legal and governance requirements. 4. Apply the principles of GSP and its professional standards, performing to the highest standards of personal behaviour in all aspects of professional practice. 5. Consistently operate in accordance with relevant current NHS policy and practice. 6. Operate consistently within a sphere of personal capability and level of authority, managing personal workload and objectives to achieve quality of care.	2.2.7 2.2.8 4.1.2 4.1.6

Domain 2: Scientific Practice

Topic	Scientific Practice	GSP reference
Learning objective	By the end of the course, the student will establish and maintain a safe environment in which healthcare science is delivered, drawing on the knowledge, skills, attitudes and behaviours required for safe and effective practice. They will be able to deliver high-quality scientific services in a safe and secure working environment. They will also be able to reflect on their performance or situations and record their action plans as they continually evaluate, review and improve their practice.	
High-level learning outcome(s)	By the end of the course, the student will be able to: • Explain and apply the knowledge, skills, values and behaviours required of a HCSP in the delivery of high-quality, evidence-based and patient-centred services in a safe and secure working environment to which they effectively contribute.	
Knowledge	By the end of the course, the student will know, comprehend and apply the key concepts of the knowledge base relevant to healthcare science and will be able to: 1. Describe information and communication technologies (ICT) appropriate to the HCS specialism. 2. Explain the principles and practice of quality control, external quality assessment and quality management as applied to relevant areas of healthcare science. 3. Explain the role of audit and the audit cycle and how it is used as a tool to facilitate continuous quality improvement. 4. Discuss and justify relevant health and safety legislation and guidance for the workplace.	1.4.5 2.2.2 2.2.7 2.2.9 2.3.1–2.3.4 3.1.17 3.2.1 4.1.2
Technical procedures and clinical skills	By the end of the course, the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. They will be able to: 1. Apply evidence-based practice, both current and new/emerging, in determining the use of scientific investigations and methods. 2. Apply the appropriate HCS knowledge and skills required for safe and effective practice. 3. Perform a range of routine technical and clinical skills relevant to the HCS division and theme in	1.1.5 1.4.5 2.1.2 2.1.3 2.2.2 2.2.3 2.2.4

Topic	Scientific Practice	GSP reference
	which they are training. 4. Master the use of ICT in relevant areas of healthcare science. 5. Apply and maintain quality standards and related quality control, assessment and management techniques to assure the validity of scientific and technical investigations routinely and assure the quality of personal practice. 6. Participate in scientific and technical audit to determine that investigations and methods are fit for purpose. 7. Practise and promote the importance of health and safety standards in the workplace, prioritising patient safety and the safety of all those working in or accessing the specialism, and identify actions that will improve health and safety, including reducing the risk of infection.	2.2.6 2.2.7 2.2.8 2.2.9 2.3 3.1.5 3.2.1 4.1.2 4.1.6
Attitudes, values and behaviours	By the end of the course, the student will be able to: 1. Consistently practise in accordance with the values described in *Good Scientific Practice* and the NHS Constitution to ensure high-level, safe, effective and compassionate patient-centred care.	1.1.1–1.1.11 1.2

Domain 3: Clinical Practice

Topic	Clinical Practice	GSP reference
Learning objective	By the end of the course, the student will be able to deliver high-quality, effective and safe technical clinical services, performing a range of clinical and/or laboratory skills consistent with the required roles, responsibilities and values of a HCSP within their scope of practice.	
High-level learning outcome(s)	By the end of the course, the student will be able to: • Explain and demonstrate the need for and the ability to deliver high-quality technical and clinical services in the investigation and management of patients as part of a MDT. • Apply and demonstrate those skills, attitudes, values and behaviours, in a variety of settings and with regard to a variety of political, social, technical, economic, organisational and professional contexts, required of a HCSP delivering consistently high-quality technical and clinical services that are targeted to meet the needs of the individual and group needs of patients.	
Knowledge	By the end of the course, the student will know, comprehend and apply their knowledge and be able to: 1. Describe the pathophysiology of common diseases that result in a referral to HCS services in a specific area of practice. 2. Evaluate the contribution of the MDT to patient care, patient safety and quality outcomes, and consider barriers to effective MDT working. 3. Describe the key roles of the healthcare professions that contribute to the MDT in your area of practice. 4. Discuss your role within the MDT and evaluate the clinical effectiveness of the team, reflecting and suggesting as appropriate areas for improvement. 5. Describe typical behaviours of team members and evaluate the clinical effectiveness of the team, and suggest areas for improvement as appropriate. 6. Discuss and evaluate the principles and practice of clinical audit as a tool to evaluate the effectiveness of services.	1.1.4 1.1.5 1.3.2 1.3.6 2.2.2 2.3.4 4.1.2 4.1.10
Technical procedures and clinical	By the end of the course, the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. They will be able to:	1.3.2 1.3.6 2.1.3

Topic	Clinical Practice	GSP reference
skills	1. Deliver high-quality technical clinical procedures in the investigation and management of patients. 2. Apply in practice consistently high standards in the technical skills required in the investigation and management of patients, and critically reflect on their performance. 3. Assist and, where appropriate, perform a range of equipment management skills, e.g. preventative maintenance, fault finding and calibration. 4. Attend and, if appropriate, actively participate in MDT meetings. 5. Assist in the design, data collection, data analysis and reporting within the clinical audit cycle.	2.1.4 2.1.5 2.1.6 2.2.1–2.2.4 2.2.6–2.2.9 4.1.10
Attitudes, values and behaviours	By the end of the course, the student would be expected to demonstrate the attitudes and behaviours necessary for the role of a HCSP and will be able to: 1. Commit to the provision of high standards of technical clinical services, taking account of the political, social, technical, economic, organisational and professional environment, and act as a positive role model. 2. Promote the importance of active participation of HCSPs in MDT meetings. 3. Advocate clinical audit as a tool to evaluate and optimise clinical services and communicate ideas and aspirations.	1.1.4 1.1.5 1.1.6 1.1.11 1.2.5 1.3.2 2.3 4.1.10

Domain 4: Research, Development and Innovation

Topic	Research, Development and Innovation	GSP reference
Learning objective	By the end of the course, the student will be able to justify the need for evidence-based practice, audit and innovation to support the development and improvement of patient services and patient safety, and will demonstrate the necessary knowledge, skills, attitudes, values and behaviours in relation to research, development and innovation in the pursuit of improved patient safety and care.	
High-level learning outcome(s)	By the end of the course, the student will be able to: • Explain the need for evidence-based practice, audit and innovation, within appropriate governance and ethical frameworks, in the delivery, development and improvement of patient-centred services. • Undertake or participate in personal or collaborative research, audit, development (professional or service) and innovation, applying the knowledge, skills, attitudes, values and behaviours required of a HCSP.	
Knowledge	By the end of the course, the student will know, comprehend and apply their knowledge and be able to: 1. Know the principles and applications of scientific enquiry, including the evaluation of treatment efficacy, the research process and research methodologies. 2. Know the value of research to the critical evaluation of practice research. 3. Describe and justify how and why research and development is undertaken within governance and ethical frameworks. 4. Explain ways in which the individual HCSP can support the wider healthcare team in the spread and adoption of innovative technologies and practice.	1.1.5 4.1.1 4.1.2 4.1.3 4.1.6 4.1.7 4.1.8 4.1.9 4.1.10
Technical procedures and clinical skills and procedures	By the end of the course, the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. They will be able to: 1. Apply research methods and techniques to initiate and complete a research project, development or innovation project. 2. Evaluate research and other evidence to inform own practice.	4.1.3 4.1.6 4.1.8 4.1.9
Attitudes, values and	By the end of the course, the student would be expected to demonstrate the attitudes and behaviours necessary for the role of a HCSP and will:	1.1.4 1.1.5

Topic	Research, Development and Innovation	GSP reference
behaviours	1. Work with appropriate research and development, governance, legal and ethical frameworks. 2. Promote the need for evidence-based practice to support the provision of high-quality care. 3. Be flexible and adaptable to the introduction of new scientific, technical, diagnostic, monitoring, treatment and therapeutic procedures into routine practice. 4. Keep up to date as part of a commitment to CPPD.	4.1.1 4.1.2 4.1.4 4.1.6

Domain 5: Clinical Leadership

Topic	Clinical Leadership	GSP reference
Learning objective	The NHS Leadership Academy states that: '*The Healthcare Leadership Model is to help those who work in health and care to become better leaders. It is useful for everyone – whether you have formal leadership responsibility or not, if you work in a clinical or other service setting, and if you work with a team of five people or 5,000.'* By the end of this course the student should therefore begin to develop an understanding of the key concepts of leadership; the skills, qualities and abilities of effective leaders and how their personal qualities affect the experiences of patients and service users, the organisation, the quality of care provided, and the reputation of the organisation itself. They will be introduced to assessment tools to measure their personal qualities 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.	
High-level learning outcome(s)	By the end of the course, the student will: • Understand the principles underpinning the current NHS clinical leadership frameworks,[40] and the associated personal qualities and the impact of personal qualities on the culture and climate within which the student, their colleagues and teams work.	
Knowledge	By the end of the course, the student will know, comprehend and apply their knowledge and be able to: 1. Explain the difference between leadership and management. 2. Discuss the skills, qualities and abilities of effective leaders. 3. Describe the impact of personal qualities on the culture and climate the student, their colleagues and teams work in. 4. Discuss how what the student does and how they behave affects the experiences of patients/service users, the organisation, the quality of care provided, and the reputation of the organisation itself.	5.1.1–5.1.6 5.1.10 5.1.12
Technical procedures and clinical	By the end of the course, the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. They will be able to:	

[40] http://www.leadershipacademy.nhs.uk/wp-content/uploads/dlm_uploads/2014/10/NHSLeadership-LeadershipModel-colour.pdf

Topic	Clinical Leadership	GSP reference
skills	1. Identify and develop skills in listening, observing and using feedback. 2. Identify conflict style and develop skills in negotiating and mediating conflicts.	
Attitudes, values and behaviours	By the end of the course, the student would be expected to demonstrate the personal qualities that underpin the practice of a HCSP, namely self-awareness, e.g. self-confidence; self-control; self-knowledge; personal reflection; resilience and determination. Students should be aware of their strengths and limitations in these areas and how these will have a direct effect on how they behave and interact with others. Students will be expected to critically reflect on performance to identify their own personal qualities, including values, principles and assumptions, developing action plans to adapt personal behaviour as necessary.	1.3.1 1.3.2 1.3.3 1.3.4 1.3.5 1.3.6

SECTION 4: GENERIC PROFESSIONAL, SCIENTIFIC AND TECHNICAL MODULES

This section covers the three generic modules that will be studied by all students undertaking an MSC accredited BSc (Hons) Healthcare Science integrated degree.

- Years 1–3: Professional Practice [10 credits per year developing learning at Level 4, Level 5 and Level 6]
- Year 1: Scientific Basis of Healthcare Science [60 credits]: Level 4
- Year 2: Research Methods [10 credits]: Level 5
- Year 3: Research Project [30 credits]: Level 6

GM(i): Professional Practice (Years 1, 2 and 3)

Topic	Professional Practice [10 credits per year]	GSP reference
Learning objective	The overall aim of this module is to ensure that the student has the underpinning knowledge, understanding and skills, and consistently demonstrates the values, attitudes and behaviours to perform a range of technical and clinical skills working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. Professional practice should be embedded in every aspect of the three-year programme to enable the student to develop and build their professional practice as they progress through the programme. In line with the concept of a spiral curriculum, students will encounter the same subject in different parts of the curriculum, but across the three-year programme the complexity will increase and the student will reinforce previous learning, gradually increasing their knowledge, skills and confidence.	
Knowledge	On successful completion of this programme the student will: **Professional practice** 1. Describe the values and principles that underpin the shared UK NHS and Social Care services culture, including the HEE five key workforce characteristics and the NHS Constitution, especially the values relating to compassion, transparency, candour, openness and leadership.[41,42] 2. Describe the role of the HCSP and how HCSPs contribute to the delivery of high-quality healthcare. 3. Explain the importance of placing the patient at the centre of care and discuss how this translates into practice. 4. Discuss the impact of culture, equality and diversity on practice. 5. Discuss how HCS services can work in partnership with patients and service users to ensure the views of patients are central to delivering, develop and maintaining high-quality, safe services. **Legal and ethical boundaries of practice**	1.1 1.2 1.3 2.3.4 4.1.1 5.1.2 5.1.4

[41] Investing in People – Workforce Plan for England
[42] Maps to Francis Report, Recommendation 2 – also to The Speaking Up Charter

Topic	Professional Practice [10 credits per year]	GSP reference
	6. Analyse the ethical, legal and governance requirements arising from working at the level of a HCSP across a range of situations. 7. Discuss the principles, guidance and law with respect to medical ethics, patient confidentiality (the limits of the concept of confidentiality), informed consent, equality and diversity, safeguarding, use of chaperones. 8. Summarise the procedures to follow if cautioned, charged with a criminal offence, suspended, or have restrictions placed on personal scientific, clinical, or professional practice. 9. Justify the importance of personal health and wellbeing to ensure personal performance and judgement is not affected by their own health. **Patient safety and quality** 10. Explain the importance of protecting patients from risk or harm presented by another person's conduct, performance, or health, and what to do when concerns are identified or raised. 11. Discuss how to share information appropriately with patients, carers, colleagues and other services to support the quality of care. 12. Explain the common causes of error and understand the critical incident reporting process, recognising the importance of promoting a no-blame culture. 13. Explain approaches to procedures for identifying and reporting critical incidents and receiving and responding to complaints. 14. Explain current national and local policy issues as they affect the service provided by HCSPs and the HCS workforce. 15. Discuss your role in healthcare science and its contribution to the delivery of high-quality healthcare. 16. Explain why it is important that the HCS workforce takes reasonable care of health and safety at work for themselves, members of their team and others. **Communication skills** 17. Explain the principles that underpin effective verbal and written communication within your role, including those who do not have English as a first language and communication with people with sensory and cognitive impairments.	

Topic	Professional Practice [10 credits per year]	GSP reference
	Leadership 18. Explain the concept of shared leadership and the associated personal qualities and behaviours that promote shared leadership, and apply this knowledge within the work base. **Continuing personal and professional development** 19. Explain the importance of keeping professional knowledge and skills up to date and working within the limits of their personal competence. 20. Justify the rationale for engaging in CPPD and critical reflective practice, and evaluate methods for recording, learning, developing and evaluating action plans.	
Technical skills and procedures	By the end of the course the student will be expected to apply in practice a range of professional, technical and clinical skills, and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC.	1.1 1.2 1.3

GM(ii): Scientific Basis of Healthcare Science (Year 1)

Topic	Scientific Basis of Healthcare Science [60 credits]	GSP reference
Learning objective	The overall aim of this introductory module is to provide all students with a broad knowledge and understanding of clinical science and scientific knowledge, contextualised to the practice of healthcare science and the services provided by their HCS division/specialism. Central to this is the contribution of healthcare science to patient care, patient safety, service delivery, research and innovation, often at the cutting edge of science, for example genomics, personalised medicine and clinical bioinformatics. All members of the HCS workforce must understand the impact of their work on patients and patient care and remember that their work has a direct or indirect impact on patient care. As an introductory module it will provide an overview and reinforcement of key concepts with respect to the organisation, structure and function of the body, and important areas such as the psychosocial aspects of health and disease, clinical pharmacology and therapeutics, genomics, personalised/precision medicine and clinical bioinformatics. Achievement of each learning outcome provides the building blocks for the division- and specialism-specific learning to follow, ensuring a common starting point for all students. This module is designed to provide students with broad scientific knowledge to underpin their future practice to provide the foundations for study in any area of healthcare science.	
Knowledge	On successful completion of this module the student will: 1. Describe the structural, chemical, cellular and tissue organisation of the body and explain the cellular, tissue and systems responses to diseases. 2. Explain the structure and function of all body systems and the effects of common diseases. 3. Explain the principles and core concepts of clinical genetics, genomics and personalised/precision medicine and discuss in the context of patients referred to HCS services. 4. Explain the basis of epidemiology, public health, health prevention and health protection and discuss in relation to the role of the public health function and HCS services. 5. Explain the principles of clinical pharmacology and therapeutics and discuss in relation to patients referred to HCS services. 6. Explain the principles and core concepts of the sociology of health and illness and discuss those	1.1.4 1.1.5 1.1.6 2.1.6

Topic	Scientific Basis of Healthcare Science [60 credits]	GSP reference
	relevant to patients typically referred to HCS services. 7. Explain the basic principles of physics and clinical engineering that underpin HCS and discuss in relation to patients referred to HCS services. 8. Explain the principles of clinical bioinformatics and health informatics and discuss their impact on healthcare, health and HCS services. 9. Explain a range of mathematical and statistical techniques that underpin the practice of healthcare science. 10. Keep up to date with developments in healthcare and healthcare science, identifying new and innovative scientific and technical developments and their application in healthcare science.	
Technical skills and procedures	By the end of this module the student will be expected to apply in practice a range of technical and clinical skills and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC. Students will be expected to apply and develop their knowledge as they progress through the programme in their academic and work-based learning. They will also be expected to develop a range of study skills, including time management, organisational skills, using the library, search engines, self-directed learning, critical analysis and avoiding plagiarism.	1.1.4 1.1.5 1.1.6 2.2.4

GM(iii): Research Methods (Year 2)

Topic	Research Methods [10 credits]	GSP reference
Learning objective	The overall aim of this module is to ensure that the student understands the research process and the place of research, development and innovation in the NHS and in Healthcare Science with respect to improving patient care and patient outcomes spanning prevention, diagnostics, treatment and service delivery. The learning outcomes and indicative content are designed to enable students to develop a broad understanding of the research process and an overview of a range of research methods together with the need for an evidence base to guide decision making process. Students will build and extend their knowledge and application of mathematics, statistics and data presentation/analysis techniques gained in Year 1 and consider methods of disseminating research findings. This module will provide the underpinning knowledge to support the final year research project.	
Knowledge	On successful completion of this module the student will: 1. Explain and justify the process and importance of research, innovation and audit to the NHS and healthcare science. 2. Explain the current UK ethical, legal and governance frameworks within which human and animal research can be conducted. 3. Explain the principles of evidence-based medicine; literature and systematic review; and the development of clinical guidelines. 4. Describe a range of study designs and discuss the appropriate use of each method. 5. Describe and justify the use of statistical techniques to analyse data, and a range of dissemination methods to share research findings.	4.1.1 4.1.7

GM(iv): Research Project (Year 3)

Please note that if the research project is completed in the work-base this should not be within the stipulated minimum 50 weeks of work-based learning but in additional time.

Topic	Research Project [30 credits]	GSP reference
Learning objective	The overall aim of this module, building on the Research Methods module, is for the student to apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding as they initiate and complete a research project. The research project may span scientific or clinical research, translational research, operational and policy research, clinical education research, innovation, service development, service improvement, or supporting professional service users. Research projects should be designed to take into account the current research programmes of the academic and/or work-based departments in which the research is to be conducted.	
Knowledge	By the end of this module the student will: 1. Discuss the range of research undertaken in health and healthcare science and how these are applied in the specialism in which the student is based. 2. Describe the ethical and governance approval processes required to undertake the planned research project.	1.1.4 1.1.5 4.1.1 4.1.2
Technical skills and procedures	On successful completion of this module and working within legal and ethical frameworks the student will be able to: 1. Work with a supervisor to design, plan and undertake a research project to test a hypothesis from conception to completion/archiving in accordance with ethical and research governance regulations, drawing on expert advice where necessary and involving patients and service users. 2. Analyse the data using appropriate methods and statistical techniques and interpret, critically discuss and draw conclusions from the data. 3. Prepare a project report that describes and critically evaluates the research project, clearly identifying the strengths and weaknesses. 4. Present a summary of the research project, responding to questions appropriately. 5. Prepare a summary of the research project suitable for non-specialist and lay audiences.	4.1.1 4.1.2 4.1.3 4.1.6 4.1.8 4.1.9
Technical	On successful completion of this module and working within legal and ethical frameworks the student	2.1.6

Topic	Research Project [30 credits]	GSP reference
skills and procedures	will be able to: 1. Undertake an evidence-based literature review, critically appraise the output, draw appropriate conclusions and prepare a written report of the findings, and where appropriate, use the findings to inform the third-year research project. 2. Present the outcome of the literature review to a non-scientific and scientific audience.	2.2.4 4.1.1 4.1.2 4.1.7 4.1.9

SECTION 5: DIVISION-THEME SCIENTIFIC AND TECHNICAL SYLLABUS

Cardiovascular Respiratory and Sleep Science Syllabus

5.1 Attitudes, Behaviours and Values

The student will be expected to critically reflect on their professional practice and consistently demonstrate the professional attributes and insights required of a HCSP.

The following learning outcomes should be achieved as appropriate to the modules within the Cardiovascular, Respiratory and Sleep Science syllabus:

- Work within the Standards of Conduct, Performance and Ethics set by the AHCS in *Good Scientific Practice*.
- Show respect and behave in accordance with *Good Scientific Practice*.
- Treat patients, carers and their families with respect, kindness and compassion, putting them at their ease.
- Show understanding of the patient's anxiety and be sympathetic and kind, respecting and understand individuals' beliefs and ways of coping with illness.
- Appreciate the empathy and sensitivity needed when dealing with the patient experience of long-term conditions and terminal illness.
- Appreciate the impact of cardiovascular, respiratory and sleep services on the patient pathway and outcome.
- Appreciate the emotional and psychological impact the patient, relatives and carers might experience when undergoing investigations, diagnosis and treatment.
- Act in a calm, controlled and reassuring manner.
- Behave in a professional manner in matters of attendance and appearance.
- Recognise the limits of professional competence, seeking help and support and referring to colleagues appropriately.
- Maintain confidentiality of patient information and data.
- Value social diversity and its relationship to service provision in healthcare.
- Work effectively within a MDT, developing and maintaining professional relationships.
- Develop a balance between reflective practice and active exploration in personal learning and take responsibility for personal learning.
- Develop, maintain and improve personal knowledge and skills.
- Consistently work safely, demonstrating being precise and paying attention to detail.

- Communicate effectively within the healthcare environment and clinical team, adapting communication to meet varying needs and overcoming barriers to understanding.
- Communicate scientific information at a level appropriate to the audience, including the public.
- Use correct terminology appropriate to healthcare, healthcare science, cardiovascular, respiratory and sleep sciences, and the specialist areas where work placements are undertaken.
- Listen and extract relevant information.
- Encourage feedback from the public, patients and staff, welcome it and use it to improve services.
- Establish and influence the culture of health and safety in the workplace.
- Recognise, where necessary, the urgency of a situation and seek help and advice.
- Show a positive attitude to lifelong learning and professional development.
- Bring the highest levels of knowledge and skill at times of basic human need when care and compassion are what matters most.

The PTP syllabus for Cardiovascular, Respiratory and Sleep Sciences follows.

5.2 Division-theme Modules

This section covers the three division-specific modules that will be studied by all students undertaking the PTP in Cardiovascular, Respiratory and Sleep Sciences:

CVRS(i): Scientific Basis of Cardiovascular, Respiratory and Sleep Science (Year 1)
CVRS(ii): Instrumentation, Signal Processing and Imaging (Year 2)
CVRS(iii): Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions (Year 2).

Year 1

CVRS(i): Scientific Basis of Cardiovascular Respiratory and Sleep Science [50 credits]

Topic	Scientific Basis of Cardiovascular [25 credits] Respiratory and Sleep Science [25 credits], including work-based training [total of 50 credits]	GSP reference
Learning objective	By the end of this module the student will understand the breadth of the application of science across Cardiovascular, Respiratory and Sleep Science, and will be able to work safely and professionally within these environments. Within the work base they will be expected to apply and contextualise their knowledge and skills, performing routine technical skills and developing and building their professional practice in accordance with *Good Scientific Practice.* They will be expected to integrate and embed many of the professional practice learning outcomes and be enabled to practise safely in the workplace. The overall aim of the work-based placements within Year 1 is to provide students with a broad appreciation of the range of work undertaken within healthcare science. Students will begin the process of the development of the skills and attitudes relevant to the HCSP, building on learning in the academic environment, including practical sessions, clinical skills sessions, reflection on development, etc. Additionally, the placements should help students learn in the context of practice and real-life experience, and provide a motivational element as they work towards a career in the NHS. Central to all work-based learning is to ensure the student understands the concept of patient-centred care that is respectful of and responsive to individual patient preferences, needs and values, and ensures that patient values guide all they do. Students will be expected to demonstrate patient-centred care at all times. This module will provide a foundation from which students will build their knowledge, skills, experience and attitudes throughout the three-year programme of study and enable them to transfer these skills to employment in healthcare science. It is expected that this period of initial work-based training will provide the opportunity to begin to integrate and embed many of the professional practice learning outcomes and enable students to practise safely in the work base. Students will be expected to begin to maintain a portfolio of evidence and complete relevant sections of the Learning Guide. *Students who complete the specialist Respiratory and Sleep Science modules in a paediatric environment will be*	

Topic	Scientific Basis of Cardiovascular [25 credits] Respiratory and Sleep Science [25 credits], including work-based training [total of 50 credits]	GSP reference
	expected to gain experience and achieve the competences in adults in this Year 1 module.	
Knowledge	By the end of this module the student will be able to: 1. Describe how the HCS workforce contributes to patient pathways in Cardiac, Vascular, Respiratory and Sleep Sciences, with particular emphasis on the role of the HCSP. 2. Explain the processes and frameworks that exist to ensure the application of safe and effective clinical practice. 3. Explain the basic principles underpinning routine investigations and procedures undertaken to investigate and treat common cardiovascular, respiratory and sleep conditions. 4. Discuss the importance of patient-centred care and effective MDT working in the investigation and treatment of patients.	1.1.4 1.1.5 3.1.5 3.1.8
Technical and clinical skills	By the end of this module, the student will be expected to apply in practice a range of technical and clinical skills and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and will be able to: 1. Perform, under direct supervision, a routine 12-lead electrocardiogram (ECG) in accordance with local health and safety regulations. 2. Measure blood pressure using an automatic device. 3. Perform spirometry as part of a routine investigation. 4. Measure spot oxygen saturation (SpO_2).	1.1.1 1.1.2 1.1.3 1.1.4 1.1.5 1.16 1.1.7 1.1.8 1.1.10 1.3.1 2.2.3 2.2.4 2.2.7 3.1.1 3.1.2 3.2.1 3.2.2

Year 2

CVRS(ii): Instrumentation, Signal Processing and Imaging [20 credits]

Topic	Instrumentation, Signal Processing and Imaging [20 credits]	GSP reference
Learning objective	By the end of this module the student will understand the underpinning principles, properties and safe application of the measurement techniques that underpin investigations in Cardiology, Vascular, Respiratory and Sleep Sciences.	
Knowledge	By the end of this module the student will be able to: 1. Explain, using correct terminology, the basic equipment/techniques used within the HCS specialisms of Cardiology, Vascular, Respiratory and Sleep Sciences. 2. Describe the principles of operation of equipment and techniques in each specialism. 3. Critically evaluate the risks and benefits related to equipment and techniques, including safety. 4. Discuss and justify the quality assurance (and if applicable legislative) framework for equipment and techniques in each specialism.	1.1.4 1.1.5
Technical and clinical skills	By the end of this module the student will be able to undertake calibration of equipment to ensure accurate signal acquisition and take appropriate action in the event of errors in calibration. **The Year 2 and 3 work-based learning outcomes can be found in module CP(iii): Cardiac Physiology, module RS(iii) Respiratory and Sleep Physiology, and further details within the Work-based Learning Syllabus: Sections 9, 10 and 11.**	2.2.3 2.2.7 2.3.1

Year 2

CVRS(iii): Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions [20 credits]

Topic	Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions [20 credits]	GSP reference
Learning objective	By the end of this module the student will know the pathophysiology of common cardiovascular, respiratory and sleep conditions that often result in referral for investigation to a cardiovascular, respiratory, or sleep service and will consider the impact on patients, carers and families.	
Knowledge	By the end of this module the student, with respect to the cardiovascular and respiratory systems and disorders of sleep in health and disease, will be able to: 1. Describe common diseases affecting the cardiovascular and respiratory systems (including those that might result in sleep pattern disruption) and discuss the impact of the diseases on patients, carers and families. 2. Describe cellular, tissue and systems responses to common cardiac, vascular, respiratory and sleep conditions. 3. Identify abnormal changes within physiological measurements and relate this knowledge to pathology within the cardiovascular, respiratory and sleep systems. *4.* Explain the impact of lifestyle choices on health relating to the specialism, e.g. smoking, body mass index (BMI), exercise and discuss patient support mechanisms.	1.1.4 1.1.5
Technical and clinical skills	By the end of this module the student will be expected to have visited multidisciplinary clinics to observe how MDTs work and gain knowledge and experience of: (i) the reasons patients are referred to hospital; (ii) common signs and symptoms patients present with; and (iii) patient-centred care. **The Year 2 and 3 work-based learning outcomes can be found in module CP(iii): Cardiac Physiology, module RS(iii) Respiratory and Sleep Physiology and further details within the Work-based Learning Syllabus: Sections 9, 10 and 11.**	1.3.1 1.3.5

SECTION 6: CARDIAC PHYSIOLOGY SYLLABUS

6.1 Specialist Modules for Cardiac Physiology

Interpretation of the high-level framework for Cardiovascular, Respiratory and Sleep Sciences specialising in Cardiac Physiology

<table>
<tr><th></th><th colspan="6">Module Title</th></tr>
<tr><td>Year 3 Application to Practice</td><td>Professional Practice
[10]</td><td colspan="3">Applying Cardiac Physiology in Practice
[60]</td><td>Research Project
[30]</td><td>Work-based training
25 weeks
[20]</td></tr>
<tr><td>Year 2 Technologies and Methodologies</td><td>Professional Practice
[10]</td><td>Research Methods
[10]</td><td>Instrumentation, Signal Processing and Imaging
[20]</td><td>Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions
[20]</td><td colspan="2">Cardiac Physiology
[50]</td><td>Work-based training
15 weeks
[10]</td></tr>
<tr><td>Year 1 Scientific Basics</td><td>Professional Practice
[10]</td><td colspan="3">Scientific Basis of Healthcare Science – integrated module across body systems
[60]</td><td colspan="2">Scientific Basis of Cardiovascular [25 credits] and Respiratory and Sleep Science [25 credits], including work-based training
Total [50]</td></tr>
</table>

[XX] = Number of credits

Generic modules: Common to all divisions of healthcare science

Division-theme modules: Shared by a group of specialisms, usually within a Healthcare Science division

Specialist modules: Specific to a specialism of healthcare science

Year 2

CP(i): Cardiac Physiology
[50 credits]

Topic	Cardiac Physiology [50 credits]	GSP reference
Learning objective	By the end of this module the student will be expected to understand the breadth of the application of science within Cardiac Physiology. Building on previous learning they will develop and apply their knowledge and understanding in Cardiac Physiology. They will develop their skills with respect to patient-centred care and the importance of ensuring that it guides all clinical decisions and: (i) perform and interpret the results from electrocardiography; (ii) perform the measurement of resting blood pressure and fitting and removing ambulatory blood pressure monitors; (iii) perform and analyse ambulatory ECG monitoring; and (iv) assist with exercise stress testing. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'.	
Knowledge	By the end of this module the student will be able to: 1. Explain the need for calibration and quality assurance across the range of investigations. 2. Explain the principles of a range of routine diagnostic cardiac investigations and compare and contrast each method: • electrocardiography (ECG); • blood pressure measurement; • ambulatory blood pressure monitoring; • ambulatory electrocardiography (including interpretation of recordings); • cardiac exercise stress testing. 3. Explain how to interpret the adult resting ECG and ambulatory ECG and identify quality control processes to support accurate interpretation. 4. Identify and evaluate the limitations of diagnostic cardiac investigations, for example sensitivity and specificity of exercise stress testing. 5. Justify the importance of effective communication skills, respecting the rights, dignity and privacy of patients and treating patients with care and compassion.	1.1.4 1.1.5 2.3.1 3.1.5 3.1.8

Topic	Cardiac Physiology [50 credits]	GSP reference
Technical and clinical skills	**The Year 2 and 3 work-based learning outcomes can be found in module CP(iii): Cardiac Physiology Work-based Training and further details within the Work-based Learning Syllabus: Section 10.**	

Year 3

CP(ii): Applying Cardiac Physiology to Practice
[60 credits] plus [30 credits work-based learning]

Topic	Applying Cardiac Physiology to Practice [60 credits] plus Year 2 and 3 work-based learning [30 credits]	GSP reference
Learning objective	The overall aim of this module is to ensure that the student begins to gain wider knowledge of investigations undertaken in a cardiology department particularly provocative electrocardiography (monitoring during functional imaging investigations/head-up tilt testing) and pacing and cardiac catheterisation. This module will also build on earlier work to develop the themes of public health and epidemiology of cardiovascular disease, risk factors, risk assessment and primary prevention, including behavioural change management. The student will be expected to develop their skills with respect to patient-centred care, ensuring that patient values guide all clinical decisions, and assist with pacing and diagnostic cardiac catheterisation in adults. During this period of work-based training students will apply their learning from earlier modules including 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'. On completion of this module the student will be able to assist with more complex investigations. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.	
Knowledge	By the end of this module the student will be able to: 1. Explain the principles of a range of cardiac investigations and compare and contrast the indications and contraindications of each method: • invasive pressure measurement and catheter based diagnostic and interventional procedures; • head-up tilt testing; • functional imaging investigations; • cardiac pacing. 2. Explain the physiology, pathophysiology and pharmacology related to functional imaging investigations, head-up tilt testing, pacing and cardiac catheterisation, and evaluate the use of each technique in clinical practice. 3. Discuss the basic principles of echocardiography and cardiac rhythm management techniques.	1.1.4 1.1.5 3.1.5 3.1.8

Topic	Applying Cardiac Physiology to Practice [60 credits] plus Year 2 and 3 work-based learning [30 credits]	GSP reference
	4. Critically evaluate the importance of patient-centred care and recognise the needs of people with disabilities within this care pathway. 5. Discuss the value of clinical audit in optimising services and contributing to the provision of safe, high-quality patient-centred cardiac science services.	
Technical and clinical skills	**The Year 2 and 3 work-based learning outcomes can be found in module CP(iii): Cardiac Physiology Work-based Training and further detail within the Work-based Learning Syllabus: Section 10.**	

Years 2 and 3

CP(iii): Cardiac Physiology Work-based Training [30 credits]

Topic	Cardiac Physiology Work-based Training [30 credits]	GSP reference
Learning objective	The overall aim of this module is to give the student experience of Cardiac Physiology that ensures they can undertake the full breadth of practice expected of a newly qualified HCSP in Cardiology. This is delivered through work-based placements in Years 2 and 3 of the degree programme. The student will be expected to develop their skills with respect to patient-centred care, ensuring that patient values guide all clinical decisions and care is respectful of and responsive to individual patient preferences, needs, and values. ***Note 1: The indicative content for the work-base training modules in Year 2 is defined in the Year 3 module content to be achieved across Years 2 and 3.*** ***Note 2: Work-based training in Years 2 and 3 does not have to be confined only to the work base. However, while elements may be taught in other environments, e.g. a clinical skills laboratory or simulation centre, it is expected that all students will spend the majority of the time in a clinical environment within a healthcare setting.***	
Knowledge	On successful completion of this module the student will be able to: 1. Discuss the underpinning principles of routine cardiac investigations, integrating knowledge of basic and clinical science and explaining the test selection process. 2. Confidently and correctly apply relevant calculations, reference ranges and interpretive strategies in the analysis and reporting of the full range of investigations covered throughout the programme. 3. Select investigations suitable for the patient and pathway, taking into account indications/contraindications and the clinical question being asked. 4. Critically review and evaluate departmental protocols in relation to the core skills in health and safety, human rights, patient identification, communication skills and management, and quality assurance. 5. Record and evidence acquisition of skills, knowledge and attitudes through critical reflection and action planning linked to evidence of technical and clinical scientific practice in a professional	1.1.4 1.1.5 3.1.5 3.1.8

Topic	Cardiac Physiology Work-based Training [30 credits]	GSP reference
	portfolio.	
Technical and clinical skills	By the end of this module, the student will be expected to apply in practice a range of technical and clinical skills and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS and will be able to: **Electrocardiography** 1. Record the resting ECG on patients in a range of clinical settings, including adults and children. 2. Interpret the resting ECG. **Resting and ambulatory blood pressure measurement** 3. Measure resting blood pressure (BP) on a range of patients, using analogue and digital equipment. 4. Fit and remove ambulatory BP devices and produce clinical data in an appropriate format. **Ambulatory ECG monitoring** 5. Fit and remove ambulatory ECG devices. 6. Analyse routine ambulatory ECG recording (excluding pacing, inherited disease and paediatrics). **Provocative electrocardiography** 7. Assist (second person) in cardiac exercise stress testing, ECG and BP aspects of functional imaging investigations, head-up tilt testing and Valsalva manoeuvre 8. Demonstrate immediate life support in accordance with current Resuscitation Council (UK) guidelines. **Pacing and diagnostic cardiac catheterisation** 9. Assist during left-heart diagnostic and therapeutic invasive procedures. 10. Assist during the implant of bradycardia management devices. 11. Assist with post-implant checks	1.1.1 1.1.2 1.1.3 1,1,4 1.1.5 1.16 1.1.7 1.1.8 1.1.9 1.1.10 1.3.1 2.2.3 2.2.4 2.2.7 2.3.1 3.1.1 3.1.2 3.2.1 3.2.2

SECTION 7: RESPIRATORY AND SLEEP SYLLABUS

7.1 Specialist Modules for Respiratory and Sleep Sciences

Interpretation of the high-level framework for Cardiovascular, Respiratory and Sleep Sciences specialising in Respiratory and Sleep Sciences

<table>
<tr><th></th><th colspan="7">Module Title</th></tr>
<tr><td>Year 3
Application to Practice</td><td>Professional Practice
[10]</td><td colspan="3">Applying Respiratory and Sleep Physiology to Practice
[60]</td><td>Research Project
[30]</td><td>Work-based training
25 weeks
[20]</td></tr>
<tr><td>Year 2
Technologies and Methodologies</td><td>Professional Practice
[10]</td><td>Research Methods
[10]</td><td>Instrumentation, Signal Processing and Imaging
[20]</td><td>Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions
[20]</td><td colspan="2">Respiratory and Sleep Physiology
[50]</td><td>Work-based training
15 weeks
[10]</td></tr>
<tr><td>Year 1
Scientific Basics</td><td>Professional Practice
[10]</td><td colspan="3">Scientific Basis of Healthcare Science – integrated module across body systems
[60]</td><td colspan="3">Scientific Basis of Cardiovascular [25 credits] Respiratory and Sleep Science [25 credits], including work-based training
Total [50]</td></tr>
</table>

[XX] = Number of credits

Generic modules: Common to all divisions of healthcare science

Division-theme modules: Shared by a group of specialisms, usually within a Healthcare Science division

Specialist modules: Specific to a specialism

Year 2

RS(i): Respiratory and Sleep Physiology [50 credits]

Topic	Respiratory and Sleep Physiology [50 credits]	GSP reference
Learning objective	The overall aim of this module is to ensure that the student has the knowledge and understanding of the breadth of the application of science within Respiratory and Sleep Sciences. The student will be expected to develop their skills with respect to patient-centred care, ensuring that patient values guide all clinical decisions, and: (i) perform spirometry, static lung volumes, and administer and measure the response to a bronchodilator; (ii) measure gas transfer and spot oxygen saturation: and (iii) set up and download of an overnight oximeter in a range of patients referred to the respiratory physiology/sleep department. During this period of work-based learning students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology in Practice'; and 'Professional Practice'. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.	
Knowledge	By the end of this module the student will be able to: 1. Explain the need for calibration and quality assurance across the range of investigations. 2. Explain the principles and application of lung volume measurement in routine clinical practice. 3. Discuss the role of inhaled drug therapy in the management of respiratory disease. 4. Explain the principles and application of operation of respiratory gas analysis. 5. Explain the principles and application of operation of pulse oximetry. *6.* Justify the importance of effective communication skills; respecting the rights, dignity and privacy of patients; and treating patients with care and compassion.	1.1.4 1.1.5 2.3.1 3.1.5 3.1.8
Technical and clinical skills	**The Years 2 and 3 work-based learning outcomes can be found in module RS(iii): Respiratory and Sleep Physiology and further details within the Work-based Learning Syllabus: Section 11.**	

Year 3

RS(ii): Applying Respiratory and Sleep Physiology to Practice [60 credits]

Topic	Applying Respiratory and Sleep Physiology to Practice [60 credits]	GSP reference
Learning objective	The overall aim of this module is to ensure that the student develops knowledge and understanding of a wider range of investigations utilised within Respiratory and Sleep Sciences and their application in relevant care pathways. This module will build on earlier work to develop themes of public health and epidemiology of respiratory disease and sleep disorders, risk factors, risk assessment and primary prevention, including behavioural change management. They will develop their skills with respect to patient-centred care and the importance of ensuring that it guides all clinical decisions, and further develop skills in muscle function testing, limited multichannel sleep studies and continuous positive airway pressure (CPAP) therapy. During this period of work-based learning students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology in Practice'; and 'Professional Practice'.	
Knowledge	By the end of this module the student will be able to: 1. Synthesise knowledge of respiratory and sleep physiology investigations and critically apply knowledge to typical clinical scenarios. 2. Explain human development from birth to adulthood with respect to the respiratory system and its impact on measured values. 3. Critically appraise the methods available for assessing respiratory function in children ≥ 8 years. 4. Explain the principles of and analyse the use of each investigation listed below in the diagnosis and treatment of patients with respect to: • blood gas analysis • field exercise in the assessment of breathlessness and disease severity • assessment of respiratory muscle function • challenge testing • limited multichannel sleep studies, including technical, clinical and physiological issues • role of lifestyle factors, co-morbidities and pharmacology on disorders of sleep	1.1.4 1.1.5 3.1.5 3.1.8

Topic	Applying Respiratory and Sleep Physiology to Practice [60 credits]	GSP reference
	• positive airway pressure therapy • role of emerging technology such as remote monitoring on patient care and pathways. 5. Justify the value of clinical audit in optimising services and improving quality and patient safety. 6. Debate the importance of patient-centred care and discuss the needs of people with disabilities within this care pathway.	
Technical and clinical skills	**The Years 2 and 3 work-based learning outcomes can be found in module RS(iii): Respiratory and Sleep Physiology and further details within the Work-based Learning Syllabus: Section 11.**	

Years 2 and 3

RS(iii): Respiratory and Sleep Physiology Work-based Training [30 credits]

Topic	Respiratory and Sleep Physiology Work-based Training [30 credits]	GSP reference
Learning objective	The overall aim of this module is to give the student experience of Respiratory and Sleep Physiology that ensures they can undertake the full breadth of practice expected of a newly qualified HCSP in Respiratory and Sleep Physiology. This is delivered through work-based placements in Years 2 and 3 of the degree programme. The student will be expected to develop their skills with respect to patient-centred care, ensuring that patient values guide all clinical decisions and care is respectful of and responsive to individual patient preferences, needs and values. ***Note 1: The indicative content for the work base training modules in Year 2 is defined in the Year 3 module content to be achieved across Year 2 and 3.*** ***Note 2: Work-based training in Years 2 and 3 does not have to be confined only to the work base. However, while elements may be taught in other environments, e.g. a clinical skills laboratory or simulation centre, it is expected that all students will spend the majority of the time in a clinical environment within a healthcare setting.***	
Knowledge	On successful completion of this module the student will be able to: 1. Discuss the underpinning principles of routine respiratory physiology and sleep investigations, integrating and applying knowledge of basic and clinical science and explaining the test selection process. 2. Confidently and correctly apply relevant calculations, reference ranges and interpretive strategies in the analysis and reporting of the full range of investigations covered throughout the programme. 3. Select investigations suitable for both the patient and the pathway, taking into account indications/contraindications and the clinical question being asked. 4. Critically review and evaluate departmental protocols in relation to the core skills in health and safety, human rights, patient identification, information governance, communication skills and management and quality assurance. 5. Record and evidence acquisition of skills, knowledge and attitudes through accumulation of evidence	1.1.4 1.1.5 2.3.1 3.1.5 3.1.8

Topic	Respiratory and Sleep Physiology Work-based Training [30 credits]	GSP reference
	in a professional portfolio.	
Technical and clinical skills	By the end of this module, the student will be expected to apply in practice a range of technical and clinical skills and critically reflect on and develop their performance, working within the Standards of Proficiency set by the AHCS. **Spirometry, static lung volumes and bronchodilator response** 1. Measure and evaluate dynamic lung volumes (forced expiratory volume in 1 second [FEV_1], forced vital capacity [FVC], peak expiratory flow [PEF] and vital capacity [VC]) in a range of patients and produce a technical report. 2. Measure static lung volumes (total lung capacity [TLC], functional residual capacity [FRC] [or thoracic gas volume (TGV)] and residual volume [RV]) and all subdivisions using helium dilution, nitrogen washout, or body plethysmography in patients with a range of underlying disorders and produce a technical report. 3. Administer a short-acting bronchodilator, measure the response and produce a technical report. 4. Perform routine maintenance, calibration and quality assurance procedures on the equipment used to undertake dynamic and static lung volumes, and ensure accurate completion of equipment maintenance records. 5. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*. **Measurement of gas transfer and oxygen saturation** 6. Measure the uptake of carbon monoxide (CO) using the single breath technique as a guide to the gas exchange function in a range of patients with respiratory and non-respiratory disorders. 7. Measure the heart rate and spot oxygen saturation using pulse oximetry in patients with a range of respiratory and non-respiratory disorders in a variety of settings. 8. Perform routine maintenance, calibration and quality assurance procedures on the equipment used to undertake dynamic and static lung volumes, gas transfer and oxygen saturation equipment, and ensure accurate completion of equipment maintenance records. 9. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*. **Assessment and treatment of sleep disorders** **Overnight oximetry**	1.1.1 1.1.2 1.1.3 1,1,4 1.1.5 1.16 1.1.7 1.1.8 1.1.9 1.1.10 1.3.1 2.2.3 2.2.4 2.2.7 3.1.1 3.1.2 3.2.1 3.2.2

Topic	Respiratory and Sleep Physiology Work-based Training [30 credits]	GSP reference
	10. Prepare, issue, retrieve and store data from overnight oximetry. 11. Download, perform manual analysis, interpret data and write a clinical report in an appropriate format. **Multi-channel limited sleep study** 12. Prepare, fit and remove multi-channel polygraphy devices on a range of patients. 13. Download, perform manual analysis, interpret data and write a clinical report in an appropriate format. **Positive airway pressure (PAP) therapy** 14. Set up a range of patients on PAP machines (continuous and automatic), selecting the appropriate settings and interface. 15. Communicate with patients, providing written and verbal information and education on the use of PAP therapy. 16. Download a PAP device, interpret the data and report the findings. 17. Review patients who have recently started on PAP therapy or those on long-term therapy and recognise where further intervention is required.	

SECTION 8: INDICATIVE CONTENT: KNOWLEDGE

8.1 Generic Professional Practice, Technical and Scientific Modules

GM(i): Professional Practice

Indicative Content

KNOWLEDGE

Professional Practice

- The role of regulation
- Regulation of the HCS workforce by the AHCS and HCPC
- NHS Constitution
- HEE five key workforce characteristics
- Values relating to compassion, transparency, candour, openness and leadership
- Current national NHS policies and practice, including policy relevant to the area of practice
- How service delivery aligns to current NHS policy and practice
- The HCS workforce:
  - structure into four divisions and specialisms within each division
  - education and training programmes
  - leadership of the HCS profession (e.g. the role of the Chief Scientific Officer)
  - Modernising Scientific Careers (MSC)
  - the contribution of the HCS workforce to health and healthcare services
- The role of the HCSP
- Patient–professional partnerships, with the patient at the centre of care
- Patient and carer perspectives and the diversity of the patient experience
- Use of chaperones
- Current safeguarding regulations relevant to practice as a HCSP
- Culture, equality and diversity and how this can affect practice
- Disability, including learning disabilities
- Mental health
- Patient wellbeing and self-care, including how to support self-care

- How to work in partnership with patients and service users to ensure that the views of patients are central to delivering, developing and maintaining high-quality, safe services
- The role of patient support groups
- The importance of the patient voice in education and training for the HCS workforce, including the structures within each BSc programme to promote the patient voice

Legal and Ethical Boundaries of Practice

- Sharing of information and advice between peers in order to encourage a consistent approach to the implementation of NHS policy
- Ethical, legal and governance requirements arising from working at the level of HCSP
- Principles, guidance and law with respect to medical ethics
- Principles, guidance and law with respect to patient confidentiality
- Principles, guidance and law with respect to informed consent and how to gain informed consent
- The limits of the concept of confidentiality
- The importance of introducing yourself and explaining your role to every patient
- Principles, guidance and law with respect to equality and diversity
- Principles, guidance and law with respect to safeguarding, including the use of chaperones
- The procedures to follow if cautioned, charged with a criminal offence, suspended, or have restrictions placed on personal scientific, clinical or professional practice
- The importance of personal health and wellbeing to ensure personal performance and judgement is not affected by their own health
- Information governance and be aware of the safe and effective use of health and social care information
- The need to manage records and all other information in accordance with applicable legislation, protocols and guidelines

Patient Safety and Quality

- NHS Constitution
- The wider context of safety in the NHS, including the culture of an organisation
- How effective communication underpins high-quality and safe patient services/patient care, including shared decision making
- The role of national organisations, e.g. NHS England; NHS Improving Quality
- Definition of terms:

    - Quality management
    - Quality control
    - Quality assurance
    - Quality improvement
    - Quality methodologies
    - Quality processes and procedures
- Principles of Quality Management Systems (QMS):
    - Quality management; quality assurance; quality control
    - The role of the United Kingdom Accreditation Service
    - Current HCS accreditation programmes, e.g. Improving Quality in Physiology Services;
- British, European and international standards that govern and affect pathology laboratory practice
- Safety – prioritisation of patient safety in practice
- Safety – team working and patient safety
- Safety – equipment management
- Calibration, action levels
- Infection control
- Equipment life cycle, including specification, procurement commissioning, preventative maintenance, fault finding and repair, calibration, safety testing and decommissioning for equipment relevant to the specialism
- Strategies to improve patient safety
- Critical incident reporting, review and action
- 'Never' events and strategies to reduce them
- Improving quality of life
- Improving quality of the patient experience of healthcare
- Processes for the distribution of documentation, e.g. Department of Health (DH), Central Alerting System (CAS), Medical Device Alerts (MDA)
- Quality, risk and audit
- Regulatory frameworks such as EU directives and Medicines and Healthcare products Regulatory Agency (MHRA) requirements
- Standard operating procedures, guidelines and protocols
- The contribution to the delivery of high-quality healthcare of the:

- HCS workforce
  - HCS student
- HCSP

- Why it is important to monitor and evaluate the quality of practice and the value of contributing to the generation of data for quality assurance and improvement programmes

Communication Skills

- Principles of effective verbal communication
- Principles of effective written communication
- Communication with those who do not have English as a first language
- Communication with people with sensory and cognitive impairments
- When and how to adapt communication methods
- Communication with patients across the age spectrum
- Use of patient leaflets and other appropriate media methods to engage with patients, donors and carers and the public

Leadership

- The concept of leadership and its application to practice
- The NHS Leadership Framework
- Leadership within the NHS, healthcare science, HCS teams and the multiprofessional team

Teaching and Learning

Students should be introduced to key theories of teaching and learning, including teaching and learning practical skills to begin to support their personal development and provide a base for their future career.

Continuing Personal and Professional Development (CPPD)

- The role and importance of CPPD to ensure that their professional knowledge and skills are being kept up to date

ATTITUDES, BEHAVIOURS AND SKILLS

Professional Practice

- Develop and maintain appropriate professional and patient–professional relationships in practice
- Treat patients with compassion and promoting patient wellbeing and self-care
- Work with colleagues, patients and carers in a respectful and non-discriminatory manner

- Provide safe, high-quality care at all times and in all settings
- Consistently bring the highest levels of knowledge and skill at times of basic human need when care and compassion are what matters most
- Create and justify open and non-discriminatory professional working relationships with colleagues, using critical reflection to review personal behaviour and responses to challenging issues
- Develop and maintain appropriate coping mechanisms for a range of potential issues, including stress, and seeking help if appropriate and evaluating the impact of an intervention
- Support and contribute to a culture in which innovation and developments are identified, discussed, evaluated and potentially introduced to improve service delivery
- Recognise and exploit learning opportunities in the workplace
- Acting in accordance with the principles and practice of patient-centred care, regularly reflecting on their personal practice and revising judgements and changing behaviour in the light of new evidence
- Practise as an autonomous professional, applying knowledge appropriately and exercising their own professional judgement within their scope of practice and with support from the team
- Promote professional attitudes and values at all times
- Recognise the need to be truthful and to admit to and learn from errors
- Seek advice in the event of ethical dilemmas, including disclosure and confidentiality
- Accept and comply with the requirements for professional regulation

Legal and Ethical Boundaries of Practice

- Consistently operate in accordance with relevant current NHS policy and practice and recognise the limits of their own competence and scope of practice in order to make safe, informed and reasonable decisions about their practice
- Respond to the ethical, legal and governance requirements arising from working at the level of a HCSP, applying accrued knowledge and evidence
- Recognise the factors influencing ethical decision making, including religion, personal and moral beliefs, and cultural practices, and make informed decisions, taking these into account
- Share 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 occur
- 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
- Recognise the problems posed by disclosure without consent of the patient, in the public interest

- Ensure patients, relatives and carers are aware of the need for appropriate information distribution within members of the immediate healthcare team
- Use appropriate methods of ethical reasoning to justify a decision where complex and conflicting issues are involved, calling on the support of others where needed
- Act in a manner that demonstrates probity in all aspects of professional practice
- Act in accordance with GSP at all times so that their conduct justifies the trust of patients and colleagues and maintains public trust in healthcare science
- Ensure that personal practice is always provided in line with the legal framework, acting with integrity at all times
- Apply appropriately the principles, guidance and laws regarding medical ethics and confidentiality and demonstrating the ability to gain informed consent
- Complete any/all documentation honestly and accurately and sign appropriately
- Apply honesty and accuracy about personal qualifications, experience and position in the scientific community
- Act 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
- Keep records in accordance with current best practice requirements, including accuracy of information recording within patient records and the framework that underpins data security practice in the NHS

Patient Safety and Quality

- Respond in an open, constructive and timely manner to critical incidents or complaints about their own or team performance, influencing the response, and using self-reflection to review personal behaviour and response to challenging issues
- Take appropriate action if it is suspected that they or a colleague may not be fit to practise, always putting patient safety at the forefront of practice
- Practise within the Standards of Proficiency set by the AHCS and for Biomedical Scientists, the HCPC
- Make appropriate judgements to ensure they limit work or stops practising if performance or judgement is affected by their health
- Recognise when personal health takes priority over work pressures, seeking appropriate advice and support, and taking appropriate action
- Co-operate with employers to ensure compliance with health and safety requirements

Leadership

- Recognise the importance of leading by example in setting high standards of personal behaviour, and in acting with openness, candour, fairness and integrity, listening and respecting the views of others.

Continuing Personal and Professional Development (CPPD)

- Contribute to a culture that values CPPD in recognising strengths and identifying areas for improvement and supporting others to do the same
- Continue to develop their own learning and reflective practice by maintaining personal records of CPPD, providing evidence of critical reflection, including action planning, with respect to technical and clinical practice and professional development in a form suitable for audit by a professional body or regulator, and demonstrate continuing fitness to practise
- Apply knowledge, experience and critical reflection to identify personal development needs using a range of tools, and develop and update action plans
- Act as a self-motivated professional HCSP, being willing to learn from self-reflection and others, responding positively to constructive and meaningful feedback
- Record critically reflective notes demonstrating how participation in CPPD has contributed to learning and led to improvements in personal and service performance
- Monitor their own performance by a variety of methods
- Respond constructively to feedback and provide feedback when asked to support personal development and the development of others
- Prioritising and organising academic and work-based tasks in order to optimise their own work and the work of the department

Communication Skills

- Effective verbal communication
- Effective written communication
- Frameworks underpinning communication
- Adapting communication skills
- Giving and receiving feedback including feedback frameworks

Teaching and Learning

- Introduction to how people learn
- Teaching and learning practical skills
- Transforming experience into knowledge and skills by reflection and action and linking this to the skills of feedback (see above) and work-based learning

GM(ii): Scientific Basis of Healthcare Science (Year 1)

Students should be introduced to every subject area described by each learning outcome and associated indicative content to provide a broad foundation of scientific and HCS knowledge on which to build their knowledge, skills and professional practice. Following the broad overview learning should then being developed in the context of individual BSc(Hons) Healthcare Science programme, providing the flexibility to study specific areas in more depth.

1. **Introduction to the organisation of the human body**
    - Structural
    - Chemical
    - Cellular
    - Tissue
    - Skin
    - Cellular, tissue and systems responses to disease:
        - cell death
        - inflammation
        - neoplasia, e.g. carcinoma
        - hypertrophy
        - hyperplasia
        - tissue responses to injury and repair
    - How the body changes from birth to old age
2. **Introduction to the structure and function of body systems: embryology, anatomy, physiology, pathology**
    - Embryology
    - Skeletal system
    - Nervous system:
        - spinal cord and spinal nerves
        - brain and cranial nerves
        - sensory and motor systems
    - Endocrine system
    - Vision, hearing and equilibrium
    - Cardiovascular system, including blood and blood vessels

- Respiratory system
- Lymphatic system
- Immune system
- Gastrointestinal tract, including digestion and absorption of food, nutrition, the liver and liver function tests
- Renal system
- Electrolyte and acid-base balance
- Hormonal mechanisms and control
- Metabolism
- Reproductive system
- Abdomen, pelvis and perineum
- Histology and cytology
- Microbiology, including infection control,
- Treatment regimens, including antibiotics and antibiotic resistance
- Virology
- Biochemistry
- Haematology
- Immunology and histocompatibility

3. Introduction to clinical genetics, genomics and personalised medicine

- Meiosis and Mendelian inheritance
- Nucleic acid structure and function
- Chromosome structure and function
- Nomenclature used to describe the human genome
- Common genetic disorders
- Impact of genetic disorders on the patient and their families
- Genomic technology and role of the genome in the development and treatment of disease
- The role of genomic counselling

4. Introduction to epidemiology and public health

- Local, national and international role of the public health function, e.g. Public Health England and related UK organisations
- Infectious disease services

- International partnership working for control of infection
- Principles of epidemiology
- Basis of health protection:
  - principles of surveillance
  - infectious disease control and emergency planning
- Screening:
  - screening programmes: purpose, design, outcomes
  - screening programmes: typical screening programmes in healthcare science
- Using epidemiological data to plan health services
- Factors affecting the health of the population
- Strategies and methods to improve health
- Factors affecting health and their contribution to inequalities in health between populations
- Changes in population demographics, including ageing

5. Introduction to clinical pharmacology and therapeutics

- Difference between pharmacology, clinical pharmacology, therapeutics and prescribing and medicine management
- Principles of pharmacology, pharmacokinetics and therapeutics:
  - drug names
  - classifications
  - definitions of terms and basic mechanisms
- Role of the pharmacist in primary and secondary care

6. Sociology of health and illness

- Patients' responses to illness and treatment:
  - the impact of psychological and social factors, including culture, age, ethnicity, gender, socioeconomic status and spiritual or religious beliefs, on health and health-related behaviour
- Health belief models
- Diversity of the patient experience
- Disability, including learning disabilities
- Mental health
- Potential health inequalities

- Self-care
- Impact of life-threatening and critical conditions
- Patient involvement in decisions regarding their healthcare

This topic area should include the underpinning theoretical foundations and models, e.g. Health Belief Model, World Health Organization (WHO) model of activity limitation (disability)

7. Introduction to Medical Physics and Clinical Engineering

- Structure of matter (atomic and nuclear models)
- Radiation: nature and its measurement and radiation safety
- Radiation dosimeters – personal dosimetry
- Basic physics and mathematics of image formation
- Imaging Techniques
    - Ultrasound
    - Magnetic Resonance Imaging (MRI)
    - Computerised Tomography (CT)
    - Positron Emission Computed Tomography (PET)
    - Single Photon Emission Computed Tomography (SPECT)
- Basic electricity and magnetism as it relates to the measurement of physiological signals
- Viscous and inertial flow of simple liquids
- Use of radiotherapy

8. Introduction to clinical bioinformatics and health informatics

Clinical bioinformatics brings together the disciplines of computer science, mathematics, statistics and physics/engineering to influence, analyse and inform clinical and biological practice, so helping to maintain patient safety and the integrity and security of data. Students should be introduced to the three specialisms of clinical bioinformatics within healthcare science (genomics, health informatics science and physical sciences) in the context of: (i) innovation, translation and interpretation of complex genomic data, optimising the benefits this brings to patient care, including personalised medicine; (ii) the development and adoption of technology solutions and biomedically motivated methods for the collection, management, movement, analysis and use of health information in line with government legislation to improve the quality and safety of healthcare practice and delivery; and (iii) devices that may have therapeutic, diagnostic, or patient monitoring functions, and they generate ever-increasing amounts of data that contribute to patient management.

Teaching should be tailored to the student group using examples relevant to health and healthcare science.

- Contribution of clinical bioinformatics genomics, health informatics sciences and physical sciences to:
  - patient safety
  - patient care
  - health care
  - healthcare science
- Governance and ethical frameworks
- Storage and sharing of images, Digital Imaging and Communications in Medicine (DICOM)
- Picture Archiving and Communications Systems (PACS)
- Clinical information systems and applications
- Clinical information systems and applications, e.g. Health Level 7 (HL7)
- Database management
- Direct patient access to test results

9. Introduction to mathematical and statistical techniques

- Data interpretation, including the variability of biological data and application of statistics
- Generation of reference ranges and their limitations

10. Introduction to innovation in health and healthcare science

- Identifying, reading and evaluating the literature
- Innovation in the NHS
- Using innovation to improve services
- Scientific and technical developments and their application in healthcare science
- The role of the HCS workforce in innovation

GM(iii): Research Methods (Year 2)

1. Research, innovation and audit

- Process and importance of research, innovation and audit to the NHS and healthcare science
- Role of healthcare science in research, innovation and audit
- NHS Research and Innovation Strategy

- Difference between research, audit and service improvement
- User/patient involvement
- Peer review
- Role of statutory, advisory regulatory bodies and funding bodies, including:
  - National Institute for Health and Care Excellence (NICE)
  - National Institute for Health Research (NIHR)
- Evidence-based practice.
- Clinical guideline development
- Quality assurance frameworks:
  - quality improvement
  - patient care
  - patient safety
  - improved treatments
- The role of the healthcare science workforce in undertaking research and innovation and applying findings.
- Use of research and audit to interpret and apply new knowledge in the NHS and healthcare science

2. Current ethical and legal frameworks

- Good Clinical Practice (GCP)
- Health and safety
- Risk assessment
- Human research
- Animal research
- Innovation
- Audit
- Ethical frameworks, including informed consent
- Legal frameworks
- Confidentiality
- Archiving
- Research governance framework for health and social care research
- Data Protection Act
- Intellectual property regulations

- Informed consent
- Roles and responsibilities of the research team

3. **Principles of literature searching**
   - Evidence-based practice
   - Principles of a literature search
   - Process of literature searching
   - Critical review of literature
   - Systematic review
   - Publication impact factor
   - Reference manager systems
4. **Introduction to study design**
   - Cohort studies
   - Qualitative
   - Quantitative
   - Case control
   - Systematic review
   - Meta-analysis
   - Sampling techniques
   - Clinical trials (pre-clinical to translational)
   - Epidemiological studies
   - Hypothesis generation and testing
   - Clinical trials
5. **Data analysis, statistical techniques and dissemination**
   - Data validity, reliability and appropriateness
   - Application and interpretation of statistical techniques:
     - parametric
     - non-parametric
   - Power calculations/sample size
   - Methods to disseminate research output

- Impact factor
- Scientific poster design
- Writing for scientific journals
- Writing scientific abstracts
- Preparing research presentations for time limited scientific meetings

GM(iv): Research Project (Year 3)

1. **Research in health and healthcare science, including:**
   - Scientific or clinical research
   - Translational research
   - Operational and policy research
   - Clinical education research
   - Innovation, service development
   - Service improvement
   - Supporting professional service users
2. **Ethical and governance approval process**
   - The student must know the ethical approval and governance process required to undertake the proposed project, including initial approval; monitoring; reporting; data storage and archiving

8.2 Division-theme Modules

Scientific Basis of Cardiovascular Respiratory and Sleep Science (Year 1)

Anatomy, physiology and pathophysiology applied to cardiology, vascular, respiratory and sleep sciences

- Cardiac and vascular system
- Respiratory system
- Sleep wake cycle and common sleep disorders
- Pathophysiology of key body systems related to physiological sciences

Application of safe and effective clinical practice in physiological measurement

- Patient pathways
- Basic principles of routine, first-line diagnostic procedures for patients in cardiorespiratory/sleep pathways
- Risk management and adverse incident reporting
- Infection control
- Quality assurance (including IQIPS process)
- Team working
- Partners in the management of disease (patient–professional partnership)
- Patient-centred care
- Role of chaperones
- Disability, including learning disabilities
- Children and adults
- Communication skills

Introduction to cardiac physiology

- Cardiac embryology and fetal heart development and changes that occur at birth
- Basic cardiac electrophysiology
- Recognition and interpretation of normal ECG waveforms
- The cardiac cycle
- Control of the circulation
- Investigations and procedures carried out in the diagnosis and treatment of cardiac disease
- Common abbreviations and units

Introduction to respiratory and sleep physiology

- Anatomy and physiology of the respiratory system
- Anatomy and physiology of central and autonomic nervous systems
- Control of respiration during sleep
- Control of sleep wake cycle
- Pathophysiology of lung diseases
- Pharmacology and therapeutics relating to bronchodilators
- Investigations and procedures carried out in the diagnosis and treatment of respiratory disease and sleep disorders
- Characteristics of equipment and their evaluation

- Calibration and quality control procedures
- Communicable disease and microbiological hazards in the respiratory laboratory
- Methods of sterilisation and disinfection
- Physiological measurement systems in the evaluation of lung function
- Dynamic lung volumes and transfer factors: mechanics and measurement
- Physiological measurement systems used to measure respiration during sleep
- Positive airway pressure systems used to treat respiratory disorders of sleep
- The effects of ageing and hormones (including pregnancy, post-partum and menopause) on sleep
- The effects of technology advances on sleep (light, particularly blue light)
- Calculation of normal ranges
- Common abbreviations and units

Introduction to vascular science

- Investigations and procedures carried out in the diagnosis and treatment of vascular disease
- Characteristics of recording equipment and their evaluation
- Anatomy of the vasculature and blood flow
- Diseases of the vascular system
- Ultrasound and physiological measurement systems in the evaluation of the vascular system
- Common abbreviations and units

Work-based Training Year 1 (10 weeks)

- Observe the work of a range of healthcare science departments, technologies and procedures
- Observe the process for handling work requests from the receipt of the request to completion
- Observe the patient journey from admission to discharge
- Patient-centred care that is respectful of and responsive to individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions
- Gain an understanding of the skills required to work safely in the clinical/laboratory/workshop/radiation environment
- Record keeping, data protection, confidentiality
- Gain an appreciation of how the NHS is structured

- Team working and the role of MDT meetings
- Meaning and role of professionalism and professions in healthcare
- Roles of different professional groupings in healthcare science
- Human and social diversity and its implications for relationships, behaviours and service provision in healthcare
- Types of effective communication in the context of healthcare. Barriers to effective communication and strategies to overcome them
- Interpersonal skills related to dealing with patients, carers and healthcare professionals
- The skills needed to work as part of a team
- Management and evaluation of adverse incidents
- Data management (paper and electronic)
- Infection control
- Basic life support
- Reflective practice and its application

Instrumentation, Signal Processing and Imaging (Year 2)

- Equipment functions and characteristics
- Equipment safety
- Application and choice of equipment
- Amplifier characteristics and functions
- Noise and noise reduction
- Operation, specifications, advantages and limitations of filters
- Fluid flow through tubes: Poiseuille's Law, laminar and turbulent flow, blood flow
- Differentiation of volume and integration of flow signals
- Digitisation of signals
- Computer acquisition, storage and analysis of physiological signals
- Techniques underpinning:
  - volume and flow measuring devices used to measure dynamic lung volumes and flows and static lung volumes
  - respiratory gas analysis
  - pulse oximetry

- positive airway pressure therapy
- airflow, pulse oximetry, respiratory effort, body position, sound during sleep
- electrocardiography
- blood pressure measurement
- imaging techniques including ultrasound, X-ray, computerised tomography (CT), magnetic resonance imaging (MRI), isotopes

- Hazards and safe of use of imaging techniques

Pathophysiology of Common Cardiovascular, Respiratory and Sleep Conditions (Year 2)

Cellular, tissue and systems response to common cardiac, vascular and respiratory diseases and sleep conditions, including:

- Tissue response to injury
- Cell death
- Inflammation
- Neoplasia
- Normal and abnormal immune responses
- Atheroma
- Thrombosis
- Embolism
- Infarction
- Anatomical airway obstruction
- Fibrosis
- Emphysema
- Hypoxaemia
- Hypercapnia
- Genetic mutations
- The effect of the ageing process

Basis of common infections affecting the cardiac, vascular and respiratory systems

Common diseases of the cardiac, vascular and respiratory systems and disorders of sleep, including the epidemiology, public health and psychosocial aspects, including:

Cardiac disease

- Ischaemic heart disease and myocardial infarction
- Acquired valvular disease
- Hypertensive heart disease
- Cardiomyopathy
- Autonomic disorders

Vascular disease

- Peripheral arterial disease
- Venous disease
- Cerebrovascular disease

Respiratory diseases

- Obstructive lung diseases:
  - chronic obstructive pulmonary disease (COPD)
  - asthma
- Restrictive patterns
  - fibrotic lung disease
  - mechanical restriction (chest wall, obesity, muscle weakness)
- Congenital lung conditions
- Pneumonia
- Lung cancer
- Pulmonary vascular disorders
- Cystic fibrosis
- Bronchiectasis

Disorders of sleep

- Obstructive sleep apnoea
- Central sleep apnoea
- Obesity hypoventilation syndrome

- Insomnia
- Periodic limb movement in sleep (PLMS)

Genomic medicine and cardiovascular/respiratory disorders, for example:

Cardiac disease
- Hypercholesterolaemia
- Cardiomyopathies
- Inherited arrhythmias

Vascular disease
- Thoracic aortic aneurysm and dissection

Respiratory disease
- Alpha 1 anti-trypsin deficiency in COPD

This module will also consider: (i) the impact of cardiovascular, respiratory and sleep conditions on patients, carers and families; (ii) the impact of smoking and obesity, on health; (iii) introduce the common risk factors for cardiovascular, respiratory disease and sleep disorders and how to support patients to take responsibility for their health and self-manage; and (iv) introduce the concept of risk assessment.

8.3 Cardiac Physiology (Years 2 and 3)

Cardiac Physiology (Year 2)

In this module students will build on Year 1 learning and begin detailed learning that underpins routine practical techniques.

- Clinical electrocardiography
  - Characteristics of recording equipment
  - Components and functions
  - Settings and adjustments made based on patient category
  - Recommended recording and measurement technique
- Development of a framework for interpretation of electrocardiograms
  - The normal electrocardiogram from birth to old age

        - Anatomy
        - Physiology
        - Leads
        - Rate
        - Rhythm
        - Cardiac axis
        - Terminology
        - Normal findings (sinus rhythms)
- Recognition of life threatening arrhythmias
    - Ventricular fibrillation
    - Asystole
    - Ventricular tachycardia
- Recognition of common arrhythmias
    - Sinus arrhythmia
    - Sinus bradycardia
    - Sinus tachycardia
    - Atrial fibrillation
    - Atrial flutter
    - Atrial ectopics
    - Atrioventricular conduction blocks
    - Supraventricular tachycardia (atrial tachycardia, atrio-ventricular nodal re-entrant tachycardia (AVNRT), atrio-ventricular re-entrant tachycardia (AVRT))
    - Ventricular arrhythmias
- The effect of myocardial infarction and ischaemia on the electrocardiogram
- Conditions affecting the left side of the heart
    - Left atrial abnormalities
    - Left ventricular hypertrophy
- Conditions affecting the right side of the heart
    - Right atrial enlargement
    - Right ventricular hypertrophy
- Conditions not primarily affecting the heart

    - Hyperkalaemia
    - Hypokalaemia
    - Thyrotoxicosis
    - Hyperthyroidism
    - Hypocalcaemia
- Conduction defects
    - Bundle branch blocks
    - Fascicular blocks
- Miscellaneous abnormalities
    - Long QT syndrome
    - Brugada syndrome
    - Digoxin effect and toxicity
    - Cardiomyopathies
    - Pulmonary embolism
    - Neurological/neuromuscular disorders
    - Pericarditis
    - Myocarditis
- Routine blood pressure measurement
    - Principles, measurement methods and limitations of a range of recording equipment used to measure blood pressure
        - Analogue and digital devices
        - Device calibration
        - Selection of cuff size
    - Current British Hypertension Society guidelines for blood pressure measurement
    - Indications for blood pressure measurement
    - Factors affecting blood pressure, including blood pressure variability and white coat hypertension
    - Recommended measurement technique
    - Common errors in blood pressure measurement
        - Observer
        - Equipment
        - Patient
        - Cardiac arrhythmias

    - Normal blood pressure ranges
    - Definition of hypertension
- Ambulatory blood pressure monitoring
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Recommended measurement technique
    - Normal ranges
    - Common problems
    - Analysis, presentation and evaluation of results
- Ambulatory electrocardiography
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - The effect of exercise on the circulatory system
    - Recommended measurement technique
    - Common problems
    - Analysis, presentation and evaluation of results
- Cardiac exercise stress testing
    - Characteristics of recording equipment
    - Current NICE guidance relating to cardiac exercise stress testing
    - Indications, contraindications and end points
    - Recommended measurement technique
    - Common problems
    - Protocols, e.g. Bruce
    - The effect of exercise on the heart, lungs and circulation
    - Electrocardiographic findings in ischaemic heart disease
    - Cardiac arrhythmias and exercise
    - Differential diagnosis of cardiac and non-cardiac outcomes
- Communication skills and team working

Applying Cardiac Physiology to Practice (Year 3)

Patient-centred care

- Communication skills
- Consent
- Confidentiality
- Disability, including learning disabilities
- Care pathways for patients with cardiovascular disease

Physiology, pathophysiology and pharmacology related to provocative electrocardiography, pacing and cardiac catheterisation

- Acquired heart disease and its effect on the heart and circulation
- Heart failure and its effect on the heart and circulation
- Cardiac drugs: effects, functions and application
- Changes to invasive measurement and interventions associated with heart disease
- Basic overview of congenital heart disease
    - Common abnormalities, which may include
        - Atrial septal defects
        - Ventricular septal defects
        - Patent ductus arteriosus
        - Coarctation of the aorta
        - Tetralogy of Fallot

Practice and principles of provocative testing

- Functional imaging (ECG/BP monitoring aspects)
- Head-up tilt testing
- Valsalva manoeuvre

Principles and practice of invasive pressure measurement and cardiac interventions

- Principles and practice of invasive pressure measurement and percutaneous coronary intervention
- Equipment and set-up
- Operation of equipment and safe use

- Catheter use and design
- Identification and measurement of intracardiac and aortic pressures (normal and abnormal)

Principles and application of management of bradycardia

- Fundamental electrical concepts applied to pacemaker theory (e.g. electricity, voltage, current, impedance)
- Components of a pacing system
- Indications and contraindications for bradycardia device implantation
- Implantation techniques and asepsis
- Basic pacemaker functions (pacing/sensing)
- Bradycardia pacing modes
- Simple electrocardiographic troubleshooting
- Undertake post-implant checks – lead impedance, P/R wave measurements and pacing thresholds
    - Recognition of post-implant pacemaker-related problems that require immediate rectification (e.g. dislodged lead)

Basic principles and practice of:

- Echocardiography

An overview to cover

- Basic scientific principles
- Role of echo in disease management
- Strengths and weaknesses, including in relation to complementary and alternative techniques

- Cardiac rhythm management

This module will also build on earlier work to develop the themes of public health and epidemiology of cardiovascular disease, risk factors, risk assessment and primary prevention, including behavioural change management.

Cardiac Physiology Work-based Training (Years 2 and 3)

Students are expected to gain knowledge, skills and experience of routine cardiology investigations across the range of conditions referred for investigation.

Common content across investigations

- Indications and contraindications for testing
- Health and safety, including safe handling of reagents
- Graphical representation of results and interpretation
- Safe decontamination of equipment
- Quality standards, control and assurance for all activities
- Care pathways for patients with cardiovascular disease

Investigations

- Electrocardiography, including recognition and interpretation of abnormal findings across a range of patients
- Blood pressure measurement
- Immediate life support
- Ambulatory electrocardiography
- Ambulatory blood pressure monitoring
- Assisting in cardiac exercise stress testing
- Haemodynamic monitoring during coronary angiography and percutaneous coronary intervention (PCI) procedures
- Providing technical assistance during implantation of simple pacemaker systems for the treatment of bradycardia
- How to undertake post-implant checks – lead impedance, P/R wave measurements and pacing thresholds

8.4 Specialist Respiratory and Sleep Physiology (Year 2 and 3)

Respiratory and Sleep Physiology (Year 2)

- Pathophysiological changes that occur with common lung diseases, including:
  - Chronic obstructive pulmonary disease
  - Asthma
  - Restrictive lung disease due to fibrotic lung disease
  - Pulmonary vascular disease
  - Congenital and genetic lung conditions
  - Respiratory muscle disorders
  - Occupational lung disease
  - Lung cancer

    - Cystic fibrosis
    - Brochiectasis
- Pathophysiological changes that occur with common respiratory-related sleep disorders, including:
    - Obstructive sleep apnoea
    - Central sleep apnoea
    - Obesity hypoventilation syndrome
- The role of respiratory mechanics in control of breathing
- Effect of neuromuscular disease on the respiratory system

Assessment of lung function

- Techniques used in the assessment of lung function
- Reference ranges
    - Uses
    - Limitations
    - Age related variations
- Reporting systems
- Static lung volumes
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Recommended measurement technique
    - Calculations
    - Cleaning procedures
    - Common problems
    - Normal values and interpretation of results
- Dynamic lung volumes and flow
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Recommended measurement technique
    - Calculations
    - Cleaning procedures

    - Common problems
    - Normal values and interpretation of results
- Reversibility testing
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Commonly used short- and long-acting bronchodilators and inhaled steroids
    - Recommended measurement technique
    - Calculations
    - Common problems
    - Normal values and interpretation of results
- Measurement of gas transfer
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Recommended calibration and measurement technique
    - Calculations
    - Cleaning procedures
    - Common problems
    - Normal values and interpretation of results
- Spot check pulse oximetry
    - Characteristics of recording equipment
    - Indications
    - Contraindications
    - Recommended measurement technique
    - Common problems
    - Normal values and interpretation of results

Basic assessment of sleep and respiration during sleep

- Overnight pulse oximetry
    - Characteristics of recording equipment
    - Indications/contraindications

- Recommended measurement technique
- Common problems
- Normal values and interpretation of results.
- Sleep apnoea

Treatment of respiratory disorders of sleep

- Positive airway pressure machines
  - Function/types/modalities
  - Cleaning and filter changing
  - Mask/interface types
  - Indications/contraindications
  - Side effects/troubleshooting
  - Patient education

Applying Respiratory and Sleep Physiology to Practice (Year 3)

Patient-centred care

- Communication skills
- Consent
- Confidentiality
- Disability, including learning disabilities
- Care pathways for patients with respiratory disease
- Problems associated with care

Human development from birth to adulthood with respect to the respiratory system and its impact on measured values

- Overview of respiratory system development and maturation
- Appreciation of variation in lung function parameters across age range

Methods available for assessing respiratory function in children ≥ 8 years

- Differences in approach between paediatric and adult lung function testing
- Importance of establishing successful rapport
- Appreciation of adjustment to technique for paediatric testing, for example reduction in number of repeat tests due to tiring; altered reproducibility criteria

- Awareness of potential unreliable results/inability to accurately reproduce findings (e.g. potential for confusion between inhaling and blowing technique)
- Paediatric reference values

Blood gas analysis

- Physiological processes that contribute to the maintenance of normal blood gases
- Gas exchange
- Gas transport
- Acid-base balance and blood gases
- Normal values

Respiratory muscle assessment

- Anatomy of respiratory muscles: inspiratory and expiratory muscles
- Pressure changes and pressure volume changes during ventilation
- Airway resistance and work of breathing
- Mouth and sniff pressures
- Supine and sitting vital capacity (SVC)

Challenge testing

- Methods for assessing airway reactivity
- Indications and contraindications for testing
- Safety precautions and safe handling of reagents
- Presentation of results
- Skin allergy testing

Use of field exercise in the assessment of breathlessness and disease severity

- Indications/contraindications for performing field exercise tests
- Indications to terminate the procedure
- 6 minute and 12 minute walking tests
- Incremental and endurance shuttle walking tests
- Assessment of desaturation during exercise
- Assessment of supplementary oxygen requirements
- Objective measures of exercise tolerance

- Use of measurements of symptoms (Borg scale, visual analogue scale, rating perceived exertion) and pulse oximetry

Principles and application of limited multi-channel sleep studies, including technical, clinical and physiological issues

- Sleep physiology
- Sleep pathophysiology
- Overnight oximetry
- Epworth sleepiness scale
- Objective measurements of sleepiness and vigilance
- Indications for positive airways pressure therapy

Role of lifestyle factors, co-morbidities and pharmacology on disorders of sleep

- Lung function and sleep
- Airflow and respiratory effort in sleep
- Obstructive sleep apnoea
- Effects of shift work and jet lag on diurnal rhythm
- Driver and Vehicle Licensing Agency (DVLA) regulations

Role of emerging technology

- Remote monitoring and its effects on patient care and pathways

Justify the value of clinical audit in optimising services and improving patient safety

- Quality standards, control and assurance for all activities

Debate the importance of patient-centred care and discuss the needs of people with disabilities within this care pathway

- Care pathways for patients with respiratory and sleep-related disease

Respiratory Physiology Work-based Training (Years 2 and 3)

Students are expected to gain knowledge, skills and experience of routine respiratory and sleep investigations across the range of conditions referred for investigation.

Common content across investigations

- Indications/justification and contraindications for testing
- Health and safety, including safe handling of reagents

- Graphical representation of results and interpretation
- Safe decontamination of equipment
- Quality standards, control and assurance for all activities
- Care pathways for patients with diseases of the respiratory system and sleep disorders

Conditions

- Breathlessness (physiology and patient perception)
- Obstructive, restrictive and mixed respiratory disorders
- Sleepiness
- Obstructive, central and mixed apneas affecting respiration during sleep

Investigations/Procedures

- Dynamic and static lung volumes
- Assessment of gas transfer
- Assessment and response to bronchodilator therapy
- Blood gas analysis
- Pulse oximetry
- Overnight pulse oximetry
- Positive airway pressure therapy
- Physiological changes – symptomatic responses
- Measurements of sleepiness (subjective/objective)

SECTION 9: WORK-BASED SYLLABUS: CARDIOVASCULAR, RESPIRATORY AND SLEEP SCIENCES

*This section describes the Learning Frameworks for the **Generic and Theme Components** of work-based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence, and Applied Knowledge and Understanding*

DIVISION	Physiological Sciences
THEME	**Cardiovascular, Respiratory and Sleep Sciences**
SPECIALISM	Cardiac Physiology
SPECIALISM	Respiratory and Sleep Physiology

Students are expected to spend 10 weeks in Year 1 undertaking work-based learning in the workplace, which should be split equally between Cardiac Physiology and Respiratory/Sleep Physiology.

9.1 Generic Introduction to Work-based Learning

MODULE	Generic Introduction to Work-based Learning	Component	Generic Year 1
AIM	The aim of this module is to introduce the student to the workplace and enable them to apply and contextualise the knowledge and skills they have gained in the module 'Scientific Basis of Healthcare Science' and the Year 1 modules in each healthcare science theme. Students will be expected to perform some routine skills and develop and build their professional practice in accordance with *Good Scientific Practice*.		
SCOPE	On completion of this module the student will be able to perform basic life support and infection control techniques and use effective communication skills in the context of patient-centred care and recognising the role of the specialism in patient care. They will also be expected to adhere to health and safety procedures and work safely in the workplace adhering to the trust procedures and governance, including patient confidentiality and the Data Protection Act.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Perform a range of generic skills, including infection control, basic life support, communication and team working, adhering to health and safety regulations, and behaving in a professional manner in accordance with *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe how staff in the workplace communicate with patients and reflect on the importance of effective communication in the workplace with respect to patient-centred compassionate care.
- Shadow a qualified HCSP and discuss the role of the practitioner in Cardiovascular, Respiratory and Sleep Sciences and their contribution to healthcare and multiprofessional teams.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Control infection risks in accordance with departmental protocols, always washing hands in accordance with the six-stage hand-washing technique when necessary.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1	Perform basic life support in accordance with current Resuscitation Council (UK) guidelines.	• Current Resuscitation Council (UK) guidelines.
1	Use effective communication skills within the healthcare environment.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • Patient-centred care and the importance of informed consent and involving patients in decisions about their healthcare. • Importance of ensuring the patient is aware of the role of the member of the HCS workforce. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1	Adhere to safe working practice in the workplace.	• The relevant health and safety regulations specific to the workplace and investigations undertaken, the potential hazards and risks, and the actions to be taken to minimise these.
1	Work professionally in the workplace at all times.	• *Good Scientific Practice*.

9.2 Cardiovascular, Respiratory and Sleep Sciences

MODULE	Introduction to Cardiovascular Sciences	Component	Year 1 Division-Theme
AIM	This module will provide a foundation from which students will build their knowledge, skills, experience and attitudes throughout the three-year programme of study, and enable them to transfer these skills to employment in healthcare science. It is expected that this period of initial work-based training will provide the opportunity to apply their learning from the module 'Scientific Basis of Cardiovascular, Respiratory and Sleep Science' and 'Professional Practice' and begin to integrate and embed many of the professional practice learning outcomes and enable students to practise safely in the workplace.		
SCOPE	This module will enable students to gain skills and experience of cardiovascular physiology through introduction to the range of cardiovascular services provided in the specialisms and the interaction with patients and patient-centred practice. On completion of this module the student will be able to perform some routine investigations in adult patients, specifically electrocardiography (ECG) and resting blood pressure measurement (BP), and will also apply knowledge and develop and build their professional practice safely.		

LEARNING OUTCOMES

On successful completion of this module, in routine adult patients, the student will:

1. Perform, under direct supervision, a routine 12-lead electrocardiogram in accordance with local health and safety regulations.
2. Measure blood pressure using an automatic device.
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- With permission and in the context of cardiovascular physiology, observe a patient journey from admission to discharge and reflect on the positive aspects of that journey and identify where improvements could be made.
- Observe the range of non-invasive and invasive tests/procedures undertaken in the department and the process of informed consent and identify examples of good practice with respect to professionalism and patient-centred care.
- Observe the work of the HCS workforce and how it contributes to the patient pathways relevant to cardiac physiology and discuss this with your training officer.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control infection risks in accordance with departmental protocols when performing routine ECG and office BP measurement.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1, 2	Minimise risks and hazards in compliance with health and safety policies when performing routine ECG and BP measurement.	• The relevant health and safety regulations specific to ECG and BP measurement, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1, 2	Obtain a suitably completed request form, greet the patient and check patient ID for routine ECG and office BP measurement.	• Referral routes for cardiac diagnostic investigations. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1, 2	Prepare the environment, set up and calibrate equipment ready for use for routine ECG and office BP measurement, including, if appropriate, resuscitation equipment.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
1, 2	Evaluate the technical quality of the ECG recording and BP measurements.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1, 2	Treat the patient in a way that respects their dignity, rights, privacy and confidentiality while undertaking routine ECG and office BP measurement.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Perform, under direct supervision, a routine ECG in accordance with local health and safety regulations.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • How a trained member of staff explains the procedure to the patient and gains informed consent. • Standard operating procedure (SOP). • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Identify electrode sites on the patient according to current American Heart Association/Society for Cardiological Science and Technology guidelines.	• How to identify electrode sites in line with current Society for Cardiological Science and Technology/American Heart Association guidelines to achieve optimum ECG waveform.
1	Prepare the patient's skin to ensure adequate electrode contact and apply suitable electrodes firmly to the patient to minimise artefact.	• How to prepare the patient's skin for electrode placement. • Correct placement and positioning of electrodes to minimise artefact.
1	Make an ECG recording ensuring that an accurate, artefact-free tracing is obtained, modifying the procedure if a suitable recording cannot be made and re-record if necessary.	• Selection of machine settings to meet needs of referral/request. • Correct operation of ECG equipment. • How to monitor recording and make adjustments to maximise results. • Routine maintenance and calibration procedures. • Choice of machine settings appropriate to the ECG recording requested/required. • Identification and rectification of equipment faults/defects. • How to check and annotate recordings to ensure accuracy, completeness, legibility and suitability for analysis and reporting.
1	Measure ECG amplitudes and intervals and recognise a normal ECG.	• Derivation of the ECG and the relationship between the ECG and the cardiac cycle. • Normal ECG findings and variations related to patient age, gender, activity and ethnic origin. • Effect of exercise on the normal ECG.
2	Under supervision measure the resting BP using an automatic device.	• British Hypertension Society guidelines for blood pressure measurement. • Importance of cuff size.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Difficulties that may be encountered in obtaining an accurate BP measurement and relevant remedial actions. • How to check and confirm results. • Normal range for systolic and diastolic blood pressure. • White coat hypertension. • When to refer results to a senior colleague for further action. • Routine maintenance and calibration procedures.
3	Reflect on your practice during this period of work-based training and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.

MODULE	Introduction to Respiratory and Sleep Sciences	Component	Year 1 Division-Theme
AIM	This module will provide a foundation from which students will build their knowledge, skills, experience and attitudes throughout the three-year programme of study and enable them to transfer these skills to employment in healthcare science. It is expected that this period of initial work-based training will provide the opportunity to apply their learning from the modules 'Scientific Basis of Cardiovascular, Respiratory and Sleep Science' and 'Professional Practice' and begin to integrate and embed many of the professional practice learning outcomes and enable students to practise safely in the workplace.		
SCOPE	This module will enable students to gain skills and experience of respiratory and sleep physiology through introduction to the range of respiratory and sleep services provided in the specialisms and the interaction with patients and patient-centred practice. On completion of this module the student will be able to perform some routine investigations in patients,* specifically spirometry and oxygen saturation (SpO_2). Students will also apply knowledge and develop and build their professional practice safely.		

LEARNING OUTCOMES

On successful completion of this module, in routine patients, the student will:

1. Perform spirometry as part of a routine investigation.
2. Measure spot oxygen saturation (SpO_2).
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

**Students who complete the specialist Respiratory and Sleep Science modules in a paediatric environment will be expected to gain experience and achieve the competences in adults in this Year 1 module.*

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe the inpatient care and treatment of patients on a ward for patients with respiratory disease and reflect on the positive examples of patient-centred care and where improvements could be made.
- Observe the range of non-invasive and invasive tests/procedures undertaken in the department and the process of informed consent, and identify examples of good practice with respect to professionalism and patient-centred care.
- Observe the work of the HCS workforce and how it contributes to the patient pathways relevant to respiratory and sleep sciences and discuss this with your training officer.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control infection risks in accordance with departmental protocols for spirometry and SpO_2 measurement.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1, 2	Minimise risks and hazards in compliance with health and safety policies when undertaking spirometry and SpO_2 measurement.	• The relevant health and safety regulations specific to spirometry and oxygen saturation measurement, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when undertaking spirometry and SpO_2 measurement.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1, 2	Obtain a suitably completed request form, greet the patient and check patient ID when undertaking spirometry and spot SpO_2 measurement.	• Referral routes for respiratory physiology diagnostic investigations. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1, 2	Prepare the environment, set up and calibrate equipment ready for spirometry and SpO_2 measurement.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
1, 2	Evaluate the technical quality of recordings/measurements for spirometry and SpO_2 measurement.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1, 2	Treat the patient in a way that respects their dignity, rights, privacy and confidentiality when undertaking spirometry and SpO_2 measurement.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Make height, weight and other appropriate measurements in accordance with standardised procedures, adapting them where necessary, for patients referred for spirometry and SpO_2 measurement.	• Importance of accurate measurement of height and weight. • Measurements that may be required pre investigation, such as height and weight.
1	Perform spirometry as part of a routine investigation.	• SOPs. • Identification and correction of errors in patient technique. • Need to provide reassurance to the patient. • Time required to recover between or from the test and potential variation

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		between patients. • The relevance of investigations to referral request and differential diagnosis. • The importance of supporting patients during the test to work with patient capabilities. • How to distinguish between poor patient performance, technical faults and deterioration in clinical status. • Reasons to stop the test to maintain the safety of the patient.
2	Obtain accurate measurements of spot SpO_2 and pulse rate in accordance with recommended procedures and patient's clinical condition.	• SOPs. • Reasons for measuring spot SpO_2 and relevance to a range of patient conditions. • Correct preparation for overnight pulse oximetry, including information needs of patients and carers. • Requirements for monitoring and recording results. • How to distinguish between technical faults or deterioration in clinical status.
4	Reflect on your practice during this period of work-based training and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.

SECTION 10: WORK-BASED SYLLABUS: CARDIAC SCIENCE

*This section describes the Learning Framework for the **Specialist Component** of work-based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence, and Applied Knowledge and Understanding.*

DIVISION	Physiological Sciences
THEME	Cardiovascular, Respiratory and Sleep Sciences
SPECIALISM	**Cardiac Physiology**

MODULE	Electrocardiography	Component	Specialist Year 2
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and performs and interprets the results from electrocardiography. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to competently perform routine electrocardiography, recognise the normal ECG and a range of common abnormalities. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Record the resting ECG on patients in a range of clinical settings, including adults and children.
2. Interpret the resting ECG.
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice.*

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning electrocardiography.
- Observe the care pathway for acute chest pain and discuss with your supervisor the role of electrocardiography in myocardial infarction or suspected angina.
- Prepare a portfolio containing ECG recordings (anonymised) from a series of patients from whom you have obtained recordings, demonstrating the normal and abnormal ECG changes, and your report on each ECG.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Control infection risks in accordance with departmental protocols when undertaking electrocardiography.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1	Minimise risks and hazards in compliance with health and safety policies when undertaking electrocardiography.	• The relevant health and safety regulations specific to the ECG, the potential hazards and risks and the actions to be taken to minimise these.
1	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when undertaking electrocardiography.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1	Obtain a suitably completed request form, greet the patient and check patient ID when undertaking electrocardiography.	• Referral routes for ECG. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1	Prepare the environment, set up and calibrate equipment ready for electrocardiography.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
1	Evaluate the technical quality of ECG recordings, identify suboptimal recordings and re-record/measure where necessary, knowing when to refer to senior colleagues.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1	Treat patients referred for ECG in a way that respects their dignity, rights, privacy and confidentiality.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Explain electrocardiography to the patient and gain informed consent.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Identify electrode sites on the patient according to current American Heart Association/Society for Cardiological Science and Technology guidelines.	• How to identify electrode sites in line with current Society for Cardiological Science and Technology/American Heart Association guidelines to achieve optimum ECG waveform.
1	Prepare the patient's skin in order to ensure adequate electrode contact and apply suitable electrodes firmly to the patient to minimise artefact.	• How to prepare the patient's skin for electrode placement. • Correct placement and positioning of electrodes to minimise artefact.
1	Make ECG recordings in a range of patients, including adults and children, ensuring that an accurate, artefact-free tracing is obtained, modifying the procedure (in accordance with national guidance), if a suitable recording cannot be made and re-record if necessary.	• Selection of machine settings to meet needs of referral/request. • Correct operation of ECG equipment. • How to monitor recording and make adjustments to maximise results. • Routine maintenance and calibration procedures. • Choice of machine settings appropriate to the ECG recording requested/required. • Identification and rectification of equipment faults/defects. • How to check and annotate recordings to ensure accuracy, completeness, legibility and suitability for analysis and reporting.
2	Measure ECG amplitudes and intervals and recognise a normal ECG.	• Derivation of the ECG and the relationship between the ECG and the cardiac cycle. • Normal ECG findings and variations related to patient age, gender, activity and ethnic origin. • Effect of exercise on the normal ECG.
2	Identify life-threatening/serious atrial and ventricular arrhythmias.	• Life-threatening/serious ECG changes and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes	• ECG changes associated with myocardial ischaemia and infarction and

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	associated with myocardial ischaemia and infarction.	their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with sinus arrhythmia.	• ECG changes associated with sinus arrhythmia and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with atrial enlargement.	• ECG changes associated with atrial enlargement and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with ventricular hypertrophy.	• ECG changes associated with ventricular hypertrophy and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with electrolytic imbalances.	• ECG changes associated with electrolytic imbalances and their relationship to cardiac physiology.
2	Identify the ECG changes associated with endocrine disorders.	• ECG changes associated with endocrine disorders and their relationship to anatomy, physiology and pathology.
2	Identify the ECG changes associated with bundle branch block.	• ECG changes associated with bundle branch block and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with fasicular-blocks.	• ECG changes associated with fascicular-blocks and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with atrio-ventricular block.	• ECG changes associated with atrio-ventricular block and their relationship to cardiac anatomy, physiology and pathology.
2	Identify the ECG changes associated with junctional rhythms.	• ECG changes associated with junctional rhythms and their relationship to cardiac anatomy, physiology and pathology.
1	Undertake routine maintenance and calibration procedures for ECG machines.	• Routine maintenance and calibration procedures.
1	Clean ECG equipment in	• Routine maintenance and calibration procedures.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	accordance with departmental protocol.	
1	Keep accurate records in accordance with current guidelines and the legal framework for data security.	• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines, and the legal framework for data security.
3	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
3	Comply with relevant guidance and laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	• Principles, guidance and law with respect to: ○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
3	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Resting and Ambulatory Blood Pressure Measurement	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and routine non-invasive investigations, performing the measurement of resting BP and fitting and removing ambulatory BP monitors. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to competently perform office and ambulatory BP measurement. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Measure resting BP on a range of patients, using analogue and digital equipment.
2. Fit and remove ambulatory BP devices and produce clinical data in an appropriate format.
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning at least one of the routine investigations and one treatment plan.
- Attend a clinic (primary or secondary care) where patients with hypertension attend and discuss with your supervisor the role of office, home and ambulatory BP measurement in the diagnosis and treatment of patients with hypertension.
- Review the pharmacological treatment of a series of patients with treated hypertension and discuss the mechanisms of action of each treatment, indications, contraindications and potential side effects.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control infection risks in accordance with departmental protocols when measuring BP.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1, 2	Minimise risks and hazards in compliance with health and safety policies when measuring BP.	• The relevant health and safety regulations specific to office and ambulatory BP measurement, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when measuring BP.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1, 2	Obtain a suitably completed request form, greet the patient and check patient ID when measuring BP.	• Referral routes for cardiac diagnostic investigations. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1, 2	Prepare the environment for office and ambulatory BP measurement, set up and calibrate equipment ready for use for each type of investigation, including, if appropriate, resuscitation	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	equipment.	in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
1, 2	Evaluate the technical quality of BP recordings/measurements, identify suboptimal recordings/measurements and re-record/measure where necessary, knowing when to refer to senior colleagues.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1, 2	Treat the patient in a way that respects their dignity, rights, privacy and confidentiality when measuring BP.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient, ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1, 2	Explain the procedure for BP measurement to the patient and gain informed consent.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Principles, guidance and law with respect to informed consent.
1	Measure the resting BP manually and identify any abnormalities or concerns, correcting any difficulties in obtaining an accurate BP measurement, taking remedial action and re-measuring if necessary, and consult senior staff if necessary.	• How to correct any difficulties in obtaining an accurate BP measurement. • British Hypertension Society guidelines for blood pressure measurement. • Importance of cuff size. • Location of pulse in the cubital fossa. • The correct use of palpation to estimate systolic BP. • Correct inflation of the cuff to at least 30 mmHg above the estimated BP. • Correct rate of pressure reduction to maximise results.
2	Measure 24-hour ambulatory BP, programming the BP recorder appropriately for each patient.	• SOP for ambulatory BP monitoring. • Pharmacological treatment of hypertension. • Non-pharmacological treatment of hypertension. • Choice of programmes/settings for ambulatory BP recording. • Normal ranges for ambulatory BP and home BP. • Identification of white coat hypertension. • The information needs of patients following ambulatory BP monitoring. • Routine maintenance and calibration procedures.
2	Identify the site for the placement of the microphone (where applicable) and choose and apply the correct size of cuff.	• Correct sites for microphone placement and/or positioning of the cuff.
2	Measure baseline BP and complete the fitting of the recorder.	• British Hypertension Society guidelines for blood pressure measurement.
2	Review the device instructions with the patient, including safety advice and completion of the diary,	• Verbal communication skills. • Safety issues with respect to 24-hour ambulatory BP monitoring. • How to complete the patient diary.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	arrange follow-up appointment.	
2	Remove ambulatory monitoring equipment.	• Verbal communication skills. • Process following 24-hour ambulatory BP monitoring. • Correct removal of ambulatory devices. • Requirements for cleaning devices in compliance with infection control. • The information needs of patients following ambulatory monitoring.
2	Download the patient's BP data and produce the results in the appropriate format, presenting the results in a format in line with local policy.	• Normal 24-hour BP ranges. • Presentation and reporting formats.
1, 2	Undertake routine maintenance and calibration procedures for BP measurement.	• Routine maintenance and calibration procedures.
1, 2	Clean BP measurement equipment in accordance with departmental protocol.	• Routine maintenance and calibration procedures.
1, 2	Keep accurate records in accordance with current guidelines and the legal framework for data security.	• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines and the legal framework for data security.
3	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		performance.
3	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• Identify and evaluate the potential role for new and innovative technologies and scientific advances.
3	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising and how they can enhance personal effectiveness.
3	Comply with relevant guidance and laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	• Principles, guidance and law with respect to: ○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
3	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Ambulatory ECG Monitoring	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and performs and analyses ambulatory ECG monitoring. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to competently perform and analyse ambulatory ECG monitoring. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Fit and remove ambulatory ECG devices.
2. Analyse routine ambulatory ECG recording (excluding pacing, inherited disease and paediatrics).
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning the use of ambulatory ECG monitoring.
- Attend outpatient clinics where patients with suspected cardiac arrhythmias are referred and discuss with your supervisor the diagnostic pathways linked to the use of ambulatory ECG monitoring.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Control infection risks in accordance with departmental protocols when undertaking ambulatory ECG monitoring.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1	Minimise risks and hazards in compliance with health and safety policies when undertaking ambulatory ECG monitoring.	• The relevant health and safety regulations specific to ambulatory ECG monitoring, the potential hazards and risks and the actions to, be taken to minimise these.
1, 2	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when undertaking ambulatory ECG monitoring.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1	Obtain a suitably completed request form, greet the patient and check patient ID when undertaking ambulatory ECG monitoring.	• Referral routes for cardiac diagnostic investigations. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1	Prepare the environment, set up and calibrate equipment ready for ambulatory ECG monitoring.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
2	Evaluate the technical quality of ambulatory ECG recordings, identify suboptimal recordings and re-record where necessary, knowing when to refer to senior colleagues.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1	Treat the patient in a way that respects their dignity, rights, privacy and confidentiality when undertaking ambulatory ECG monitoring.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient, ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Explain the procedure to the patient and gain informed consent for ambulatory ECG monitoring.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.
1	Fit ambulatory ECG monitoring	• SOP for ambulatory ECG monitoring.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	equipment, explaining the procedure to the patient and checking the patient's understanding.	• Factors influencing selection of correct ambulatory monitoring devices. • Correct preparation of ambulatory ECG recording equipment, including recorder and choice of the most appropriate electrodes for the ambulatory ECG monitoring. • Requirements for preparation of patient's skin for electrode placement and how to instruct a patient for self-positioning.
1	Choose the appropriate electrodes and optimal electrode position for ambulatory ECG monitoring, and either prepare the patient's skin and apply electrodes, or instruct the patient on how to prepare their skin and apply the electrodes.	• Correct positioning of electrodes on patient's skin. • How to activate ambulatory devices. • Information needs of patients fitted with ambulatory devices, including pre-test, fitting, use, activation, deactivation, diary, cleaning and removal. • Factors influencing the quality of results from ambulatory recordings, including minimisation of artefacts.
1	Connect the ambulatory ECG leads and recorder (or explain to the patient how to connect) in such a way that artefact is minimised and to ensure patient comfort.	• Correct positioning of leads to minimise artefact and maximise patient comfort.
1	Explain the use of the patient diary, how to activate the device as necessary, what to do with the recorder at night and when to return the device.	• The importance and use of the patient diary.
1	Remove the equipment from the patient (or explain how to remove), clarify symptoms and explain the procedure for receiving results.	• Procedures for safe removal of equipment.
2	Operate a playback/analyser system	• How to check accuracy of recording, identify artefacts and determine

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	recognising, analysing and interpreting the ECG features seen during playback and correlating patient symptoms with ECG findings, checking automated evaluations for accuracy.	suitability for analysis. • How to download data and produce results in appropriate format for next stage of processing. • The possible clinical outcomes for the patients.
2	Select ECG tracings sufficient to illustrate and support the final evaluation and produce a factual report, reviewing with senior staff when appropriate.	• Report formats.
1	Undertake routine maintenance and calibration procedures associated with ambulatory ECG monitoring.	• Routine maintenance and calibration procedures.
1	Clean ambulatory ECG monitoring equipment in accordance with departmental protocol.	• Routine maintenance and calibration procedures.
1	Keep accurate records in accordance with current guidelines and the legal framework for data security.	• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines and the legal framework for data security.
3	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		performance.
3	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
3	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Know different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
3	Comply with relevant guidance and laws to include those relating to • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	• Principles, guidance and law with respect to: ○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
3	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Assisting with exercise stress testing/provocative electrocardiography/functional imaging	Component	Specialist Year 2/3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and assists in exercise stress testing or monitoring during functional imaging investigations. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice;' and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to assist with more complex investigations. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Assist (second person) in cardiac exercise stress testing/undertake monitoring role during provocative ECG or functional imaging investigations.
2. Perform immediate life support in accordance with current Resuscitation Council (UK) guidelines.
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe the reporting of exercise stress testing or provocative ECG investigations and discuss the role of these investigations in the relevant care pathway.
- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning at least one of the routine investigation and one treatment plan.
- Observe the use of cardiac ultrasound (observation may occur during functional imaging investigation as well as in echo clinic) and discuss the role of this test in the diagnosis and management of patients.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control infection risks for diagnostic and therapeutic invasive procedures in accordance with departmental protocols.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1, 2	Minimise risks and hazards in compliance with health and safety policies.	• The relevant health and safety regulations specific to the investigations, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2, 3	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when assisting during diagnostic procedures.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence, and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1	Obtain a suitably completed request form, greet the patient and check patient ID for patients attending for cardiac exercise stress testing/provocative ECG/functional imaging procedures.	• Referral routes for cardiac diagnostic investigations. • Requirements for correct completion of request forms and how to validate. • The importance of checking and confirming the patient identity and the implications of not doing so.
1	Prepare the environment, set up and calibrate equipment ready for use for cardiac exercise stress testing/provocative ECG/functional imaging procedures.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment. • Manufacturer's and local protocols for equipment used.
1	Treat the patient in a way that respects their dignity, rights, privacy and confidentiality.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Check all resuscitation equipment in the room for exercise testing.	• Local resuscitation guidelines.
2	Undertake immediate life support in accordance with in accordance with current Resuscitation Council (UK) guidelines.	• Current Resuscitation Council (UK) guidelines.
1	Under supervision review the clinical history of the patient for suitability to perform the test, explain the procedure to the patient and gain their consent.	• Adherence to any pre-test instructions. • Suitability of clothing/footwear for the test. • Indications/contraindications for testing.
1	Prepare electrode sites and apply electrodes to the patient to obtain accurate and artefact-free recordings.	• Electrode sites for cardiac exercise testing.
1	Record the patient's resting ECG	• British Hypertension Society guidelines for blood pressure measurement.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	and BP and compare these with the last set of patient recordings.	
1	Carefully explain the procedure to the patient and if appropriate demonstrate walking technique to ensure that the patient understands how to perform the procedure safely.	• Verbal communication skills. • SOPs for the investigation.
1	Assist in an exercise ECG test/provocative ECG/functional imaging procedures	• Contraindications for the test. • How and when to record any adverse or unexplained changes and take appropriate action. • Test end-point. • Common presenting conditions and pathological processes underlying the presentation of patients referred for these investigations. • Identification of when to end an exercise test. • The local and national guidelines for the recovery period and why the patient must be supported through the recovery period. • Rationale for specific test selection. • Correct annotation of the recording. • How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1	Monitor and record the ECG and BP throughout the test, recording any adverse or unexplained changes, and take appropriate action.	• Safety procedures during the test. • Adverse BP and ECG changes that should be reported.
1	Produce ECG tracings of sufficient accuracy to support the supervisor's clinical report.	• Criteria for accurate ECG recordings.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1	Undertake routine maintenance and calibration procedures.	• Routine maintenance and calibration procedures.
1	Clean the equipment in accordance with departmental protocol.	• Routine maintenance and calibration procedures.
1	Keep accurate records in accordance with current guidelines and the legal framework for data security.	• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines and the legal framework for data security.
3	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
3	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
3	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
3	Comply with relevant guidance and laws, to include those relating to: • your scope of practice	• Principles, guidance and law with respect to: o personal health and wellbeing o medical ethics

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	• research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
3	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Pacing and Diagnostic Cardiac Catheterisation	Component	Specialist Year 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and assists with pacing and diagnostic cardiac catheterisation in adults. During this period of work-based training students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Cardiac Physiology'; 'Applying Cardiac Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to assist with more complex investigations. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Assist at left-heart diagnostic and therapeutic invasive procedures.
2. Assist at the implant of bradycardia management devices.
3. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe left and right-heart catheterisation and angiography, including blood sampling, and discuss the role of invasive cardiology in the diagnosis, treatment and management of patients with cardiac disease.
- Attend outpatient clinics and/or inpatient ward rounds to gain experience of the linkages between cardiac physiology and other clinical specialisms in the investigation of cardiovascular diseases.
- Attend a multidisciplinary meeting at which the outcome of a clinical audit, research, innovation, or service development is presented, and discuss with your training officer how evidence-based practice is implemented with respect to cardiac investigations.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control infection risks for diagnostic and therapeutic invasive procedures in accordance with departmental protocols.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection and local trust requirements.
1, 2	Minimise risks and hazards in compliance with health and safety policies for diagnostic and therapeutic invasive procedures.	• The relevant health and safety regulations specific to the investigations, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2, 3	Use effective communication skills within the healthcare environment, adapting communication style and language to meet the needs of the listener when assisting during diagnostic and therapeutic invasive procedures.	• The principles of effective communication, including written and electronic, verbal and non-verbal. • The way effective communication can assist in identifying problems accurately, increase patient satisfaction, enhance treatment adherence and reduce patient distress and anxiety. • The importance of some key ideas, for example signposting, listening, language, non-verbal behaviour, ideas, beliefs, concerns, expectations and summarising in communication.
1, 2	Prepare the environment, set up and calibrate equipment ready for use for diagnostic and therapeutic invasive procedures, including, if appropriate, resuscitation equipment.	• Range of equipment used, relative merits and principles of measurement. • Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action. • Current safety standards, including safety testing and routine maintenance. • Preparation and calibration of equipment.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Manufacturer's and local protocols for equipment used.
1, 2	Treat the patient in a way, which respects their dignity, rights, privacy and confidentiality.	• The rights of the patient with regard to consent for treatment and confidentiality of consultation and medical records. • Key factors influencing dignity, rights, privacy and confidentiality, including age, gender, culture and beliefs. • Correct position of the patient, ensuring comfort, co-operation and optimal investigation results. • The impact of incorrect positioning or non-co-operation on investigation results.
1	Assist at diagnostic and therapeutic invasive procedures.	• Referral routes for cardiac diagnostic investigations. • Range of diagnostic and therapeutic invasive procedures undertaken in a cardiac department. • Adherence to any pre-test instructions. • The need to check the ECG, BP and patient status throughout the procedure and report any adverse changes as necessary. • The Ionising Radiation (Medical Exposure) Regulations **(**IRMER) guidelines.
1	Perform procedures in accordance with the aseptic technique and comply with asepsis measures during the procedure.	• Hand hygiene and asepsis procedures in accordance with local policies.
1	Assemble the pressure transducers and monitoring lines to ensure a sterile, fluid-filled and air-free system, and check the calibration.	• The requirement to identify mid-chest position on the patient and correctly align the transducer.
1	Take recordings appropriate to the investigation, make measurements from these, and	• Zero pressure to ensure a correct patient baseline reading/measurement.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	change the range and paper speed to suit the pressures recorded.	• How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
2	Select and prepare equipment for the implant of bradycardia devices and, under direct supervision, make appropriate measurements at both implant and at immediate post-implant checks.	• Required documentation for implant of bradycardia devices. • Range of diagnostic and therapeutic invasive procedures undertaken in a cardiac department. • Adherence to any pre-test instructions. • The need to check ECG and patient status throughout the procedure and report any adverse changes as necessary. • Factors influencing the choice of technology for a cardiac rhythm management device. • Indications, contraindications and patient benefit for a cardiac rhythm management device. • American Heart Association and European Standard Identification. • How to identify recordings/measurements that are sub-standard. • When and how to refer to senior colleagues.
1, 2	Undertake routine maintenance and calibration procedures.	• Routine maintenance and calibration procedures.
1, 2	Clean the equipment in accordance with departmental protocol.	• Cleaning protocols.
1, 2	Keep accurate records in accordance with current guidelines and the legal framework for data security.	• Best practice recommendations for record keeping and data security. • The Data Protection Act and current key guidelines and the legal framework for data security.
3	Reflect on your practice and generate a reflective diary that	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
3	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
3	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
3	Comply with relevant guidance and laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	• Principles, guidance and law with respect to: ○ personal health and wellbeing ○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
3	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

SECTION 11: WORK-BASED SYLLABUS: RESPIRATORY AND SLEEP PHYSIOLOGY

*This section describes the Learning Framework for the **Specialist Component** of work-based learning covering the Learning Outcomes, Clinical Experiential Learning, Competence, and Applied Knowledge and Understanding.*

DIVISION	Physiological Sciences
THEME	Cardiovascular, Respiratory and Sleep Sciences
SPECIALISM	**Respiratory and Sleep Physiology**

MODULE	Spirometry, Static Lung Volumes and Bronchodilator Response	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and performs spirometry, static lung volumes and administer and measure the response to a bronchodilator. During this period of work-based learning students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to perform spirometry and static lung volumes competently, administer and measure the response to a bronchodilator, and undertake routine maintenance, calibration and quality assurance procedures on the equipment used. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Measure and evaluate dynamic lung volumes (forced expiratory volume in 1 second [FEV_1], forced vital capacity [FVC], peak expiratory flow [PEF] and maximal flow volume curves (MFVC) in a range of patients and produce a technical report.
2. Measure static lung volumes (total lung capacity [TLC], functional residual capacity [FRC] [or thoracic gas volume (TGV)] and residual volume [RV]) and all subdivisions using helium dilution, nitrogen washout, or body plethysmography in patients with a range of underlying disorders and produce a technical report.
3. Administer a bronchodilator, measure the response and produce a technical report.
4. Perform routine maintenance, calibration and quality assurance procedures on the equipment used to undertake dynamic and static lung volumes, and ensure accurate completion of equipment maintenance records.
5. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe the reporting of routine respiratory and sleep investigations and discuss the role of these investigations in the relevant care pathway.
- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning at least one of the routine investigation and one treatment plan.
- Attend outpatient clinics and/or inpatient ward rounds to gain experience of the linkages between respiratory and sleep science and other clinical specialisms in the investigation of respiratory diseases and disorders of sleep.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2, 3	Control of infection risks pre, during and post investigations, and actions taken to manage these when undertaking spirometry, static lung volumes and the administration of bronchodilators.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection.
1, 2, 3	Minimise risks and hazards in compliance with health and safety policies when undertaking spirometry, static lung volumes and the administration of bronchodilators.	• The relevant health and safety regulations specific to respiratory and sleep science investigations, the potential hazards and risks and the actions to be taken to minimise these.
1, 2, 3	Identify and act on any special requirements of patients undergoing spirometry, static lung volumes and the administration of bronchodilators, and, if necessary, discuss with senior staff and carers.	• Potential special requirements of patients referred to a respiratory and sleep department.
1, 2, 3	Select suitable equipment for spirometry, static lung volumes and the administration of bronchodilators, ensuring that the equipment is in working order and is correctly configured in accordance with the requirements of the test.	• Factors influencing the choice of technology for investigating respiratory symptoms. • Clinical indications, contraindications and patient benefit for respiratory and sleep investigations. • Medication used to treat respiratory symptoms and conditions.
1, 2, 3	Obtain a suitably completed request form, greet the patient, and check patient ID and recent clinical history for patients referred for spirometry, static	• Referral routes for respiratory/sleep investigations. • The pathophysiology of the respiratory system and the appropriate choice of investigation considering the findings from the history and clinical examination.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	lung volumes and the administration of bronchodilators.	• Indications and contraindications for each test. • Requirements for correct completion of request forms and how to validate. • How to communicate with patients in a way that respects their dignity, rights, privacy and confidentiality. • The importance of checking patient identity. • The importance of explaining the procedure to the patient and gaining consent. • How to take and record a patient history and key information required. • Common pharmacological treatments used by patients referred with respiratory disease and disorders of sleep.
1, 2, 3	Explain the procedure for spirometry, static lung volumes and the administration of bronchodilators to the patient, address any procedure-related questions they may have and provide information on how the patient will be informed of the results.	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about procedures. • Risks and benefits of undertaking the investigation. • The information needs of patients following investigation. • The authority level for provision of information to patients. • The process of notifying patients of the results. • The range of treatment pathways and their relevance/applicability to respiratory disease. • Factors affecting selection of treatment option.
1, 2, 3	Obtain and review relevant patient information for spirometry, static lung volumes and the administration of bronchodilators.	• Relevant patient pre-test patient information, including medication, smoking history, recent change in condition and any previous test results.
1, 2, 3	Gain informed consent for spirometry, static lung volumes and the administration of bronchodilators.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.
1, 2, 3	Prepare the environment, equipment and patient for investigations, to include: • dynamic lung volumes • static lung volumes • bronchodilator therapy.	• Requirements for the investigation environment to ensure privacy, dignity and comfort of patients, to facilitate investigation procedure and to maximise results. • How to check, calibrate and prepare equipment and devices. • Correct configuration of recording systems. • Correct positioning of the patient ensuring comfort and co-operation. • The importance of explaining the procedure to the patient and the impact of incorrect positioning or non-co-operation on investigation results. • How to identify potential special needs of patients and the relevant action required. • Range of equipment used, relative merits and principles of measurement. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action.
1, 2, 3	Make height, weight and other appropriate measurements in accordance with standardised procedures, adapting them where necessary.	• Importance of accurate measurement of height and weight. • Measurements that may be required pre and post investigation, such as height and weight.
1	Obtain accurate measurements of VC, FVC, FEV_1, PEF and MFVCs in accordance with recommended	• SOPs. • Identification and correction of errors in patient technique.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	guidelines and patient capability, identifying and correct errors in patient technique.	• Need to provide reassurance to the patient. • Time required to recover between or from the test and potential variation between patients. • The relevance of investigations to referral request and differential diagnosis. • The importance of supporting patients during the test to work with patient capabilities. • How to distinguish between poor patient performance, technical faults and deterioration in clinical status. • Reasons to stop the test to maintain the safety of the patient.
2	Obtain accurate measurements of TLC, FRC (or TGV) and RV and all subdivisions in accordance with recommended guidelines and patient capability, identifying and correct errors in patient technique.	• SOPs. • The relevance of investigations to referral request and differential diagnosis. • The importance of supporting patients during the test to work with patient capabilities. • How to distinguish between poor patient performance, technical faults and deterioration in clinical status. • Reasons to stop the test to maintain the safety of the patient.
3	Select, prepare and administer a bronchodilator(s) and perform post-bronchodilator measurements according to local and national guidelines.	• SOPs. • Factors influencing the selection of bronchodilator and device. • Correct preparation of bronchodilator and device. • Information needs of patients and how to explain in terms that facilitate understanding and co-operation. • Factors influencing the effectiveness of administration that may impact on results. • Correct administration of bronchodilator/device. • Format and requirements for recording results.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	Interpret technically data from patients and generate a report for: • spirometry • lung volumes • bronchodilator therapy.	• Normal reference ranges. • Typical patterns and results for common respiratory diseases. • How to check accuracy of recording, identify artefacts and determine suitability for analysis. • How to download data and produce results in the appropriate format for the next stage of processing. • The possible clinical outcomes for the patients.
1, 2, 3	Inform the patient of the procedure for notification of the results.	• The process to inform the patient of the procedure for notification of the results of each test.
1, 2, 3	Record the results accurately in an appropriate format together with any technical comments that may influence the test outcome.	• Report formats relevant to workplace.
1, 2, 3	Generate a suitable report.	• Normal reference ranges. • Typical patterns and results for common respiratory disorders.
1, 2, 3	Decontaminate equipment for spirometry, static lung volumes and the administration of bronchodilators, and leave in a suitable condition for reuse.	• Decontamination procedures.
4	Perform routine calibration/quality control/verification of full lung function testing equipment, to include printouts of volume verification at different flow rates.	• Calibration logs, including both volume and gas concentration calibration. • Volume calibration verification at differing flow rates on one piece of equipment. • Requirements for calibration and quality control. • The importance of the calibration log and records, including volume, flow and gas concentration. • Current safety standards, including safety testing and routine

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		maintenance. • Requirements for accurate completion of equipment maintenance records.
4	Perform VC measurements using a calibration syringe.	• SOP. • The importance of volume verification.
4	Perform FVC, FEV_1 and PEF measurements on a physiological control.	• SOP. • The importance of flow verification.
4	Perform FRC/TGV, TLC and VC measurements on a physiological control.	• SOP. • The use of physiological controls.
5	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
5	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
5	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
5	Comply with relevant guidance and	• Principles, guidance and law with respect to:

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	laws, to include those relating to • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
5	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Measurement of Gas Transfer and Oxygen Saturation	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and measures gas transfer and spot SpO_2 in a range of patients referred to the respiratory physiology department. During this work-based learning module students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology in Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to perform single breath gas transfer competently and undertake routine maintenance, calibration and quality assurance procedures on the equipment used. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Measure the uptake of carbon monoxide (CO) using the single breath technique as a guide to the gas exchange function in a range of patients with respiratory and non-respiratory disorders.
2. Measure the heart rate and spot SpO_2 using pulse oximetry in patients with a range of respiratory and non-respiratory disorders in a variety of settings.
3. Perform routine maintenance, calibration and quality assurance procedures on the equipment used to undertake dynamic and static lung volumes, gas transfer and SpO_2 equipment, and ensure accurate completion of equipment maintenance records.
4. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning single breath gas transfer.
- Observe the use of respiratory exercise testing and discuss the role of this test in the diagnosis and management of patients.
- Attend a multidisciplinary meeting and reflect on the way the MDT contributes to the care of patients with disorders of the respiratory system or disorders of sleep.
- Attend a meeting at which the outcome of a clinical audit is presented and discuss with your training officer how evidence-based practice is implemented with respect to respiratory and/or sleep investigations.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 2	Control of infection risks pre, during and post gas transfer and SpO_2 measurement, and actions taken to manage these.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection.
1, 2	Minimise risks and hazards in compliance with health and safety policies when undertaking gas transfer and SpO_2 measurement.	• The relevant health and safety regulations specific to respiratory and sleep science investigations, the potential hazards and risks, and the actions to be taken to minimise these.
1, 2	Identify and act on any special requirements of the patient when undergoing gas transfer and SpO_2 measurement and, if necessary, discuss with senior staff and carers.	• Potential special requirements of patients referred to a respiratory and sleep department.
1, 2	Select suitable equipment for gas transfer and SpO_2, ensuring that the equipment is in working order and is correctly configured in accordance with the requirements of the test.	• Factors influencing the choice of technology for investigating respiratory symptoms. • Clinical indications, contraindications and patient benefit for respiratory and sleep investigations. • Medication used to treat respiratory symptoms and conditions.
1, 2	Obtain a suitably completed request form, greet the patient and check patient ID and recent clinical history for measurement of gas transfer and SpO_2.	• Referral routes for respiratory/sleep investigations. • The pathophysiology of the respiratory system and the appropriate choice of investigation considering the findings from the history and clinical examination. • Indications and contraindications for each test. • Requirements for correct completion of request forms and how to validate. • How to communicate with patients in a way that respects their dignity, rights, privacy and confidentiality.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• The importance of checking patient identity. • The importance of explaining the procedure to the patient and gain consent. • How to take and record a patient history and key information required. • Common pharmacological treatments used by patients referred with respiratory disease and disorders of sleep.
1	Explain the procedure for gas transfer to the patient, address any procedure-related questions they may have and provide information on how the patient will be informed of the results.	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about procedures. • Risks and benefits of undertaking the investigation. • The information needs of patients following investigation. • The authority level for provision of information to patients. • The process of notifying patients of the results. • The range of treatment pathways and their relevance/applicability to respiratory disease. • Factors affecting selection of treatment option.
2	Explain the procedure for spot SpO_2 measurement to the patient, address any procedure-related questions they may have and provide information on how the patient will be informed of the results.	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about procedures. • Risks and benefits of undertaking the investigation. • The information needs of patients following investigation. • The authority level for provision of information to patients. • The process of notifying patients of the results. • The range of treatment pathways and their relevance/applicability to cardiac disease. • Factors affecting selection of treatment option.
1	Obtain and review relevant patient information for gas transfer measurement.	• Relevant patient pre-test patient information, including medication, smoking history, recent change in condition and any previous test results.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
2	Obtain and review relevant patient information for SpO_2 measurement.	• Relevant patient pre-test patient information, including medication, smoking history, recent change in condition and any previous test results.
1	Gain informed consent for gas transfer.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.
2	Gain informed consent for SpO_2 measurement.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.
1	Prepare the environment, equipment and patient for gas transfer.	• Requirements for the investigation environment to ensure privacy, dignity and comfort of the patient, to facilitate investigation procedure and to maximise results. • How to check, calibrate and prepare equipment and devices. • Correct configuration of recording systems. • Correct positioning of the patient, ensuring comfort and co-operation. • The importance of explaining the procedure to the patient and the impact of incorrect positioning or non-co-operation on investigation results. • How to identify potential special needs of patients and relevant action required. • Range of equipment used, relative merits and principles of measurement.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action.
1	Make height, weight and other appropriate measurements in accordance with standardised procedures, adapting them where necessary.	• Importance of accurate measurement of height and weight. • Measurements that may be required pre and post investigation, such as height and weight.
1	Interpret technically patient and generate a report for gas transfer.	• Normal reference ranges. • Typical patterns and results for common respiratory diseases. • How to check accuracy of recording, identify artefacts and determine suitability for analysis. • How to download data and produce results in appropriate format for next stage of processing. • The possible clinical outcomes for the patients.
1	Inform the patient of the procedure for notification of the results from gas transfer testing.	• The process to inform the patient of the procedure for notification of the results of each test.
1	Record the results for gas transfer accurately in an appropriate format together with any technical comments that may influence the test outcome	• Report formats relevant to workplace.
1	Generate a suitable report for gas transfer testing.	• Normal reference ranges. • Typical patterns and results for common respiratory disorders.
1	Decontaminate gas transfer equipment and leave in a suitable	• Procedures for decontamination of gas transfer equipment.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	condition for reuse.	
2	Obtain accurate measurements of spot SpO_2 and pulse rate in accordance with recommended procedures and the patient's clinical condition.	• SOPs. • Reasons for measuring SpO_2 and relevance to a range of patient conditions. • Correct preparation for overnight pulse oximetry, including information needs of patients and carers. • Requirements for monitoring and recording results. • How to distinguish between technical faults and deterioration in clinical status.
3	Perform alveolar volume and transfer test measurements on a physiological control.	• SOP.
4	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
4	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
4	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Know different methods of planning, prioritising and organising and how they can enhance personal effectiveness.
4	Comply with relevant guidance and	• Principles, guidance and law with respect to:

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	○ medical ethics ○ confidentiality ○ information governance ○ informed consent ○ equality and diversity ○ child protection ○ elder abuse ○ use of chaperones ○ probity ○ fitness to practise.
4	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Assessment of Disorders of Sleep	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and begins to develop skills in the measurements used to assess disorders of sleep. During this period of work-based learning students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology to Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to perform a range of routine investigations competently and undertake routine maintenance, calibration and quality assurance procedures on the equipment used. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

Overnight oximetry

1. Prepare, issue, retrieve and store data from overnight oximetry.
2. Download, perform manual analysis, interpret data and write a clinical report in an appropriate format.

Multi-channel limited sleep study

3. Prepare, fit and remove multi-channel polygraphy devices on a range of patients.
4. Download, perform manual analysis, interpret data and assist with reporting findings in an appropriate format.
5. Perform routine maintenance, calibration and quality assurance procedures on the equipment used to undertake limited multi-channel sleep studies, and ensure accurate completion of equipment maintenance records.
6. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Observe the reporting of routine sleep investigations and discuss the role of these investigations in the relevant care pathway.
- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning at least one of the routine investigation plan.
- Attend outpatient clinics and/or physiologist-led clinics and discuss with your supervisor the diagnostic pathways for Obstructive Sleep Apnoea Hypopnoea Syndrome (OSAHS).

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 3, 5	Control of infection risks pre, during and post overnight oximetry and limited multi-channel sleep studies.	• Protocols and requirements for hygiene and infection control related to the relevant range of investigations, including preparation, conduct and completion of investigation. • Protocol for hand washing and how effective hand washing contributes to control of infection.
1, 3, 5	Minimise risks and hazards in compliance with health and safety policies when undertaking overnight oximetry and limited multi-channel sleep studies.	• The relevant health and safety regulations specific to respiratory and sleep science investigations, the potential hazards and risks and the actions to be taken to minimise these.
1, 3, 5	Identify and act on any special requirements of patients undergoing overnight oximetry and limited multi-channel sleep studies.	• Potential special requirements of patients referred to a respiratory and sleep department.
1, 3, 5	Select suitable equipment for overnight oximetry and limited multi-channel sleep studies, ensuring that the equipment is in working order and is correctly configured in accordance with the requirements of the test.	• Factors influencing the choice of technology for investigating sleep disorders. • Clinical indications, contraindications and patient benefit for respiratory sleep investigations.
1, 3, 5	Obtain a suitably completed request form, greet the patient, and check patient ID and recent clinical history for patients referred for overnight oximetry and limited multi-channel sleep studies.	• Referral routes for sleep investigations. • The pathophysiology of sleep disordered breathing and the appropriate choice of investigation considering the findings from the history and clinical examination. • Indications and contraindications for each test. • Requirements for correct completion of request forms and how to

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		validate. • How to communicate with patients in a way that respects their dignity, rights, privacy and confidentiality. • The importance of checking patient identity. • The importance of explaining the procedure to the patient and gaining consent. • How to take and record a patient history and key information required. • Common pharmacological and non-pharmacological treatments used by patients referred with respiratory disease and disorders of sleep.
1, 3, 5	Explain the procedure for overnight oximetry and limited multi-channel sleep studies to the patient, address any procedure-related questions they may have and provide information on how the patient will be informed of the results.	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about procedures. • Risks and benefits of undertaking the investigation. • The information needs of patients following investigation. • The authority level for provision of information to patients. • The process of notifying patients of the results. • The range of treatment pathways and their relevance/applicability to disorders of sleep. • Factors affecting selection of treatment option.
1, 3, 5	Obtain and review relevant patient information for overnight oximetry and limited multi-channel sleep studies.	• Relevant patient pre-test patient information, including medication, smoking history, recent change in condition and any previous test results.
1, 3, 5	Gain informed consent for overnight oximetry and limited multi-channel sleep studies.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure for each investigation to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Clinical indications and contraindications for each investigation. • Principles, guidance and law with respect to informed consent.
1, 3, 5	Prepare the environment, equipment and patient for investigations, to include: • overnight oximetry • multi-channel sleep study.	• Requirements for the investigation environment to ensure privacy, dignity and comfort of patients, to facilitate investigation procedure and to maximise results. • How to check, calibrate and prepare equipment and devices. • Correct configuration of recording systems. • Correct positioning of sensors. • The importance of explaining the procedure to the patient and the impact of incorrect positioning or non-co-operation on investigation results. • How to identify potential special needs of patients and the relevant action required. • Range of equipment used, relative merits and principles of measurement. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action.
1, 3, 5	Make height, weight, neck circumference and other appropriate measurements in accordance with standardised procedures, adapting them where necessary.	• Importance of accurate measurement of height and weight. • The use of neck circumference in predicting outcome and potential treatment.
1, 2, 3, 4	Perform download procedures into appropriate software of overnight oximetry and limited multi-channel sleep studies.	• Information technology issues associated with downloading devices. • How to download data and produce results in the appropriate format for the next stage of processing. • How to check accuracy of recording, identify artefacts and determine suitability for analysis.
1, 2, 3, 4	Record the results accurately in an	• Report formats relevant to workplace.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	appropriate format together with any technical comments that may influence the test outcome.	
2, 4	Perform manual analysis of oximetry and limited multi-channel sleep studies in accordance with local and/or national guidelines and obtain accurate measurement of oxygen desaturation index (ODI), apnoea hypopnoea index (AHI) and average oxygen saturation (SpO_2).	• SOPs. • Typical patterns and results for patients with respiratory sleep disorders. • How to distinguish between poor patient performance, technical faults and deterioration in clinical status. • Scoring criteria for apnoeas, hypopnoeas and desaturations. • The impact variations in scoring criteria have on the final results.
2, 4	Interpret the results of analysed overnight oximetry and limited multi-channel sleep studies and assist with the generation of a suitable report.	• The relevance of investigations to referral request and differential diagnosis. • Normal reference ranges. • Typical patterns and results for patients with respiratory sleep disorders. • The impact of sleeping position on the results. • Format and requirements for recording results. • Report formats relevant to workplace.
1, 3	Inform the patient of the procedure for notification of the results.	• The process to inform the patient of the procedure for notification of the results of each test.
1, 3, 5	Decontaminate equipment for overnight oximetry and limited multi-channel sleep studies, and leave in a suitable condition for reuse.	• Decontamination procedures. • Local infection control procedures.
5	Perform routine calibration/quality control/verification of overnight oximetry and sleep study equipment.	• Requirements for calibration and quality control. • The importance of the calibration log and records, including SpO_2, nasal flow and respiratory effort. • Current safety standards, including safety testing and routine

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		maintenance. • Requirements for accurate completion of equipment maintenance records.
5	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
5	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
5	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
5	Comply with relevant guidance and laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones • informed consent.	• Principles, guidance and law with respect to: o medical ethics o confidentiality o information governance o informed consent o equality and diversity o child protection o elder abuse o use of chaperones o probity o fitness to practise.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
5	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

MODULE	Treatment of Respiratory Sleep Disorders	Component	Specialist Years 2 and 3
AIM	The aim of this module is to ensure that the student develops their skills with respect to patient-centred care and performs trials of positive airway pressure (PAP) therapy in the treatment of respiratory disorders of sleep. During this period of work-based learning students will apply their learning from the modules 'Instrumentation, Signal Processing and Imaging'; 'Pathophysiology of Common Cardiovascular and Respiratory Conditions'; 'Respiratory and Sleep Physiology'; 'Applying Respiratory and Sleep Physiology to Practice'; and 'Professional Practice'.		
SCOPE	On completion of this module the student will be able to perform trials of PAP therapy competently and undertake routine maintenance, calibration, infection control and quality assurance procedures on the equipment used. They will be expected to build their professional practice and practise safely in the workplace. Students will be expected to use critical reflection to review and improve their performance in the workplace and develop skills to promote CPD.		

LEARNING OUTCOMES

On successful completion of this module the student will:

1. Set up a range of patients on continuous positive airway pressure (CPAP)/automatic positive airway pressure (APAP) selecting the appropriate settings and interface.
2. Communicate with patients, providing written and verbal information and education on the use of PAP therapy.
3. Download a PAP device, interpret the data and report the findings.
4. Review patients who have recently started on PAP therapy or those on long-term therapy and recognise where further intervention is required.
5. Perform routine maintenance, calibration, infection control and quality assurance procedures on the equipment used to treat sleep-disordered breathing, and ensure accurate completion of equipment maintenance records.
6. Adhere to appropriate standards of professional practice as defined in *Good Scientific Practice*.

CLINICAL EXPERIENTIAL LEARNING

The clinical experiential learning for this module is:

- Critically apply the scientific principles covered in the academic modules to this work-based module and specifically appraise the evidence base underpinning at least one treatment plan in patients with sleep-disordered breathing.
- Identify a patient with OSAHS treated by PAP therapy and, with permission, discuss the impact of CPAP on the quality of life of the patient and reflect on how your discussion will impact on your future practice.
- Attend a clinic where patients with disorders of sleep attend for non-pharmacological treatment, for example a stop smoking clinic, dietetic clinic, or exercise session, and reflect on the role on non-pharmacological treatment in the prevention and management of respiratory disease and disorders of sleep.
- Attend a multidisciplinary meeting and reflect on the way the MDT contributes to the care of patients with respiratory disorders of sleep.

All of these experiences should be recorded in your e-portfolio.

The following section details the competence and knowledge and understanding each student must gain. Each competence is linked to the relevant learning outcomes and students must demonstrate achievement of each competence for each linked learning outcome.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 4, 5	Control of infection risks pre, during and post trial of PAP therapy and actions taken to manage these.	• Protocols and requirements for hygiene and infection control related to PAP devices, interfaces and accessories, including preparation, conduct and completion of PAP trials. • Protocol for hand washing and how effective hand washing contributes to control of infection.
1, 5	Minimise risks and hazards in compliance with health and safety policies when undertaking PAP trials.	• The relevant health and safety regulations specific to respiratory and sleep science investigations, the potential hazards and risks and the actions to be taken to minimise these.
1, 2, 4	Identify and act on any special requirements of patients undergoing PAP trials and those on long-term therapy and, if necessary, discuss with senior staff and carers.	• Potential special requirements of patients referred for PAP therapy.
1, 2, 4, 5	Select suitable equipment for PAP therapy, including device, interface and accessories, ensuring that the equipment is in working order and is correctly configured in accordance with local policy.	• Factors influencing the choice of technology for treating respiratory sleep disorders. • Factors influencing the choice of interface. • Factors influencing the need for accessories such as integrated humidification. • Clinical indications, contraindications and patient benefit for treating sleep-disordered breathing. • Impact of medications on sleep and breathing.
1, 2	Obtain a suitably completed request form, greet the patient, and check patient ID and recent clinical history for patients referred for a trial of PAP therapy.	• Referral routes for treatment of sleep disorders. • The pathophysiology of sleep-disordered breathing and the appropriate choice of PAP device, considering the findings from the history and sleep study results. • Indications and contraindications for PAP therapy.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
		• Requirements for correct completion of request forms and how to validate. • How to communicate with patients in a way that respects their dignity, rights, privacy and confidentiality. • The importance of checking patient identity. • The importance of explaining the procedure to the patient and gaining consent. • How to take and record a patient history and key information required. • Common pharmacological and non-pharmacological treatments used by patients referred with respiratory disease and disorders of sleep.
1, 2, 6	Gain informed consent for a trial of PAP therapy.	• The importance of introducing yourself and your role as a student HCSP as part of the process of introduction and consent. • The importance of explaining the procedure to the patient and gaining informed consent. • The relevant procedures and requirements for patient conformance. • Clinical indications and contraindications for treatment. • Principles, guidance and law with respect to informed consent.
1, 2, 3, 4	Obtain and review relevant patient information for trials of PAP therapy.	• Relevant patient pre-trial patient information, including medication, smoking history, recent change in condition and any previous test results. • The importance of other conditions that will affect sleep quality.
1, 2, 6	Explain the procedure for issuing PAP to the patient, address any procedure-related questions they may have and provide written and verbal information on use and maintenance of the equipment	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about PAP therapy. • Risks and benefits of undertaking PAP therapy. • The authority level for provision of information to patients. • The information needs of patients following commencement of PAP therapy.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	provided and on how the therapy will be reviewed and monitored. Address any procedure-related questions they may have.	• Factors affecting selection of therapy option. • The process of reviewing and monitoring PAP therapy. • The range of treatment pathways and their relevance/applicability to disorders of sleep. • The importance of other conditions that will affect sleep quality.
1, 2, 5	Prepare the environment, equipment and patient for a trial of PAP therapy.	• Requirements for the treatment environment to ensure privacy, dignity and comfort of patients, to facilitate treatment procedure and to maximise results. • How to check, adjust settings and prepare equipment and devices, including erasing previous data. • Correct configuration of therapy settings. • Correct positioning of interfaces. • The importance of explaining the procedure to the patient and the impact of incorrect positioning or non-co-operation on treatment results. • How to identify potential special needs of patients and the relevant action required. • Range of equipment (devices) used, relative merits and principles of treatment. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common faults and remedial action. • Range of interfaces available and their relative merits and limitations.
1, 2, 4, 5	Fit an appropriate interface to patients ensuring that the patient is comfortable and is informed how to make adjustments to the mask. Check the mask seal/fit at a range of	• How to check, adjust settings and prepare equipment and devices. • Correct configuration of therapy settings. • Correct positioning of interfaces. • The importance of explaining the procedure to the patient and the impact of incorrect positioning or non-co-operation on treatment results.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	pressures.	• How to identify potential special needs of patients and the relevant action required. • Range of equipment (devices) used, relative merits and principles of treatment. • Range of interfaces available and their relative merits and limitations. • Recognition of the errors or potential risks of using defective equipment in clinical practice and the implications of use. • Identification of common problems and remedial action.
1, 2, 4	Educate the patient on potential problems with CPAP and how to overcome them. Give contact details and how to gain support with treatment.	• The importance of explaining the procedure to the patient. • Common questions and concerns of patients about PAP therapy. • Common side effects of PAP therapy and remedial action required. • Risks and benefits of undertaking PAP therapy. • The information needs of patients following commencement of PAP therapy. • Factors affecting selection of therapy option. • Local policy for providing support – for example, telephone, email, or drop-in clinic.
1,5, 6	Ensure full documentation is made of equipment, settings and interfaces used in accordance with local policy, pre, during and post PAP trials, and during any review visits.	• SOP. • The importance of equipment maintenance and location logs. • Good clinical record keeping.
3, 4	Perform download procedures into appropriate software data from PAP devices. This may include data from remote monitoring.	• Information technology issues associated with downloading devices. • How to download data and produce results in the appropriate format for the next stage of processing.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
3, 4	Review the downloaded data from a PAP device and interpret the results.	• Awareness of different levels of information available from PAP downloads, from compliance to leak and AHI information to full flow profiles. • Recognise common issues with PAP therapy relating to devices or interfaces. • Recognise common issues with PAP therapy relating to the patient, including reasons why PAP therapy may not be successful. • Recognise where remedial action is required to improve patient compliance and/or treatment efficacy. • Recognise where further intervention is required from senior staff or other specialities.
3, 4	Discuss the results with patients and take remedial action where necessary to improve the results.	• Recognise common issues with PAP therapy relating to devices or interfaces. • Recognise common issues with PAP therapy relating to the patient, including reasons why PAP therapy may not be successful. • Recognise where remedial action is required to improve patient compliance and/or treatment efficacy. • Recognise where further intervention is required from senior staff or other specialities.
1, 3, 4, 6	Record the results accurately in an appropriate format together with any technical comments and plans of action and produce a written report.	• Report formats relevant to workplace. • The importance of good record keeping.
1, 2, 4	Inform the patient of the procedure for continuation of the trial, long-term therapy, or what happens next when therapy is unsuccessful.	• SOP. • Local procedure for monitoring patients on long-term therapy. • Local procedure for reviewing patients who are unsuccessful with therapy.

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
1, 5	Decontaminate PAP equipment, and leave in a suitable condition for reuse.	• Decontamination procedures. • Local infection control procedures. • How to erase data from previous patient. • How to adjust settings of PAP devices. • Local policy for regular servicing of PAP devices.
6	Reflect on your practice and generate a reflective diary that demonstrates how you take responsibility for your learning and utilise the skills required of an independent learner, and your commitment to your CPD.	• Personal values, principles and assumptions, emotions and prejudices, understanding how these may influence personal judgement and behaviour. • The role of critical reflection and reflective practice and the methods of reflection that can be used to maintain or improve knowledge, skills and attitudes. • How continuous personal development can improve personal performance.
6	Take responsibility for keeping your professional, technical and scientific knowledge and skills up to date.	• How to identify and evaluate the potential role for new and innovative technologies and scientific advances.
6	Meet commitments and goals in your professional practice using a range of organisational and planning tools.	• Different methods of planning, prioritising and organising, and how they can enhance personal effectiveness.
6	Comply with relevant guidance and laws, to include those relating to: • your scope of practice • research ethics and governance • patient confidentiality • data protection • equality and diversity • use of chaperones	• Principles, guidance and law with respect to: o medical ethics o confidentiality o information governance o informed consent o equality and diversity o child protection o elder abuse o use of chaperones

KEY LEARNING OUTCOMES	COMPETENCES	KNOWLEDGE AND UNDERSTANDING
	• informed consent.	○ probity ○ fitness to practise.
6	Work constructively and effectively as a member of a MDT.	• The underpinning principles of effective teamwork and working within and across professional boundaries.

SECTION 12: APPENDICES

Appendix 1: Contributor List

The BSc curriculum for Physiological Sciences (Cardiovascular, Respiratory and Sleep Sciences) has been co-ordinated by the Modernising Scientific Careers (MSC) team working with professional colleagues in Cardiovascular, Respiratory and Sleep Sciences within each of the specialisms of Cardiovascular, Respiratory and Sleep Sciences within this programme.

Cardiac Physiology, Respiratory and Sleep Science curriculum working group since first publication

To 2015

Jane Allen	Cardiac Science
Martin Allen	Respiratory Physiology
Jacqueline Bennett	Sleep Science
Martyn Bucknall	Respiratory Physiology
Brian Campbell	Cardiac Science
Brendan Cooper	Respiratory Physiology
Chris Eggett	Cardiac Science
Jacqui Howard	Cardiac Science
Simone de Lacey	Sleep Science
Julie Lloyd	Respiratory Physiology
Dave Richley	Cardiac Science
Joanna Shakespeare	Respiratory Physiology
Trefor Watts	Respiratory Physiology

In addition, the professionals detailed above who have worked closely with the MSC professional advisors have utilised the skills and knowledge of a wider reference group relevant to their specialism.

The BSc curriculum for Physiological Sciences in the Cardiovascular, Respiratory and Sleep Sciences theme has also been circulated to the following professional bodies and societies for their comments.

Cardiology

BCS – British Cardiovascular Society
BHF – British Heart Foundation
BSE – British Society of Echocardiography
HRUK – Heart Rhythm UK

IPS – Institute of Physiological Sciences
RCCP – The Registration Council for Clinical Physiologists
SCST – Society for Cardiological Science and Technology

Respiratory and Sleep
ARTP – The Association for Respiratory Technology and Physiology
BSS – British Sleep Society
BTS – British Thoracic society

In addition, as this Practitioner Training Programme (PTP) may generate future entrants into STP programmes the following professional bodies and societies were also asked for their comments:

Autonomic Science
SCCT – Society for Critical Care Technologists
SVT – Society for Vascular Technology

2015 revision

Chris Eggett	Lead editor, University of Newcastle
Andrea Arnold	Cardiac Science
Victoria Cooper	Sleep Science
Dave Richley	Cardiac Science
Joanna Shakespeare	Respiratory Physiology

In addition to the professionals detailed above, 23 patient groups, 54 professional bodies/groups and 26 PTP accredited higher education institutions were alerted to the opportunity to give feedback on the proposed revisions to the scientific content between December 2015 and February 2016.

Appendix 2: BSc (Hons) Healthcare Science Amendments
March 2016

Generic changes
The BSc (Hons) curriculum has been amended and is now presented in a single document which includes both the BSc syllabus and the work-based Learning Guide.

The Introduction (Section 1) has been updated and amended to reflect the totality of the curriculum and apprenticeships. A background to the Modernising Scientific Career (MSC) programme has been added and the importance of *Good Scientific Practice* (GSP) in setting the standards of practice in healthcare science has been emphasised. There has been additional information and emphasis in areas such as: entry routes, progression, patient and public involvement, accreditation through the National School of Healthcare Science, programme delivery and monitoring, student support and mentoring and clarity about a number of issues around programme delivery.

Key professional practice learning outcomes have been added through the GSP syllabus (Section 3), which embeds the standards of professionalism set out in GSP in all aspects of the delivery and assessment of the programme. The GSP syllabus is a common component of all PTP curricula and must be followed throughout the whole training period, with engagement at the appropriate level, depending on the stage of training.

The Professional, Scientific and Technical modules (Section 4) have been revised.

Division-theme and specialist CVRS content
Following wide consultation during 2015/2016 this curriculum has been reviewed, corrected and updated. Learning outcomes have been reduced and descriptors refined. Modules have been mapped to *Good Scientific Practice*. Indicative content has been expanded to improve clarity. Within cardiac science, ECG knowledge, previously split between taught modules and work-based modules, has been consolidated within the taught module. Sleep science elements are more specifically defined in this version of the curriculum with greater emphasis on this area in both learning outcomes and indicative content. The application of remote technology and developments in genomic medicine have been incorporated into the relevant aspects of this revised curriculum reflecting current interest in these emerging fields.

April 2017

The recommended number of assessments per year on p.20 was clarified and a table added to illustrate this. The new version of the curriculum is PTP CVRS 1.01 2016.

For any queries regarding this change please email: nshcs@wm.hee.nhs.uk

Appendix 3: Abbreviations

Generic abbreviations

AHCS	Academy for Healthcare Science
AO	Assessment Organisation
APL	Accreditation of Prior Learning
BSc	Bachelor of Science
CAS	Central Alerting System
CBD	Case Based Discussion
CEL	Clinical Experiential Learning
COSHH	Control of Substances Hazardous to Health
CPD	Continuing Professional Development
CPPD	Continuing Personal and Professional Development
CSO	Chief Scientific Officer
CT	Computer Tomography
DH	Department of Health
DICOM	Digital Image and Communications in Medicine
DfE	Department for Education
DOPs	Direct Observation of Practical skills
EPA	End-point Assessment
ETSG	Education and Training Scrutiny Group
ETWG	Education and Training Working Group
EU	European Union
FHEQ	Framework for Higher Education Qualifications
FtP	Fitness to Practise (FtP)
GCP	Good Clinical Practice
GM	Generic Module (Professional, Scientific and Technical)
GSP	Good Scientific Practice
HCPC	Health and Care Professions Council

HCS	Healthcare Science
HCSP	Healthcare Science Practitioner
HEE	Health Education England
HEI	Higher Education Institutions
HL7	Health Level 7
IBMS	Institute of Biomedical Science
ICT	Information and Communication Technologies
IOE	Institute of Education
IT	Information Technology
LETB	Local Education and Training Board
MDA	Medical Device Alerts
MDT	Multidisciplinary Team
MHRA	Medicines and Healthcare products Regulatory Agency
MRI	Magnetic Resonance Imaging
MSC	Modernising Scientific Careers
NES	NHS Education for Scotland
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NHS	National Health Service
NSHCS	National School of Healthcare Science
OCE	Observed Clinical Event
OLAT	Online Assessment Tool
PACS	Picture Archiving and Communications Systems
PSA	Professional Standards Authority
PTP	Practitioner Training Programme
QA	Quality Assurance
QAA	Quality Assurance Agency
QC	Quality Control
QMS	Quality Management System
RoAAO	Register of Apprenticeship Assessment Organisations
RoATP	Register of Apprenticeship Training Providers

SCQF	Scottish Credit and Qualifications Framework
SFA	Skill Funding Agency
SJT	Situational Judgement Test
SPECT	Single Photon Emission Computed Tomography
UCAS	The Universities and Colleges Admissions Service
UK	United Kingdom

Programme Specific Abbreviations (CVRS)

AHI	Apnoea Hypopnoea Index
AVRT	Atrio-Ventricular Re-entrant Tachycardia
AVNRT	Atrio-Ventricular Nodal Re-entrant Tachycardia
BMI	Body Mass Index
BP	Blood Pressure
CO	Carbon Monoxide
CP	Cardiac Physiology
CPAP	Continuous Positive Airway Pressure
CVRS	Cardiovascular, Respiratory and Sleep
DVLA	Driver & Vehicle Licensing Agency
ECG	Electrocardiogram
FEV_1	Forced Expiratory Volume in 1 second
FRC	Functional Residual Capacity
FVC	Forced Vital Capacity
IRMER	Ionising Radiation (Medical Exposure) Regulations
MFVC	Maximal Flow Volume Curves
ODI	Oxygen Desaturation Index
IQIPS	Improving Quality In Physiological Sciences
OSAHS	Obstructive Sleep Apnoea Hypopnoea Syndrome
PAP	Positive Airway Pressure
PCI	Percutaneous Coronary Intervention
PEF	Peak Expiratory Flow

PLMS	Periodic Limb Movement in Sleep
RS	Respiratory and Sleep Science
RV	Residual Volume
SOP	Standard Operating Procedure
SpO_2	Average Oxygen Saturation
TGV	Thoracic Gas Volume
TLC	Total Lung Capacity
VC	Vital Capacity

Appendix 4: Glossary

Term	Definition
Clinical experiential learning	The cyclical process linking concrete experience with abstract conceptualisation through reflection and planning.
Clinical experiential learning outcomes	The activities that the student will undertake to enable and facilitate their learning in the workplace.
Competence	The ability of an individual to perform a role consistently to required standards, combining knowledge, understanding, skills, attitudes, behaviour and values.
Competence statements	Active and outcome-based statements that provide a further breakdown of the work-based Learning Outcomes – reflecting what the student will be able to do in the workplace at the end of the programme. Each competence should be linked back to the numbered Learning Outcomes.
Component	An indication of the type of module within the curriculum, i.e. Generic, Theme or Specialist.
Curricula	An outline of the expected educational outcomes across a subject area. The learning that is expected to take place during the Practitioner Training Programme described in terms of knowledge, skills, attitudes, behaviours and values.
Division	A high-level description of an area of practice within healthcare science. There are four divisions: Life Sciences, Physical Sciences, Physiological Sciences and Clinical Bioinformatics.
Domains of learning	Cognitive (knowledge and intellectual skills), affective (feelings and attitudes), interpersonal (behaviour and relationships with others) and psychomotor (physical skills).
Feedback	Specific information about the comparison between a student's observed performance and a standard, given with the intent of improving the student's performance (van de Ridder JMM, Stokking KM, McGaghie WC and ten Cate OT. What is feedback in clinical education? *Medical Education* 2008: 42: 189–197).
Good Scientific Practice	Non-statutory guidance on the minimum requirements for good practice for the healthcare science workforce.
Job	A specific definition of the work activities, requirements and skills required to undertake work activities within a local context. This differs from a role – see below.
Key learning outcome	A defined learning outcome linked to relevant competence(s) within the work-based Learning Framework.
Learning framework	The specification for work-based learning contained within the work-based syllabus.

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

Appendix 5: Assessment Proformas

A5.1: Direct Observation of Practical/Procedural Skills Template

Student identification data			
Procedure			
Clinical context	**Insert module title**	**Insert module title**	**Insert module title**

Assessor's name					
Assessor's position				**Insert**	**Insert**

Difficulty of the procedure		**Low**	**Average**	**High**
Number of times procedure performed by student		**1–4**	**5–9**	**>10**

Please grade the following areas using the scale below	**Below expectations**	**Borderline**	**Meets expectations**	**Above expectations**	**Unable to comment**[1]
1. Understands scientific principles of procedure, including basic science underpinning it					

Please grade the following areas using the scale below	Below expectations	Borderline	Meets expectations	Above expectations	Unable to comment[1]
2. Has read, understands and follows the appropriate standard operating procedures, risk and COSHH assessments, and any other relevant health and safety documentation					
3. Understands and applies the appropriate internal and external quality control associated with the procedure					
4. Understands the risks associated with items of equipment and uses them appropriately					
5. Completes associated documentation accurately					
6. Output meets accepted laboratory/professional standards					
7. Carries out the procedure within the appropriate time frame					

Please grade the following areas using the scale below	Below expectations	Borderline	Meets expectations	Above expectations	Unable to comment[1]
8. Is aware of the limitations of the test					
9. Demonstrates awareness of the limits of responsibility and when to seek advice					
10. Professionalism					

[1]Please mark this if you have not observed the behaviour.

FEEDBACK AND DOCUMENTATION OF LEARNING NEEDS	AGREED ACTION

Outcome	Satisfactory	Date of		Time taken for	

	Unsatisfactory		**assessment**		**assessment**	
Signature of assessor		**Signature of student**			**Time taken for feedback**	

A5.2: Case-based Discussion Template

Student identification data			
Brief description of output and focus of scenario discussed			
Module	**Insert title**	**Insert title**	**Insert title**
Complexity of the scenario	**Low**	**Average**	**High**

Assessor's name	
Assessor's position	

Please grade the following areas using the scale below	**Below expectations**	**Borderline**	**Meets expectations**	**Above expectations**	**Unable to comment**[1]
1. Understands clinical and/or scientific principles relevant to scenario					
2. Can discuss relevant health and safety issues					

Please grade the following areas using the scale below	Below expectations	Borderline	Meets expectations	Above expectations	Unable to comment[1]
3. Can discuss the procedures used to obtain the results					
4. Can discuss the quality control procedures to ensure the result is accurate					
5. Demonstrates a knowledge of relevant 'Best Practice' guidelines and other policies relevant to the scenario					
6. Can discuss the significance of routine patient results with reference to the reason for referral					
7. Is aware of, and can use as required, appropriate resources to aid in the interpretation of results					
8. Is aware of the importance of the audit trail and can complete the audit trail accurately					

Please grade the following areas using the scale below	Below expectations	Borderline	Meets expectations	Above expectations	Unable to comment[1]
9. Demonstrates awareness of the limits of responsibility and when to seek advice					
10. Professionalism					

[1]Please mark this if you have not observed the behaviour.

FEEDBACK AND DOCUMENTATION OF LEARNING NEEDS	AGREED ACTION

Outcome	Satisfactory Unsatisfactory		Date of assessment		Time taken for assessment	
Signature of assessor		Signature of student			Time taken for feedback	

A5.3: Observed Clinical Event Template

Student identification data			
Brief description of output and focus of scenario discussed			
Module	**Insert title**	**Insert title**	**Insert title**
Complexity of the scenario	**Low**	**Average**	**High**

Assessor's name	
Assessor's position	

Please grade the following areas using the scale below	**Below expectations**	**Borderline**	**Meets expectations**	**Above expectations**	**Unable to comment[1]**
1. History taking *Does the student obtain the information required prior to undertaking a procedure from the patient or a clinical colleague?*					
2. Communication skills *e.g. Does the student use language appropriate to the situation (verbal and/or body language) when explaining or discussing an aspect of clinical care (test results, diagnostic procedure, equipment repair at the bedside), do they check the understanding of the patient or their*					

Please grade the following areas using the scale below	**Below expectations**	**Borderline**	**Meets expectations**	**Above expectations**	**Unable to comment[1]**
colleague?					
3. Clinical examination skills *e.g. Does the student undertake a clinical skill, such as locating a vein for phlebotomy, performing a diagnostic test appropriately and accurately?*					
4. Clinical judgement *e.g. Is the procedure correct for the required outcome?*					
5. Scientific judgement *e.g. Was the choice of equipment appropriate for the required outcome, has it been correctly calibrated and any necessary settings correctly applied?*					
6. Professionalism *e.g. Did the student introduce themselves and their role or did they discuss the procedure/result with a colleague using appropriate language, considering any patient confidentiality or ethical issues?*					
7. Organisation and efficiency *e.g. Was the student well organised and efficient, ensuring all record keeping was appropriate and accurate; did they keep to time and ensure accurate recording of results; did they process the results in a timely fashion?*					

Please grade the following areas using the scale below	**Below expectations**	**Borderline**	**Meets expectations**	**Above expectations**	**Unable to comment[1]**
8. Overall clinical care *e.g. Did the student show respect, empathy and compassion for the patient and/or recognise the importance of the procedure/test within the care pathway for the patient or colleagues where the test contributes to a diagnosis, treatment or management?*					

For specific examples of opportunities where an OCE may be appropriate please visit the National School of Healthcare Science website (www.nshcs.org.uk/).

Appendix 6: Further Information

NHS Networks

An open network to share curricula produced for the Modernising Scientific Careers (MSC) programme.
www.networks.nhs.uk/nhs-networks/msc-framework-curricula/

Details of the Practitioner Training Programme including curricula from 2010/11 to 2015/16 can be found at:
www.networks.nhs.uk/nhs-networks/msc-framework-curricula/ptp

Details of the Practitioner Training Programme including curricula from 2016 onwards can be found at:
https://www.nshcs.hee.nhs.uk/

National School of Healthcare Science (NSHCS)

As part of the Modernising Scientific Careers (MSC) programme, the National School of Healthcare Science (the School) was established in October 2011 to support the implementation and delivery of the new healthcare science education and training programmes and to comply with the structures within 'Liberating the NHS: Developing Healthcare Workforce - Policy 16977 (January 2012)' acting on behalf of the Chief Scientific Officer (CSO) for England. It also provides some elements of support for the three other UK health departments.

On 1st April 2013, the School became part of Health Education England (HEE) and is hosted within the West Midlands.
The role of the NSHCS includes:

- Curricula management including assessment (new developments; review; fitness for purpose; version control etc);
- Coordination and monitoring of MSC Education and Training implementation;
- Quality management including accreditation of academic and work-based training environments;
- Monitoring and supporting the progress of trainees through the NSHCS themed boards (STP/HSST).

www.nshcs.org.uk

Chief Scientific Officer (CSO)

Source of information and news, including the CSO Bulletin, latest press releases, publications and consultations can be found at:
https://www.england.nhs.uk/tag/chief-scientific-officer/

Academy for Healthcare Science (AHCS)

The Academy for Healthcare Science (AHCS) brings together the UK's diverse and specialised scientific community who work across the health and care system including; NHS Trusts, NHS Blood and Transplant, Public Health England, independent healthcare organisations, and the academic sector across the UK.

The AHCS runs a Professional Standards Authority accredited Register for Healthcare Science Practitioners not covered by statutory regulation.
www.academyforhealthcarescience.co.uk/

Council of Healthcare Science in Higher Education (CHSHE)

The Council of Healthcare Science in Higher Education builds a unified identity of academic healthcare science by representing the interests of the sector. Working to improve and maintain quality in healthcare science education and training, the Council itself is made up of senior members of the academic healthcare science team. The work of the Council is also informed by two special interest groups made up of staff involved in the delivery and implementation of MSC programmes the PTP SIG and STP SIG.
www.councilofhealthcarescience.ac.uk/

Health and Care Professions Council (HCPC)

The Health and Care Professions Council is a regulator set up to protect the public. It keeps a register of health professionals who meet the HPC standards for their training, professional skills, behaviour and health.
www.hpc-uk.org/

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