EST 1892 LSBU

Course Specification

A. Course Information			
Final award title(s)	BSc (Hons) Biomedical Science (with Foundation Year)		
Intermediate exit award title(s)	Certificate in Higher Education (Cert HE) Diploma in Higher Education (Dip HE)		
UCAS Code	C500	**Course Code(s)**	5926
Awarding Institution	London South Bank University		
School	☒ ASC ☐ ACI ☐ BEA ☐ BUS ☐ ENG ☐ HSC ☐ LSS		
Division	Human Sciences		
Course Director	Professor Eiman Abdel Aleem, PhD, MSc, BSc (Hons), SFHEA, FIBMS		
Delivery site(s) for course(s)	☒ Southwark ☐ Havering ☐ Other: please specify		
Mode(s) of delivery	☒Full time ☐Part time ☐Sandwich		

Length of course/start and finish dates

Mode	Length years	Start – month	Finish – month
Full time	4	September	July
Full time with placement/ sandwich year			
Part time			
Part time with Placement/ sandwich year			

Is this course suitable for a Visa Sponsored Student?	Please complete the International Office questionnaire Yes (FT only) Students are advised that the structure/nature of the course is suitable for those on a Tier 4 visa but other factors will be taken into account before a CAS number is allocated.	
Approval dates:	Course(s) validated	June 2023
	Course review date	June 2025
	Course specification last updated and signed off	June 2023
Professional, Statutory & Regulatory Body accreditation	Institute of Biomedical Science (IBMS)	
Reference points:	Internal	LSBU Corporate Strategy 2020 -2025

		Academic Quality and Enhancement Website LSBU Mission Statement and Strategic Plan LSBU Core Skills Policy LSBU Academic Regulations Applied Sciences School Roadmap 2020-2025
	External	Subject Benchmark Statement for Biomedical Science (QAA, 2019) Framework for Higher Qualifications (QAA, 2018) SEEC Credit Level Descriptors, 2021 Criteria and Requirements for the Accreditation and Re-accreditation of BSc (Hons) degrees in Biomedical Science (2021-2022), V2 Office for Students (OfS) Guidance

B. Course Aims and Features

Distinctive features of course	**The Foundation Year features:** The Foundation Year provides students with a solid foundation in academic skills and science-related disciplines; instilling knowledge and practical skills that will prepare them for the BSc (Hons) Biomedical Science. The course is structured such that all S1 modules are shared across all BSc with foundation year programmes in the School of Applied Sciences. Students who wish to change programme at the end of S1 can do so through consultation with the course director of both their parent programmes and the programme they wish to change too. This is subject to approval by both Course Directors and successfully passing all S1 modules. **The aims and features of the BSc (Hons) Biomedical Science are as follows:** This innovative programme is designed primarily for those students wishing to pursue careers as biomedical scientists in clinical service laboratories in any of the BMS specialist fields (Blood Science, Cellular Pathology, Clinical Microbiology or Molecular Science) or in biomedical research and pharmaceutical industry. "An honours degree in Biomedical Science accredited by the IBMS is acceptable as a preliminary academic qualification for registration with the Health and Care Professions Council (HCPC). By undertaking a period of laboratory training and completion of the Institute's Registration Training Portfolio for the award of a Certificate of Competence, individuals are able to demonstrate they meet the fitness to practice standards (HCPC Standards of Proficiency) required for registration as a biomedical scientist. The degree gives eligibility for Licentiate membership of the IBMS*"* (Criteria and Requirements for Accreditation and Re-accreditation of BSc (Hons) degrees in Biomedical Science (final-4, 2020-2021). The course provides students with understanding and in-depth knowledge of human health and disease, and with embedded employability skills. In addition, two modules are entirely dedicated to developing employability skills and work experience. Students will acquire knowledge, intellectual and practical skills to understand human disorders and means of disease diagnosis and treatment through laboratory testing. A distinctive feature of the course is that it introduces the students to state-of-the-art tools used in precision medicine, such as bioinformatics, genomics, transcriptomics, proteomics, and high-throughput drug screening geared towards molecular target identification and targeted therapeutics. This falls under the BMS specialist field of

	Molecular Science. Furthermore, students will be trained to apply their knowledge to offer solutions and to develop opportunities in a wide range of clinical settings and industries that require a broad understanding of biomedical science. All the required core- and subject-specific biomedical science areas are covered as core modules in this course. Therefore, all students will gain the subject knowledge, practical and transferable skills that enable them to work as biomedical scientists, regardless of their chosen career track. In addition, the course allows students, through optional modules and/or University shared modules, to gain knowledge in areas, such as clinical, and pharmaceutical sciences. Graduates with BSc (Hons) Biomedical Science (FT) may apply for medical school (if they meet all the criteria required for graduate entry medicine), or pursue careers in biomedical research and, pharmaceutical industry.
Course Aims	**The BSc (Hons) Biomedical Science foundation year aims to:** 1. Develop academically confident "level 4 ready" students through the provision of a supportive learning environment at Foundation Level that nurtures the development of the theoretical knowledge, academic and practical skills necessary to successfully study the BSc (Hons) Biomedical Science. 2. Introduce the student to critical reflection, analytical and problem solving and strategic thinking in a broad context at Foundation Level. 3. Develop the academic and scientific knowledge skills and competencies necessary to promote success in degree level study of Biomedical Science. 4. Enhance student employability through the embedding of a cohesive blend of professional and academic skills whilst simultaneously providing career support and making available opportunities for problem-based learning, volunteering and engaging in extra-curricular activities at university and beyond. 5. Deliver a future-fit curriculum at Foundation level that is aligned to the BSc (Hons) Biomedical Science. **The BSc (Hons) in Biomedical Science aims to:** 1. Enable students to understand the biology of human health and disease, including the basic knowledge of human anatomy and physiology, cell biology, genetics and molecular biology, biochemistry, immunology, and microbiology. 2. Provide students with practical and laboratory skills relevant to the field of biomedical science and enable them to design and carry out an independent research project. 3. Provide the knowledge and understanding of disease processes in the context of laboratory investigations through clinical modules such as cellular pathology and imaging, clinical biochemistry, haematology and blood transfusion, and medical microbiology.

	4. Provide competency in data analysis, statistics, numeracy, an overview of big data analysis, and health informatics through the modules of bioinformatics and research skills for biomedical scientist, and clinical OMICS and precision medicine. 5. Make students aware of employability pathways early on, and develop their leadership skills, analytical thinking, critical evaluation, and entrepreneurial skills, teamwork, time management, negotiation skills and communication skills, particularly those from local areas in accordance with the policies and practice of equality and diversity. 6. Develop students' awareness of the need for compliance with health and safety policies, good laboratory practice, risk and COSHH assessments, the Human Tissue Act and the importance of quality control and quality assurance.
Course Learning Outcomes	**On successful completion of the course**: **Biomedical Science Foundation Year learning outcomes:** **Students will have knowledge and understanding of:** S1: The scientific disciplines which underpinning the study of Biomedical Science (biology; chemistry and physics) S2: The role of Biomedical Science in the context of human health and disease. S3: The different disciplines of Biomedical Science and their role in understanding human health and disease. S4: The specialist fields of Biomedical Science. S5: The application of academic and scientific skills including numerical and statistical methods, academic and scientific writing, communication, and presentation skills. S6: The application of appropriate scientific knowledge and understanding to facilitate the understanding of Biomedical Science theory, laboratory methods, data collection, processing, and interpretation. **A. Students will demonstrate knowledge and understanding of:** A1. The basic biology of human health and disease represented by the disciplines of human anatomy and physiology, cellular, genetic, and molecular biology, microbiology, immunology, chemistry, physics and biochemistry. A2. Basic principles of laboratory-based diagnostic and analytical techniques used in clinical pathology, human haematology and clinical immunology, clinical biochemistry and blood transfusion, and medical microbiology. A3. Aetiology, progression, and diagnosis of human diseases to support clinical management and treatment selection.

	A4. Bioinformatic and statistical principles for analysis of big data for the study of genomics, proteomics and transcriptomics, and their application in precision medicine. A5. Research design, quantitative/qualitative methods, critical review of evidence in the biomedical sciences, data interpretation, reporting, biosafety, ethics, and conduct. **B. Students will develop their intellectual skills such that they are able to:** B1. Apply theories, paradigms, concepts, or subject-specific principles to a new context. B2. Obtain and integrate lines of subject-specific evidence to formulate hypotheses, design experiments, critically evaluate data and use it to develop research proposal. B3. Demonstrate independence of thought to identify the key features of a problem and suggest possible means of investigation. B4. Keep abreast of current insights in core and specialist areas of biomedical science. B5. Recognise the moral and ethical issues of investigations and appreciate the need for ethical standards and professional codes of conduct. B6. Synthesise, analyse, and summarise a body of information and come to an informed and logically consistent conclusion. **C. Students will acquire and develop practical skills such that they are able to:** C1. Demonstrate competence in the basic experimental skills relevant to cell and molecular biology, genetics, human anatomy and physiology, medical microbiology, cellular pathology, and imaging, clinical biochemistry, and blood transfusion. C2. Demonstrate knowledge of quality assurance and quality control principles, hazard identification, risk assessment and safety procedures associated with a particular technique or methodology. C3. Select and apply appropriate techniques and evaluate alternative methodologies for an investigation or to complete a process. C4. Undertake practical investigations in a responsible, safe, and ethical manner, while observing relevant health and safety regulations. C5. Organise and allocate duties, set targets, and evaluate progress in achieving specific technical goals, evaluate own performance and performance of others within a team. C6. Use relevant numerical quantitative techniques and demonstrate competence in bioinformatic and statistical methods to validate, calibrate and analyse big data. C7. Present data in seminars or small-group tutorials to develop interpersonal skills such as information retrieval, problem-solving, communication and team working.

	C8. Demonstrate competence in the use of word-processors, spreadsheets, biological databases, and data presentation packages. **D. Students will acquire and develop transferrable skills such that they are able to:** D1. Identify individual and collective goals and responsibilities. D2. Develop the ability to work on one's own initiative and manage one's own time to meet deadlines. D3. Develop negotiation skills, and lifelong learning in the field of biomedical science including enterprise and knowledge transfer skills. D4. Provide reflective and evidence-based solutions to problems. D5. Recognise and respect the views and opinions of other team members. D6. Evaluate their own performance as an individual and as a team member, as well as the performance of others. D7. Develop a flexible and effective approach to study and work. D8. Communicate ideas, arguments, and concepts in a rational and systematic way, using a variety of media. D9. Clearly communicate in writing for both academic and lay audiences. D10. Use the full range of sources of information, citing references properly and avoiding plagiarism.

C. Teaching and Learning Strategy

i) The level S (year 1) outcomes will develop the student's ability in the context of academic, literacy, numeracy and subject specific skills. This will be achieved through a range of teaching and learning approaches that will include formal lectures, seminars, group work, problem-based learning and laboratory work.

ii) The teaching and learning (T&L) strategy employed in the course is designed to encourage a progressive approach towards the acquisition of subject knowledge and practical skills in a gradual manner, thus leading the students from a greater level of support provided in level 4 (year 2) towards a more independent and self-directed learning at level 6 (year 4).

iii) Teaching and learning activities vary based on the module aims and learning outcomes. All modules offered at level S provide the basic background of Chemistry, physics and Biochemistry, Cell Biology, Human Anatomy and Physiology, Genetics and Molecular Biology, Microbiology, and Immunology (A1) through a blend of keynote lectures, tutorials, group work, flipped learning, and problem-based learning activities. Many of the L4 modules develop and assess practical skills for which students have to demonstrate competence. The laboratory-based practical will predominantly use approaches that engage students through structured laboratory demonstrations, practical experiments, group work, and problem-based learning. Attendance/passing laboratory practical is compulsory to achieve an accredited degree. Developing the students' employability skills is of prime importance and these skills are introduced at L4 through the module "Employability Skills in Biomedicine".

iv) After students gain the fundamental background in core biological subjects at level S (first year of study) and level 4 (second year of study) , they will be introduced at level 5 (third year of study) to modules dealing with aetiology of human disease, disease progression, diagnosis, and treatment (A2 and A3). These modules include Cell Pathology and Imaging, Human Haematology and Clinical Immunology and Clinical Biochemistry and Blood transfusion, which provide students with basic necessary skills to perform diagnostic tests in hospitals or in clinical laboratory settings. During level 5, the students will be also introduced into essentials of Bioinformatics, Biostatistics and into Research skills for Biomedical Scientists (A4); thus, allowing an assessment of student ability in Mathematics, Statistics, Bioinformatics and English. The social and ethical context of Biomedicine also begins in the Bioinformatics and Research skills for Biomedical Scientists module where students discuss case studies on some aspects of scientific ethics. The latter emphasises critical review and argument development using exercises, and reviews current key biomedical issues (A5). This module also begins the student's induction into the scientific method (A5). The latter is further developed in level 6 (fourth year of study in the Research Project in Biomedicine module, which concentrates on data generation, analysis, and presentation, including accessing and review of published sources. This module provides additional practice and assessment of research skills and scientific writing, and the students have to research and develop a workable project proposal to be conducted in their final year (A5).

v) At level 6, students will continue to receive training in clinical sciences such as in Medical and Public Health Microbiology. The Bioinformatics and Research skills for Biomedical Scientists module offered to the students at level 5 serves as a background for the Clinical OMICS and Precision Medicine module at level 6 (A5). The latter deals with current technologies in genomics, transcriptomics, and proteomics used in precision medicine for diagnosis, patients' stratification, and treatment options. This module will also introduce the students to the basics of systems biology (A5). In addition, students will select two optional modules relevant to the career choice.

vi) Lectures will convey major elements of the subject-specific content and provide explanations of difficult concepts. Lectures will facilitate the development of students' active listening skills, and enable them to appreciate how information is structured, and presented. Additionally, lectures will involve computer-based aids, and multimedia, as well as will encourage the interactive participation of students in groups.

vii) A schedule of personal tutoring monitors student progress especially during the first year. The details of this and the action taken by the student to address any weaknesses will be recorded (see Appendix B).

viii) All modules employ teaching methods that encourage students to consider and challenge the evidence with which they are presented. The assessment schedule requires students to question and evaluate the arguments surrounding some key concept or principle. This may be formally assessed or simply part of group discussions, debates or as part of some problem-solving exercises. Biology of the Cell, Biochemistry, Genetics and Molecular Biology at level 4 introduce the students to current thinking over a range of rapidly developing areas in biology and biomedicine, and to look at the different approaches being adopted to analyse these in a series of in-class workshops and coursework tasks (B1and B2). Bioinformatics and Research skills for Biomedical Scientists at level 5 and the Research Project in Biomedicine module at level 6 have specific lectures on how to approach the primary literature and evaluate the evidence presented (B1, B2, B3, B4). This is assessed by the project proposal the student is required to generate as part of this module (B2), in preparation for their final year, and which must include a preliminary experimental design (B2, B3). The topics selected for the research proposal must be current and up to date, thus requiring the students to keep abreast of current insights in core and specialist areas of biomedical science (B4). According to the criteria for IBMS accreditation (2020-2021), the research project will be either lab-based, or in bioinformatics or biostatistics such as meta-analysis. Additionally, the research proposal will have to be approved by the research ethics committee at the school, thus requiring the students

to recognise the moral and ethical issues of investigations and appreciate the need for ethical standards and professional codes of conduct (B5). The final year project report must finish by placing the findings in the context of current thinking (B6).

ix) Laboratory skills and technical proficiency in analytical methods are developed from the first (year to the fourth year modules through practical elements that offer subject-specific techniques (C1, C2 and C3). This is further reiterated during the final year Project.

x) Through the two employability-focused modules (Employability skills in Biomedical Science at L4 and Work Experience in Biomedical Science at L5, year 3) we will provide the students with the opportunity to apply the intellectual (B1-6), the practical (C1-8), and transferable skills (D1-10) acquired throughout the program and will prepare them for their chosen careers. Additionally, at L5, each student will select one optional module relevant to their career choice.

xi) A key emphasis of the Biomedical Science programme is the development of the student's practical and analytical skills through subject-specific and generic practical. Students are inducted into teamwork skills, and into health and safety regulations, and their evaluation from their first sessions in Bioinformatics and Research skills for Biomedical Scientists (C4). Part of their assessment is to evaluate their performance and that of their group, to encourage them to be reflective about their approach (C5), and to manage their activity to best effect.

xii) Skills in Biostatistics and Bioinformatics, and *in silico* approaches to practical work are developed at level 5 and 6 to analyse big data using relevant biological databases (C6).

xiii) Presentation skills are practiced from level S and 4 and extend up to level 6 in most modules. Group work, including the use of word processing software, spreadsheets and presentations that review recent scientific literature, features in several subject-specific modules at level 5 and 6 and in the Research Project in Biomedicine module (C7 and C8). Bioinformatics and Research skills for Biomedical Scientists and subject-specific modules encourage the students to consider alternative ways to approach specific problems, or to address specific questions (C1, C2, C3), typically through their practical work. In this way we are able to build student confidence in their technical and practical skills and reinforce the basic concepts delivered in the associated lecture programme.

xiv) The transferable skills are fully mapped through the curriculum, principally through the core modules. Career Management Skills will be offered through the Employability skills in Biomedical Science at level 4, in addition to the annual employability workshop, in which the course team and representatives from relevant sectors will give talks about career options and skills required for different career pathways. The module and workshop will also involve group work facilitated by staff members to help the students identify individual goals (D1), and to introduce them to negotiation skills and self-development skills (D3). This is to ensure that personal development planning is mapped throughout the course, is obvious, and transparent to the students and is fully supported by the personal tutoring system from the first year. There is also subsequent testing of scientific writing skills (D9) and preparation for researching future possible careers. A number of further tasks assessed in Bioinformatics and Research skills for Biomedical Scientists measures students' progress in managing their own learning (D2) and students are required to assume responsibility for this, under the guidance of their personal tutor. In-class worksheets, problem-solving exercises and group-based work at level 4 and level 5 provide rapid feedback and encourage students to review and develop their approaches to their learning (D4, D7). Across most modules students are required to work in teams, and to present in front of peers to develop communication skills (D8), the skills of respecting opinions of other team members (D5), and the skills of evaluating their own- and others' performance (D6). Through preparing their final year project students will learn to cite references and avoid plagiarism (D10).

xv) Excellent command of technical English is essential for biomedical scientists. Students whose first language is not English will have several opportunities to improve their language skills on the levels

of reading, comprehension, speaking and writing so that at the point of graduation they must attain the equivalent of IELTS level 7.0. All lectures, tutorials and laboratories are in English. Presentation and writing skills are practiced from level 4 and extend up to level 6 in most modules, culminating with writing a research project of 8000 words at L6 and presenting the results in a *viva voce*. English language skills are also embedded within the "academic skills development plan" that the School of Applied Sciences will scaffold around degree programs to specifically develop both academic/graduate and employability skills in our students and ensure increased opportunity for student success and progression to employment. These skills include the development of reading and writing skills. All enrolled BMS students will be required to complete the Personal Development Plan and write a reflection about the results during the first two weeks of the first year of study (L4). Themes within the academic skills development toolkit, including development of English reading and writing skills are available through this link: https://www.lsbu.ac.uk/research/academic-skills-toolkit. Additionally, students may want to join the preparation for IELTS course at Lambeth College, which is part of the LSBU group. This course is designed for students who would like to improve their language skills for study or job in the UK. On this course students will practice and improve their reading and writing skills and undergo intense study and practice grammar. More information about this course is available at https://www.southbankcolleges.ac.uk/courses/esol/preparation-for-ielts.

xvi) Digitally Enhanced Learning will be incorporated into the T&L strategy to develop and support learning. Examples will include the University VLE (Moodle), Panopto lecture capture and on-line formative assessment platforms, discussion groups and remote tutorial support.

xvii) Students will be expected to engage in independent learning as outlined in each of the module descriptor documents which will be made available on the Moodle sites. Where appropriate this learning will be guided by staff via tasks set in class and on the VLE.

xviii) A wide range of subject-related resources are available within the LSBU Library. These reflect a typical academic repository that includes access to textbooks, licensed E-journal subscriptions, scientific databases, interactive e-learning platforms, and multimedia. Moreover, students have access to site-licensed software and assistive technologies to support their learning (if registered for Disability and/or specific learning difficulties).

xix) The current infrastructure is well equipped to support the course. There are a total of 7 teaching and research laboratories that provide a rich learning environment for combining theory and practice. Each contains state-of-the art equipment to support delivery across all core and specialist modules.

xx) The core staff that will teach on the programme comprise: 1 Professor, 2 Associate Professors, 2 Senior Lecturers, and 3 Lecturers (at the time of writing). Contributions to the programme may also be made by guest lecturers, external practitioners from the NHS as hourly paid lecturers and postdoctoral trainees. All staff are appropriately qualified and where postdoctoral trainees are involved, they will be appropriately trained and supervised.

D. Assessment

- Assessment will be progressive in terms of level and content and leads to effective feedback to enable development of students' knowledge and skills as per the subject benchmark statement-biomedical science-2019.

- The course will use a blend of formative and summative assessment, as well as self- and peer assessment. Formative assessment will provide structured feedback to support students in the summative task, therefore scaffolding the approach to assessment and ensuring appropriate development of critical thinking, academic writing, practical and technical comprehension, and creativity.

- Students experience variety of assessment during their first and second years, including testing of their practical and analytical skills through level S and 4 modules' coursework, practice tests and laboratory reports. Proficiency in Mathematics and English is assessed during the Bioinformatics and Research skills for Biomedical Scientists module (A4). Knowledge is tested by unseen written examinations in as well using essays or problem-solving exercises across the modules (A1, A2, A3).

- Level 5 and 6 assessments is a combination of examination, a variety of coursework, including presentations, essays, in-class problem-solving exercises and calculations (A4), devising of experiments (A5), case studies and a final year project (A5). The latter develops out of an extended literature search and initial experimental design (project proposal) submitted at level 5 within Bioinformatics and Research skills for Biomedical Scientists module.

- Most examination papers at level 5 and all at level 6 also demand the intellectual skills. English language skills (comprehension, reading and writing) will be assessed through coursework essays and extended essays at all levels. Real world problem-based learning exercises at all levels typically require students to work individually or collectively by applying their understanding of current thinking or methodologies to a new context (B1, B2, B3).

- Assessments in the Bioinformatics and Research skills for Biomedical Scientists module require the students to demonstrate their competence using the range of bioinformatics tools, and statistical methods using worksheets completed on regular basis in compulsory workshops (C6, C8). The rest of the assessment for the latter module requires students to produce a viable experimental design through discussion with their supervisor, in preparation for their final year project (C2, C3, C4, C5).

- Their capacity to summarise and critically evaluate methodologies is assessed in the Research Project in Biomedicine module at level 6 (C2, C3, C4, C5, C7, C8). This module also seeks to establish good investigative techniques, by applying skills and attributes acquired in other modules, and as a result of working in close association with a supervisor on a well-defined experiment (C3). The assessment here requires the student to keep a contemporaneous lab book and to produce a paper close to submission standard and defend this in a viva voce examination (C1-C8).

- A range of modules at level 4 and 5 require students to manage a task and to be able to communicate their findings to their cohort. Bioinformatics and Research skills for Biomedical Scientists requires them to summarise the recent scientific literature on a topic and use this to develop a hypothesis and associated experimental design. Some of the higher-level attributes are only fully assessed at level 6 in the largely independent work in the research project (D1, D2, D4, D8). These require a flexible approach to data acquisition, interpretation and presentation, and the use of a full range of sources of information and proper citations (D7, D10). The development of a research proposal and establishing an investigation protocol begins in Semester II of the second year as part of the assessment of Bioinformatics and Research skills for Biomedical Scientists (D1, D2, D8, D9).

- Employability and work experience skills are assessed at levels 4 and 5 through writing reports and group presentations, and a portfolio at L5.

- Presentations, debates, essay writing and seminars are used extensively at each level which assess these skills in addition to the students' English language skills (reading, comprehension, writing and speaking) and through feedback, students are encouraged to polish these skills up to their final year (D4, D8, D9). The case studies in Bioinformatics and Research skills for Biomedical Scientists assesses the student's ability to argue logically on a topic in scientific ethics (C2, C4). Once again, many of these skills and attributes are brought together to complete the final year project (D1-D10), and the assessment of these are one of the principal elements by which the graduate status of the student and their English language proficiency is assessed.

- Table 2 (below) shows how the course will be assessed by module. All career choices share a similar variety of summative assessment, with all comprising coursework (written essays, oral presentation, oral discussion, or group work) and the majority also include a final exam. Most modules carry several points of assessment; however, in some, there are sub-components of the coursework comprising a blend of assessments (e.g., practical demonstration + essay, or oral presentation + module viva). In the Research Project in Biomedicine module, 50% of the overall assessment will be for the 8000- word dissertation, 15% for the interim report, 20% for the project management, and the *viva voce* of the work will constitute 15% of the overall summative assessment for this module.

    - Students must achieve a pass mark in all assessment components for modules that cover the clinical laboratory sciences subject areas. Condonement/compensation will not be permitted for these modules or for any other module(s) that contribute significantly to the benchmark statement and have learning outcomes that students achieve that cannot be evidenced elsewhere (*IBMS criteria, 4.2 (v)*).

    - In order to obtain an award, students must pass all required modules (for the relevant award: CertHE; DipHE; Honours Degree) and gain the required number of credits as stated in the LSBU regulations.

E. Academic Regulations

The University's Academic Regulations apply for this course. Any course specific protocols will be identified here. IBMS accreditation requires that the students acquire practical skills to prepare them for biomedical science careers. For this reason, attending labs is a requirement for accreditation. Additionally, condonement and compensation will not be applied for this course. Intermediate exit awards such as Certificate in Higher Education (Cert HE) or
Diploma in Higher Education (Dip HE) will not include the title Biomedical Science.

F. Entry Requirements

In order to be considered for entry to the course, applicants will be required to have the following qualifications:

Entry to the Foundation year:

To be considered for entry to the course applicants would normally need at least 1 A level in a science subject or a minimum of 32 UCAS points from an equivalent L3 qualification as follows:

- BTEC Subsidiary/National/BTEC Extended Diploma) but may not have achieved the appropriate grades to immediately join the BSc Programme.
- English Language and Mathematics GCSE at grade C (grade 4) or above (or equivalent).

Entry to the foundation year will also consider conversion students, I.e. those students who wish to change their area of study / re-train.
Level 4

2023 entry

- A Level: BCC to include Biology and a second STEM subject or;
- BTEC National Diploma DMM ideally with a good Biology profile or;
- Access to Science with 39 Merits and 6 Passes including 12 credits in science related subjects or;
- Equivalent level 3 qualifications worth 104 UCAS points
- Applicants must hold 5 GCSEs minimum grade 4 including Maths, Biology and English or equivalent (reformed GCSEs grade 4 or above).

- We welcome qualifications from around the world. If English is not your first language an IELTS score of 6.0 overall or Cambridge Proficiency or Advanced Grade C (or equivalent) when you start the course is essential. In addition, English language will be assessed in different modules throughout your course. At graduation, you must be capable of attaining the equivalent of IELTS score 7.

Direct Entry to Level 5
Students with the knowledge and skills equivalent to the required learning outcomes for Level 4 modules of the BSc (Hons) Biomedical Science (FT) will be encouraged to make direct entry to Level 5. Such knowledge and skills should be commensurate with those identified in the IBMS criteria for accreditation handbook (QAA template), in the ***Policy*** and Procedures for the Accreditation of Prior Learning (APEL), of London South Bank University APEL, and in the guidelines on levels and learning outcomes produced by the South East of England Consortium for Credit Accumulation and Transfer (SEEC/CAT, May 1996, SEEC Credit Level Descriptors for HE, 2021)

G. Course structure(s)

Course overview

BSc (Hons) Biomedical Science [with Foundation Year]– **Full time**

- The course is structured around 480 credits. The course offers the award name of BSc (Hons) Biomedical Science [with Foundation Year] offered as a four-year full-time course or 5-year sandwich course. The course structure information is shown below followed by the listing of all modules potentially offered.

Awards are given in accordance with current London South Bank University Academic Regulations for Taught Programmes. The overall modular structure of the BSc (Hons) Biomedical Science is shown in Figure 1. Fourteen core modules (total credit accumulation: 300 credits), including a Research Project (40 credits) will be common to two career choices. In addition, three optional modules (total credit: 60 credits) will be required to be selected by students in level 5 and level 6 from each career choice (Table 1). The two career choices are i) Applied Medical Sciences, and ii) Pharmaceutical industry, (please see the course specifications for details).

The academic year will run as usual in two Semesters from September to June.

The degree will be offered as FT (4 years). Details of modular structure are shown in Tables, 2 and 3 below.

Table 1. Course Structure for BSc (Hons) Biomedical Science (With Foundation Year) (FT) 2023/24

Semester 1	Semester 2
Level S	
Introduction to academic Skills for the Applied Sciences	Foundations of Chemistry
Foundation Maths for Science	Foundations of Human Nutrition
Foundations of Biology	Foundations of Biomedical Science
Level 4	
Biochemistry	Genetics and Molecular Biology
Human Anatomy and Physiology	Microbiology
Biology of the Cell	Employability Skills for Biomedicine
Level 5	
Human Haematology and Clinical Immunology	Clinical Biochemistry and Blood Transfusion
Cell pathology and Imaging	Bioinformatics and Research Skills for Biomedical Scientists
Option	Work Experience
Level 6	

Research Project in Biomedicine	
Clinical OMICS and Precision Medicine	Medical and Public Health Microbiology
Option	Option

Option modules

Option modules will form coherent "career choices" within the course structure, so their individual selection will be defined by the students' interests. It is intended that the students will meet with their personal tutors and discuss their personal career plans to ensure the selected Options are appropriate and meet their individual aspirations. Seven Option modules are included in the Module Descriptor document (at the time of writing). These modules meet the credit requirements of any of the two career choices shown in Table 1. Additional Option modules will be added as the course is developed.

Table 2 Optional modules for BSc (Hons) Biomedical Science (FT)

"Career Choice"	Level	Option
Applied Medical Sciences	5	Stem Cells and Developmental Biology
	6	Cancer Biology and Therapy, Neuroscience and Aging, Clinical Nutrition, and the Microbiome
Pharmaceutical Industry	5	Introduction to Pharmacology and Toxicology
	6	Bioreactors, Drug Design and Development

Employability

Maximising graduate employment opportunity is a central consideration in the design of the proposed career choice(s) in Biomedical Science. In addition to the array of graduate skills, both transferable and subject-specific, that the course is providing throughout the modular structure, a graduate employability workshop will be offered during Level 4. This workshop will host representatives from diverse professional bodies. The purpose of this workshop is to help the students identify the career choice they want to pursue from the first year of their studies. The workshop will also include talks highlighting relevance of learning to employability, and practical skill acquisition in presentation, CV writing and communicating to diverse audiences. In addition, two core employability and work-experience modules are offered to develop the students' professional skills in biomedical science.

Career choices and option modules: At the end of L4, students will choose the career track they would like to follow, as well as option modules relevant for each career choice. An optional career choice will only run if the minimum threshold for students (*n*=8) is recruited. Students who are interested in a career choice that does not reach its threshold will be offered an alternative choice. It is their decision to accept the alternative offer. This information will be communicated to students before enrolment so that they will be made aware that the career track of their choice may not be available if certain modules have not reached the threshold to be offered, i.e. fewer than 8 students have enrolled. The two available career choices are:

(i) **Applied Medical Sciences:** students who choose this career choice may pursue careers in clinical NHS or private health laboratories, or in biomedical research. Additionally, students who meet the requirements for graduate entry into Medical Schools, or the requirements of enrolling in a physician associate training program may apply to relevant Schools providing these courses. Optional modules available for students in the applied medical sciences include modules of clinical relevance such as "Cancer Biology and Therapy", "Stem Cells and Developmental Biology", "Neuroscience and Ageing", and "Clinical Nutrition and the Microbiome" (Table 1).

(ii) **Pharmaceutical Industry:** students who choose this career track may pursue careers in the pharmaceutical, or biomedical industry such as those working in small molecules, clinical research and monitoring, next-generation sequencing, diagnostics, blood stem cell & bone marrow

transplantation. Students may work in quality assurance to ensure that the pharmaceutical healthcare products are produced in accordance with quality and safety guidelines. Students may also work in marketing and sales and customer support. Optional modules available for students in this career choice include “Introduction to Pharmacology and Toxicology”, “Drug Design and Development”, and “Bioreactors” (Table 1).

Students who chose any of the above career tracks may also decide to pursue postgraduate studies in a biomedical science-related field of research.

H. Course Modules

Table 3shows the core and optional modules, and their assessment.

Table 3. Core and optional modules, and their assessment.

Course Modules					
Module Code	**Module Title**	**Level**	**Semester**	**Credit value**	**Assessment**
ASC_S_AAA	Introduction to Academic Skills for Applied Sciences	S	1	20	100% CW (written report) c
ASC_S_FOB	Foundations of Biology	S	1	20	50% CW1 (practical skills) 50% CW 2 (information retrieval)
ASC_S_FMS	Foundations of Mathematics for Science	S	1	20	100% CW (problem solving tasks)
ASC_S_FOC	Foundations of Chemistry	S	2	20	100% CW (written report)
ASC_S_FHN	Foundations of Human Nutrition	S	2	20	50% CW1 (small group project 50% CW2 (SAQ’s)
ASC_S_FBS	Foundations of Biomedical Science	S	2	20	CW1 Laboratory report CW2 statistical methods assessment
Module Code	**Module Title**	**Level**	**Semester**	**Credit value**	**Assessment**
ASC_4_498	**Human Anatomy and Physiology (Core)**	4	1	20	50 % CW (lab report) 50% exam
ASC_4_488	**Biochemistry (Core)**	4	1	20	30 % CW (presentation on practical component)

					70% exam
ASC_4_489	**Microbiology (Core)**	4	2	20	50 % CW (laboratory report) 50% exam
ASC_4_490	**Genetics and Molecular Biology (Core)**	4	2	20	30 % CW (lab report on practical component) 70% exam
ASC_4_EBS	**Employability Skills in Biomedicine (Core)**	4	2	20	30% CW1-Group presentation 70% CW2- written report
ASC_5_HCI	**Human Haematology and Clinical Immunology (Core)**	5	1	20	40 % CW on practical component 60 % exam
ASC_5_493	**Cellular Pathology and Imaging (Core)**	5	1	20	50% CW on practical component 50% exam
ASC_5_IPT	Introduction to Pharmacology and Toxicology (Option)	5	1	20	30 % CW (lab report on practical component) 70% exam
ASC_5_SDB	Stem Cells and Developmental Biology (Option)	5	1	20	50% CW: Students will prepare an essay on current topics in Stem Cell research 50% exam
ASC_5_BRB	**Bioinformatics and Research Skills for Biomedical Scientists (Core)**	5	2	20	50%CW1-Research Proposal 50 % CW2-(computer exercises in bioinformatics and biostatistics)
ASC_5_CBT	**Clinical Biochemistry and Blood Transfusion (Core)**	5	2	20	40% Laboratory practical test 60% exam
ASC_5_WBS	**Work Experience in Biomedical Science (Core)**	5	2	20	50%-CW1 portfolio 50%-CW2 (Group presentation)
ASC_6_RPB	**Research Project in Biomedicine (Core)**	6	1 & 2	40	100% CW (Research project)
ASC_6_MPM	**Medical and Public Health Microbiology (Core)**	6	1	20	50 % CW (laboratory report) 50% exam
ASC_6_TBC	Cancer Biology and Therapy (Option)	6	1	20	50% CW

					Poster presentation 50% exam
ASC_6_BIR	Bioreactors (Option)	6	1	20	40% CW (PBL-poster presentation) 60% Exam
ASC_6_497	**Clinical OMICS and Precision Medicine (Core)**	6	2	20	50 % CW (Exercise on big data) 50% exam
ASC_6_NAA	Neuroscience and Aging (Option)	6	2	20	40% CW (PBL-presentation) 60% Exam
ASC_6_CNM	Clinical Nutrition and the Microbiome	6	1	20	50% (Group presentation) 50% CW2 (In class test)
ASC_6_TBC	Drug Design and Development (Option)	6	1	20	30 % CW (lab report on practical component) 70% exam

I. Timetable information

- Timetables will be provided to students via Moodle sites as soon as possible before the start of each semester.
- Typical contact hours for each week will range from 9 to 15 hours depending on the level of study and the modules that run in a semester. Modules that have laboratory sessions will normally have more contact time in a week than those without.
- Each module is timetabled for 1x3 hour block in a week (except those with laboratory sessions)..

J. Costs and financial support

Course related costs

Costs that are in addition to the tuition fees in this course may include:

- The cost of textbooks and journal subscriptions.
- Student membership of relevant professional bodies and organisations such as the Institute of Biomedical Science.
- Costs related to subject specific seminars or conferences.
- Any extracurricular courses that a student wishes to take that are NOT provided and supported financially by the University, and accreditation applications.

Tuition fees/financial support/accommodation and living costs

Information on tuition fees/financial support can be found by clicking on the following link:
http://www.lsbu.ac.uk/study/undergraduate/fees-and-funding or
http://www.lsbu.ac.uk/study/postgraduate/fees-and-funding

https://www.lsbu.ac.uk/international/fees-and-funding

Information on living costs and accommodation can be found by clicking the following link: https://www.lsbu.ac.uk/student-life/our-campuses/southwark/cost-of-living

List of Appendices

Appendix A: Curriculum Map
Appendix B: Terminology

Appendix A: Curriculum Map

This map provides a design aid to help course teams identify where course outcomes are being developed, taught, and assessed within the course. It also provides a checklist for quality assurance purposes and may be used in validation, accreditation, and external examining processes. Making the learning outcomes explicit will also help students to monitor their own learning and development as the course progresses.
T is taught, D is developed, and A is assessed.

	Level S Module					
Foundation level S programme outcome	Introduction to Academic Skills for Applied	Foundations of Biology	Foundation Maths for Science	Foundations of Chemistry	Foundations of Human Nutrition	Foundations of Biomedical Science
1	D	T, D, A		T,D,A	T,D,A	T,D,A
2						T,D
3		D	D	D	D	T,D,A
4		D	D	D	D	T,D
5	T,D,A	D,A	T,D,A	T,D,A	D	T,D
6	T,D,A	D,A	T,D,A	T,D,A	T,D,A	T,D

S1: The scientific disciplines which underpinning the study of Biomedical Science (biology; chemistry and physics)
S2: The role of Biomedical Science in the context of human health and disease.
S3: The different disciplines of Biomedical Science and their role in understanding human health and disease.
S4: The specialist fields of Biomedical Science.
S5: The application of academic and scientific skills including numerical and statistical methods, academic and scientific writing, communication, and presentation skills.
S6: The application of appropriate scientific knowledge and understanding to facilitate the understanding of Biomedical Science theory, laboratory methods, data collection, processing, and interpretation.

L	Module Title	A					B						C								D									
		1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6	7	8	1	2	3*	4	5	6	7	8	9	10
4	Biology of the Cell	T/A	T				T/A			D/A		D/A	T/A							A	D	D/A		A		D	D		D/A	D/A
4	Biochemistry	T/A	T							D/A		A	T/A	T					A	A	D	D					D	D/A	D/A	D/A
4	Microbiology	T/A	T/A	T		T/A	T				T/A	A	T/A	T/A		T/A				A	D					D	D	D	D/A	D
4	Human Anatomy and Physiology	T/A	T/A				T					A	T/A			T				A	D	D/A					D		A	A
4	Genetics and Molecular Biology	T/A	T/A				T/A			T/A		A	T/A		T	T			A	A	D	D/A		D/A			D	D/A	D/A	D/A
4	***Employability Skills in Biomedicine***					T/A	T/A		D	D/A	D/A	D/A		D/A			D/A		D/A	D/A	D	D/A	D	D	D/A	D/A	D/A	D/A	D/A	D/A
5	Human Haematology and Clinical Immunology	T/A	T/A	T/A		T/A	T/A			T/A	D	A	T/A	T/A	T/A	T/A			A	A		D/A		D/A			D	D/A	A	D/A
5	Bioinformatics and Research Skills for			T	T/A	T/A	T/A	T/A	T/A	T/A	T/A	T/A		T/A	T/A		T/A	T/A	T/A	T/A	D/A	D/A		D/A		D/A	D	D/A	D/A	D/A

	Biomedical Scientists																													
5	Cellular Pathology and Imaging	T/A	T/A	T/A		T/A	T/A		A	T/A	T/A	T/A	T/A	T/A	T/A	T/A	T/A	T/A	D/A	D/A		D		D	D	D	D	D/A	D/A	D/A
5	Clinical Biochemistry and Blood Transfusion	T/A	T/A	T/A		T/A	T/A	T/A		T/A	T/A	T/A	T/A	T/A	T/A	T/A	T/A	T/A	D/A	D/A	T/A	D	T/A	D/A	D/A	D/A	D	D	D/A	D/A
5	*Stem Cells & Developmental Biology*	T/A	T/A	T/A		D/A	D/A	D/A	D/A	D/A	T/A	D/A		T/A	D/A		D		D/A	D/A	D/A	D/A	D	D/A	D/A	D/A	D/A	D/A	D/A	D/A
5	*Introduction to Pharmacology and Toxicology*	T/A	T/A	T/A		D/A	D/A	D/A	D/A	D/A	T/A	D/A		T/A	D/A		D		D/A	D/A	D/A	D/A	D	D/A	D/A	D/A	D/A	D/A	D/A	D/A
5	**Work Experience**					T/A	T/A		D	D/A	D/A	D/A		D/A			D/A		D/A	D/A	D	D/A	D	D	D/A	D/A	D/A	D/A	D/A	D/A
6	Research Project in Biomedicine	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	D	A	A	A
6	Clinical OMICS and Precision Medicine	T/A		T/A	T/A	T/A	T/A	T/A	A	T/A	T/A	T/A			T/A		D/A	T/A	T/A	D/A	D	D/A	D	D	D	D	D	D	D/A	D/A
6	Medical and Public Health Microbiology	T/A	T/A	T		T/A	T				T/A	A	T/A	T/A		T/A				A	D					D	D	D	D/A	D
6	*Neuroscience and Ageing*	T/A		T/A		T/A	T/A	T/A	A	D					D		D			D/A	D	D					D/A	D/A	D/A	
6	*Drug Design and Development*	T/A		T/A		T/A	T/A	T/A	A	D					D		D			D/A	D	D					D/A	D/A	D/A	

6	Cancer Biology and Therapy	T/A	T/A	T/A		D/A	D/A	D/A	D/A	D/A	T/A	D/A		T/A	D/A		D		D/A	D/A	D/A	D/A	D	D/A	D/A	D/A	D/A	D/A	D/A

Key 1: T = Taught, i.e. contributing in some way to the Learning Outcomes; D = Developed i.e. a focus of the module; A = Assessed and therefore also developed, Key 2: L=Level, Modules in italics are optional modules

*****D3: negotiation skills, and lifelong learning in the field of biomedical science including enterprise and knowledge transfer skills will be developed during the career workshop offered in level 4, and during optional modules in level 5 and 6.*

A. Knowledge and understanding:

A1. The basic biology of human health and disease represented by the disciplines of human anatomy and physiology, cellular, genetic and molecular biology, microbiology, immunology, chemistry and biochemistry.
A2. Basic principles of laboratory-based diagnostic and analytical techniques used in clinical pathology, human haematology and clinical immunology, clinical biochemistry, and blood transfusion and medical microbiology.
A3. Aetiology, progression, and diagnosis of human diseases to support clinical management and treatment selection.
A4. Bioinformatic and statistical principles for analysis of big data for the study of genomics, proteomics and transcriptomics, and their application in precision medicine.
A5. Research design, quantitative/qualitative methods, critical review of evidence in the biomedical sciences, data interpretation, reporting, biosafety, ethics, and conduct.

B. Intellectual skills:

B1. Apply theories, paradigms, concepts, or subject-specific principles to a new context.
B2. Obtain and integrate lines of subject-specific evidence to formulate hypotheses, design experiments, critically evaluate data and use it to develop research proposal;
B3. Demonstrate independence of thought to identify the key features of a problem and suggest possible means of investigation.
B4. Keep abreast of current insights in core and specialist areas of biomedical science.
B5. Recognise the moral and ethical issues of investigations and appreciate the need for ethical standards and professional codes of conduct.
B6. Synthesise, analyse and summarise a body of information and come to an informed and logically consistent conclusion.

C. Practical skills:

C1. Demonstrate competence in the basic experimental skills relevant to cell and molecular biology, genetics, human anatomy and physiology, medical microbiology, cellular pathology and imaging, clinical biochemistry and blood transfusion.
C2. Demonstrate knowledge of quality assurance and quality control principles, hazard identification, risk assessment and safety procedures associated with a particular technique or methodology.
C3. Select and apply appropriate techniques and evaluate alternative methodologies for an investigation or to complete a process.
C4. Undertake practical investigations in a responsible, safe and ethical manner, while observing relevant health and safety regulations.
C5. Organise and allocate duties, set targets and evaluate progress in achieving specific technical goals, evaluate own performance and performance of others within a team.
C6. Use relevant numerical quantitative techniques and demonstrate competence in bioinformatic and statistical methods to validate, calibrate and analyse big data.
C7. Present data in seminars or small-group tutorials to develop interpersonal skills such as information retrieval, problem-solving, communication and team working.
C8. Demonstrate competence in the use of word-processors, spreadsheets, biological databases and data presentation packages.

D. Transferrable skills:

D1. Identify individual and collective goals and responsibilities.

D2. Develop the ability to work on one's own initiative and manage one's own time to meet deadlines.
D3. Develop negotiation skills, and lifelong learning in the field of biomedical science including enterprise and knowledge transfer skills.
D4. Provide reflective and evidence-based solutions to problems.
D5. Recognise and respect the views and opinions of other team members.
D6. Evaluate their own performance as an individual and as a team member, as well as the performance of others.
D7. Develop a flexibe and effective approach to study and work.
D8. Communicate ideas, arguments and concepts in a rational and systematic way, using a variety of media.
D9. Clearly communicate in writing for both academic and lay audiences.
D10. Use the full range of sources of information, citing references properly and avoiding plagiarism.

Appendix B: Terminology

The following is a list of terminologies used in the context of the BSc (Hons) Biomedical Science Course:

Awarding body	a UK higher education provider (typically a university) with the power to award higher education qualifications such as degrees
Bursary	a financial award made to students to support their studies; sometimes used interchangeably with 'scholarship'
Collaborative provision	a formal arrangement between a degree-awarding body and a partner organisation, allowing for the latter to provide higher education on behalf of the former
Compulsory module	a module that students are required to take
Contact hours	the time allocated to direct contact between a student and a member of staff through, for example, timetabled lectures, seminars and tutorials
Coursework	student work that contributes towards the final result but is not assessed by written examination
Current students	students enrolled on a course who have not yet completed their studies or been awarded their qualification
Delivery organisation	an organisation that delivers learning opportunities on behalf of a degree-awarding body
Distance-learning course	a course of study that does not involve face-to-face contact between students and tutors
Extracurricular	activities undertaken by students outside their studies
Feedback (on assessment)	advice to students following their completion of a piece of assessed or examined work.
Formative assessment	a type of assessment designed to help students learn more effectively, to progress in their studies and to prepare for summative assessment; formative assessment does not contribute to the final mark, grade or class of degree awarded to students
Higher education provider	organisations that deliver higher education.

Independent learning	learning that occurs outside the classroom that might include preparation for scheduled sessions, follow-up work, wider reading or practice, completion of assessment tasks, or revision
Lecture	a presentation or talk on a particular topic. in general lectures involve larger groups of students than seminars and tutorials
Learning zone	a flexible student space that supports independent and social earning
Material information	information students need to make an informed decision, such as about what and where to study
Mode of study	different ways of studying, such as full-time, part-time, e-learning or work-based learning
Modular course	a course delivered using modules
Module	a self-contained, formally structured unit of study, with a coherent and explicit set of learning outcomes and assessment criteria; some providers use the word 'course' or 'course unit' to refer to individual modules
National teaching fellowship	a national award for individuals who have made an outstanding impact on student learning and the teaching profession
Optional module	a module or course unit that students choose to take
Professional body	an organisation that oversees the activities of a particular profession and represents the interests of its members
Prospective student	those applying or considering applying for any programme, at any level and employing any mode of study, with a higher education provider
Regulatory body	an organisation recognised by government as being responsible for the regulation or approval of a particular range of issues and activities
Scholarship	a type of bursary that recognises academic achievement and potential, and which is sometimes used interchangeably with 'bursary'
Semester	either of the parts of an academic year that is divided into two for purposes of teaching and assessment (in contrast to division into terms)

Seminar	seminars generally involve smaller numbers than lectures and enable students to engage in discussion of a particular topic and/or to explore it in more detail than might be covered in a lecture
Summative assessment	formal assessment of students' work, contributing to the final result
Term	any of the parts of an academic year that is divided into three or more for purposes of teaching and assessment (in contrast to division into semesters)
Total study time	the total time required to study a module, unit or course, including all class contact, independent learning, revision and assessment
Tutorial	one-to-one or small group supervision, feedback or detailed discussion on a particular topic or project
Work/study placement	a planned period of experience outside the institution (for example, in a workplace or at another higher education institution) to help students develop particular skills, knowledge or understanding as part of their course
Written examination	a question or set of questions relating to a area of study to which candidates write answers usually (but not always) under timed conditions