

Qualification Requirement in the BTEC Higher Nationals in Biomedical Science

This Qualification Requirement should be read in conjunction with overarching guidance from Edexcel.

Rationale

The BTEC Higher Nationals using the title Biomedical Science should provide:

- the education and training of biomedical science technologists employed in biomedical diagnostics, laboratory analysis, research and development, education, etc.
- a standard, national, vocationally-specific qualification at Level 4, linked to National Occupational Standards and professional body requirements
- a nationally-recognised, vocationally-specific qualification that will provide confidence to employers recruiting biomedical science technologists that holders of the qualification possess the requisite knowledge, understanding and skills
- a qualification that will be assessed to national standard and thus provide confidence to those recruiting to more advanced higher education vocational qualifications such as a degree in Biomedical Science or related area
- a programme of learning that ensures full understanding of the role of the biomedical science technologist. This includes an understanding of the role at departmental/section level as well as an appreciation of how the role and that of the department/section fits within the overall structure of their organisation and within the scientific and local community.

Aims of the Qualification

Qualifications in Biomedical Science meet the needs of the above rationale by:

- equipping individuals with knowledge, understanding and skills for success in employment in biomedically-based industries
- enabling progression to an undergraduate degree or further professional qualifications in biomedical science or related areas
- providing specialist studies relevant to individual vocations and professions in which students are working or intend to seek employment in the field of biomedical sciences or its related industries
- developing the learners' ability in the biomedical sciences environment through effective use and combination of the knowledge and skills gained
- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life, thereby enabling learners to make an immediate contribution to employment
- providing flexibility, knowledge, skills and motivation as a basis for future studies and career development - an educational foundation for a range of careers in biomedical science and its related industries
- providing opportunities for learners to focus on the development of the higher level skills in a science and technological context

Mandatory Curriculum

Cell Biology: develops knowledge and understanding of eukaryotic and prokaryotic subcellular organelles, their relationship to their function and to cellular diversity; meiosis and mitosis – comparison and significance; cell division cycle and its control; cell growth and differentiation in multicellular organisms; evaluate techniques used for the growth and maintenance of cell cultures and determine factors that affect cell growth.

Biological Building Block Molecules: applies chemical principles to develop knowledge and understanding of the structure and classification of amino acids, monosaccharides, mononucleotides and fatty acids; optical isomerism in amino acids and monosaccharides and its significance; α - and β -anomeric forms of monosaccharides.

Structure and Function of Macromolecules: applies knowledge of building block molecules to derive the detailed structures of proteins, polysaccharides, nucleic acids and lipids and relates the structures to biological function – globular and fibrous proteins, enzymes and active sites, storage and structural polysaccharides, RNA/DNA and role in protein biosynthesis, storage and membrane lipids.

Major Metabolic Pathways: develops knowledge and understanding of the relationship between and function of glycolysis, fermentation, electron transport, fatty acid β -oxidation, gluconeogenesis and fatty acid synthesis; metabolism and free energy change; control of catabolic and anabolic pathways.

Human Physiology: develops detailed knowledge and understanding of the subcellular structure and biochemical composition of human specialised cells and their function; communication between distinct human tissues and organs; components of human homeostatic control systems and the maintenance of a constant internal environment.

Laboratory and Analytical Techniques: develops knowledge and understanding of the principles underlying a wide range of modern instrumental and associated techniques; selection of technique appropriate to required analysis, preparation and calibration of instrument; quantitative analytical techniques; risk assessment and health and safety at work.

Data Evaluation, Interpretation and Presentation: develops ability to use appropriate methods to record, evaluate and process physical and instrumental data, interpret results, draw valid conclusions, suggest improvements and produce written reports in standard format with correct referencing; use of correct statistical techniques; poster and oral presentations, IT; use of libraries, databases and Internet.

Optional Curriculum

Laboratory Management: develops knowledge, understanding and appreciation of the importance of good laboratory organisation – use of reference book and manuals, purchasing procedures for equipment or consumables, stock control systems, laboratory design; Health and Safety at Work Act – impact on laboratory work and staff, risk assessment and COSHH regulations; supervisory management techniques.

Assignment in the Workplace: applies with a degree of autonomy and responsibility for own learning the knowledge, understanding and technical skills to a practical work-based assignment.

Molecular Biology & Genetics: develops detailed knowledge and understanding of the process of information transfer and its regulation in prokaryotes and eukaryotes, the methods appropriate to DNA technology and patterns of inheritance.

Genetics: develops and applies Mendelian principles to selective breeding in animals, genetic counselling and paternity testing; molecular biology techniques and their application to industry and medicine; genetic modification of organisms; microbial genetics and human disease; extra-nuclear genetics and human disease; ethical issues surrounding genetically-modified products.

Pharmacology: develops knowledge and understanding of pharmacokinetic principles and the factors affecting pharmacokinetic processes; drug modification of nerve impulse transmission, drug treatment of diseases of central, autonomic and voluntary nervous systems; drug use for auto immune diseases and organ transplants.

Immunology: develops knowledge and understanding of the immune system; elements of the immune response, lymphatic system, cells of the immune system, soluble factors; interaction of the elements of the immune system, innate and acquired responses; manipulation of the immune response, vaccination, transplantation rejection, tumour immunology; abnormal immune responses; immunological techniques.

Histology & Haematology: develops knowledge and understanding of the principles and practice of advanced microscopic techniques, the preparation of pathological specimens, histology and cytopathology. Formation and function of blood: formation in the embryo, foetus and adult, functions of blood cells, factors regulating cell maturation, synthesis and function of haemoglobin, analysis of blood and bone marrow smears, transfusion and transplantation, blood group serology, blood disorders.

Infectious Diseases: develops knowledge and understanding of host parasite relationships; evaluates microbial structural features that contribute to host infection; microbial virulence factors and transmission routes; collection, handling and transport of specimens; advanced diagnostic laboratory techniques.

Medical Microbiology: develops knowledge and understanding of the current methods used for the collection of specimens from patients; isolation and identification of bacteria by biochemical, serological and other laboratory methods, laboratory methods of screening for antibiotic sensitivity, types of pathogen.

Clinical Chemistry: develops knowledge and understanding of the levels of organisation within the modern clinical chemistry laboratory, major laboratory analytical methods, body fluid analysis, examples of systemic testing and diagnostic pathology, clinical chemistry laboratory techniques and their applications.

Pathology Laboratory Management: develops understanding of the importance of the business environment to pathology laboratory management, demography, legislation, business types and planning; resource management; hazards and safety; quality assurance and quality control, operational procedures used in different pathology laboratory specialisms.

Chemistry for Biology: develops knowledge and understanding of important concepts needed for a detailed understanding of biological processes; molecular interactions, enthalpy concepts, redox reactions, equilibrium; nomenclature, structural types, reactions, uses and experimental investigations of organic molecules; radioactive decay and use of radioisotopes. This unit is intended for those students who have not studied chemistry.

Statistics: develops a working knowledge of statistics and its application to scientific data – data sources, classification, recording, displaying and interpretation; statistical concepts – distributions, sampling and hypothesis testing; statistical techniques – t-test, analysis of variance, experimental

design, correlation and regression. IT should be used to perform the complex calculations involved in statistical analyses.

Links to Professional Body

Students possessing an HNC/D in Biomedical Science and a number of years (usually between 3 – 5 years) of post HNC/D experience in the biological industry are able to apply for 'Associate Membership of the Institute of Biomedical Science'.

Links to National Standards

There is the opportunity for programmes in Biomedical Science to provide some of the underpinning knowledge, understanding and skills for the Level 4 NVQ in Laboratory and Associated Technical Activities.

Higher Level Skills and Abilities

During the programme of study learners will be expected to develop the following skills and abilities:

Work as an individual and in teams for successful performance in a biomedically-based working environment

Communicate effectively and appropriately

Accept supervisory management responsibilities in an appropriate context

Develop personal qualities and attributes essential for successful performance in working life

Think independently, take responsibility for their own learning and recognise their own learning style

Think laterally and be innovative and creative in relevant contexts

Develop an appreciation of the interdisciplinary nature of science

Be flexible and respond to the changing climate within the scientific community

Recognise the moral and ethical issues of scientific enquiry and experimentation and appreciate the need for ethical standards and professional codes of conduct

Analyse, synthesise and summarise information critically

Read and use appropriate literature with a full and critical understanding

Obtain and integrate several lines of subject-specific evidence to formulate and test hypotheses

Apply subject knowledge and understanding to address familiar and unfamiliar problems

Design, plan, conduct and report on investigations

Undertake laboratory and/or field investigations of living systems in a responsible, safe and ethical manner

Give a clear and accurate account of a subject, marshal arguments in a mature way and engage in debate and dialogue both with specialists and non-specialists