



**BIOCHEMICAL
SOCIETY**



BIOCHEMISTRY the career guide

for 16-18 year olds considering their options

THE **IMPACT** OF BIOCHEMISTRY

Over the past 100 years, biochemists have been responsible for a huge number of important scientific breakthroughs that have helped to develop our understanding of living organisms. These discoveries have had a big impact on many areas of science, including biotechnology, agriculture, veterinary science and medicine.



UNDERSTANDING THE CHEMISTRY OF OUR BRAINS

Understanding how the messages in our brains are transmitted has allowed us to study behaviour at a new level, and develop a wide range of medicines that we use in our everyday lives. It has led to the development of drugs

to treat conditions such as Attention Deficit Hyperactivity Disorder, Parkinson's disease, and schizophrenia. Biochemists are also researching how we feel pain, and form new memories.

REVOLUTIONIZING FORENSIC SCIENCE

Biochemists have discovered that everyone has their own unique genetic code or "fingerprint", which has led to huge developments in forensic science and evolutionary history. We can now track the genetics of family histories, and

understand the evolutionary origins of diseases like sickle cell anaemia. DNA analysis is also invaluable in police investigations, with genetic testing being used in criminal forensics and immigration cases.

HELPING FIGHT DISEASE

Biochemists have discovered some of the mechanisms behind many serious diseases, such as cancer, Alzheimer's disease, diabetes, cystic fibrosis, and many more. Understanding these diseases at a molecular level has made

not only diagnoses possible and more efficient, but has also led to the development of groundbreaking new drugs and treatments. In the future, scientists hope these could be tailored to the patient's genetic make-up.

PUSHING THE BOUNDARIES OF OUR KNOWLEDGE

In recent decades there have been great scientific advances, such as the discovery of DNA, how cells communicate with one another using signalling and how diseases such as HIV, cancer

and Alzheimer's develop. Today, scientists around the world research and develop new and exciting practical techniques, with the aim of furthering our scientific knowledge and changing the future.



SO, WHAT IS BIOCHEMISTRY?

Biochemistry is the branch of science that explores the chemical processes and reactions within living organisms. It is a laboratory based subject that uses chemical knowledge and techniques to understand and solve biological problems.

Biochemistry focuses on processes at a molecular level, and uses this knowledge to explain how cells and organisms behave. It examines what is happening within our cells, studying components like proteins, lipids, and organelles and how they all work together. It looks at how cells communicate with each other, for example during growth or development. Biochemistry also looks at the biological, chemical and sometimes structural basis for disease, including genetic disorders, infection, neurodegeneration and cancer.

Central to biochemistry is an understanding of how the 3-dimensional structure of a biological molecule relates to

its function. This information allows biochemists to predict how molecules might interact with each other, and to design drugs based on this.

Biochemistry also helps us to decode the genetic information found in our DNA. Biochemists identify specific genes and, in turn, the proteins they code for, and use this information to investigate the functions of the protein within the cell. All this information helps to enhance our knowledge of how cells work and how processes are regulated, so that we can develop methods to fix them when things go wrong.

Since biochemistry is the study of life at the molecular level, it provides the foundations of a wide range of other scientific disciplines, including genetics, forensics, microbiology, plant science, and medicine. This breadth makes it difficult to draw a neat border around “biochemistry”, and highlights just how important the subject is.

Want to be part of the scientific movement?

BIOCHEMISTRY CAN TAKE YOU THERE...

Biochemists play an important role in contributing to advances in a wide variety of areas, including health, agriculture and the environment. Progress in the biochemical understanding of disease and complex molecular structures has led to medical applications including the screening of unborn babies for disease, investigation of possible cures for illnesses such as cancer and AIDS, and the formulation of new and improved medicines.

Biochemistry also contributes to protecting the environment, by combating pollution and designing biocompatible products. The genetic engineering of plants has led to advances in agriculture which include crop improvement and resistance to pests and disease.

Biochemistry is often a collaborative field, requiring biochemists to work and communicate as a team with professionals from a variety of disciplines to achieve their goals.



Because of the fundamental nature of biochemistry, you can find biochemists working in a variety of places, for example:



HOSPITALS
analysing samples from patients to advising on treatments



UNIVERSITY LABS
researching anything from gene therapy to new cancer treatments



FOOD INDUSTRY
ensuring the safety of our food



LAW FIRMS
dealing with scientific specific cases



THE COSMETIC INDUSTRY
creating safe or more effective products



PHARMACEUTICAL LABORATORIES
drug development or carrying out research into different diseases



PUBLISHING
commissioning, proof reading and reviewing scientific articles



SALES AND MARKETING
selling the latest technology to the right people



THE GOVERNMENT
advising on current scientific issues

“The problem solving and critical thinking is quite appreciated by the Financial Sector and so it was a bit of a surprise to hear that some went for a career in Finance after having completed a Science degree.”

Martin, an undergraduate student at the University of Glasgow.



WHY STUDY BIOCHEMISTRY?

TRANSFERABLE SKILLS

After studying a biochemistry degree, there are numerous options available to you. You can stay in Higher Education and study for a PhD or a Masters Degree in science (a good route into research and working in industry). Or you could apply your scientific knowledge to a range of other careers, including patent law, teaching or science communication.

Alternatively, you may pursue a career outside of science. The skills you will develop during your studies are transferable across a number of career areas, meaning you could end up working as anything from an accountant to a marketing manager or event organizer. These transferable skills, which are sought after by employers, include:

ANALYTICAL SKILLS

NUMERACY AND MATHS

EXPERIENCE OF WRITING REPORTS

PRESENTATION SKILLS

TIME MANAGEMENT

CREATIVE THINKING

PROBLEM SOLVING

IT SKILLS

PLANNING

OBSERVATIONAL SKILLS

WORKING IN A TEAM

The importance of biochemistry is demonstrated by the variety of different fields biochemists are working in today, to help to make the world a better place to live in. By studying biochemistry, you would be able to contribute to a brighter future and be a part of the exciting new advances still to come.

Since biochemistry underpins many of the other life sciences, it allows you to specialize in a range of different subjects at a later date. This flexibility allows you to keep your career options open.

TYPES OF BIOCHEMISTRY UNDERGRADUATE DEGREES

If you decide you want to study biochemistry at university, you will next need to decide which type of degree is best for you. For example, some courses can include a year working in industry, or a year studying abroad. Below are some useful descriptions of the types of degrees available:

BACHELOR OF SCIENCE (BSC)/BACHELOR OF ART (BA) COURSES

These are usually three years full time study (four years in Scotland). The course provides a good science basis, after which you can go on to take part in post-graduate study or numerous scientific or other careers. Previous scientific qualifications are needed, such as A-levels or Highers. Most bioscience courses will follow a common first year, then specializing in the second and third years when you can normally choose some optional modules in the areas that interest you most.

MSCI/ MBIOLSCI/ MBIOCHEM COURSES

These courses are normally four years full time study (five years in Scotland). The final year involves a more in-depth study of the subject in order to enhance the qualification to a higher Masters level. Most courses will involve an extensive research project during the final year, where you will learn and develop research and practical skills. All the courses have the same Masters status, the title simply distinguishes what area it specializes in.

BIOCHEMISTRY WITH A YEAR ABROAD/IN INDUSTRY

Some courses are available with a “sandwich” year option. This essentially means the course is a year longer, so you spend the penultimate year of your course studying abroad or working in the sector. Biochemistry with a year in industry allows you to gain valuable work experience, normally working in a lab at a pharmaceutical company or research lab. These placements are often paid. Biochemistry with a year abroad involves studying at an overseas university, normally in Europe or the USA. During this time you will follow the programme of lectures at the host university, before returning to the UK for your final year.

During a year in industry or studying abroad, most universities expect you to still pay fees, however this is normally at a reduced rate.

COMBINED DEGREES

Combined degrees, such as ‘Biochemistry with . . .’ or ‘Biochemistry and...’ (e.g. Biochemistry with French or Biochemistry and Business management) normally involve splitting your time between two subjects. The time spent on each may be split equally, or you might spend more time on one subject than the other. If considering this type of combined degree, it is important that you check how the time is split between the disciplines on each course you are considering, as it may vary between different universities. Although this allows you to have a more varied degree and learn another discipline, it is important to consider whether this may affect your future career when applying for jobs against students who’ve had more in depth teaching in one of the areas. You may also want to consider the second subject being one related to biochemistry, in order for them to support each other, such as biochemistry and pharmacology or ecology.

Alternatively, some universities offer combined degrees that encompass a broader science base - for example, a Natural Sciences degree. Again, check individual university courses for further details.

FOUNDATION COURSES

These courses offer a broad introductory year covering the more basic scientific disciplines. They are suitable for students who have either not studied the required subjects to start a biochemistry degree, or have recently completed advanced apprenticeships or NVQ’s (level 3), instead of A-levels or Highers which are the more traditional entry requirement. The study methods can be very flexible, which means you may be able to get a job and earn whilst you learn.

A full-time course usually takes one to two years. Part-time courses may take longer, although this is not always the case.

FOR MORE INFORMATION ON COURSE TYPES VISIT WWW.UCAS.COM

WHAT QUALIFICATIONS DO I NEED TO STUDY BIOCHEMISTRY?



The most common route to entering university to study a biochemistry-related degree is to first complete A-levels, or equivalent qualifications, in biology and chemistry, however some universities will accept Maths as a substitute for one of these subjects. Some universities will accept students with one science A-level or equivalent, so it's worth checking the entry requirements before applying. Some universities will also consider some BTEC courses as supporting qualifications.

If you are concerned you do not have the necessary qualifications, you may want to consider taking a foundation course, or access course, before embarking on a degree.

See our biochemistry prospectus at www.biochemistry.org/Education/Schoolsandcolleges/Qualifications.aspx for more information on entry requirements.

DO

I NEED
 $\sqrt{\text{MATHS}}$

?

Maths plays an important role in some parts of biochemistry and a good understanding of the subject will help you throughout your studies. It will help when designing experiments, carrying out research, analyzing your results, and understanding some key concepts in biochemistry. Although it may not be a requirement for all biochemistry courses, you should consider studying it at AS or A-level, or consider a form of tutoring or a free standing Maths course to make sure you are up to scratch.

If you have not studied Maths at A-level but are keen to pursue a bioscience related degree, some universities will offer extra support in the form of tutorials and extra classes to help you in your studies.



NOT STUDYING MATHS? HAVE YOU CONSIDERED A FREE STANDING MATHS QUALIFICATION (FSMQ)?

To help ensure your Maths is up to scratch, or develop your knowledge in a particular area, you may want to consider taking an FSMQ. These are designed for all post-16 students, and can be taken at three levels, foundation, intermediate or advanced.

Find out more information at www.nuffieldfoundation.org/fsmqs/about-fsmqs

WHAT DOES STUDYING BIOCHEMISTRY NORMALLY INVOLVE?

All university courses will vary slightly in course structure, module topics, amount of time in the lab, and assessment. It is important you do your research and check the details with specific universities before applying to any course.

Whilst at university, teaching will involve a combination of lectures and practical sessions which are usually in laboratories. Depending on the university, lectures can be for anything between 50 to 300 students, normally with one tutor at the front. Students are often also expected to attend tutorials; these are classes with smaller numbers. The level of practical work is different depending on which course you choose and where you study, but normally undergraduate courses contain 10-15% practical work.

A biochemistry course will normally involve a broad first year, moving on to more detailed optional modules in the latter years. Subjects you can expect to cover at degree level include:

- Cell Biology and signalling
- Genetics and DNA
- Structure and function of molecules
- Enzymology
- Proteins and membranes
- Neurobiology
- Biochemical techniques
- Plant biochemistry
- Microbiology and viruses
- Disease mechanisms
- Metabolism

Assessment whilst at university is normally in the form of essays, projects (normally based on practical work), and sometimes presentations. Most universities will have a wide range of learning resources online, including lecture notes, access to research journals, links to more information, and tips for writing up reports and essays.

"I wanted to keep my degree as broad as possible so that I could specialize in an area later on in my career and biochemistry allowed me to do this."

Leyla, now a PhD student at the University of Bristol.



CHOOSING THE RIGHT DEGREE FOR YOU



Attending open days at university is a good way to help you choose where to study. Some universities will also have subject specific days, which are a great way to learn more about the courses available in detail. Visiting a university will help give you a good idea about whether you like the campus, location, and general feel of the place, and help you answer any questions you may have. For a list of useful questions to ask yourself when deciding which course and university to choose, see www.biochemistry.org/Education/Schoolsandcolleges/Choosingtherightcourse.aspx

"I have become adept at many molecular biology techniques, have produced many fantastic experimental findings, and found the process of discovery to be absolutely thrilling."

Hazel, an undergraduate student



NOT SURE IF A DEGREE IS THE RIGHT OPTION FOR YOU?

If you would like a career related to biochemistry or the biological sciences, but are unsure if a degree is right for you, there are careers related to biochemistry that you can access without having a degree. You may be able to become a laboratory technician through an Apprenticeship or Higher Apprenticeship scheme. The range of schemes available in your area will depend on the local jobs market and the types of skills employers need from their workers. You can find out more at www.gov.uk/further-education-skills/apprenticeships

Many clinical laboratory support and laboratory technician jobs and Apprenticeships offer access to National Vocational Qualifications (NVQ) or Higher National Diplomas (HNDs) as part of their training.

An NVQ is a competence based qualification, which allows you to develop the knowledge and skills to do a particular job.

A HND is a 2 year full time course (or 3 years part time), aimed at preparing you for careers in specific areas of industry, but can lead on to entry into the final year of a degree. They are more vocational than degree courses. See www.gov.uk/what-different-qualification-levels-mean/overview for more information.

BIOCHEMISTS AT WORK

BEN CHAFFEY IS A CLINICAL OPERATIONS AND BUSINESS DEVELOPMENT MANAGER AT BIOSIGNATURES LTD.



I can't remember a time when I wasn't interested in science and technology. My first degree was a BSc in Molecular Biology, a course which gave me a good basic level of knowledge across a broad range of life-science subjects.

After completing my PhD in Applied Immunobiology and an academic post-doctoral position, I moved from academia to industry. Currently, I work at Biosignatures Ltd., an innovative medical informatics company which

develops products that help improve and guide disease diagnosis and treatment. Studying biosciences taught me how to think logically and how to prioritize tasks. I also learned how to design and manage projects, as well as developing research and analytical skills.

These skills are essential in my current role, where I have a wide range of responsibilities, from writing technical marketing literature and grant funding applications, through experiment and assay design and development to project management, IP and regulatory affairs.

FIONA RUSSELL IS A POSTDOCTORAL RESEARCH FELLOW AT THE UNIVERSITY OF CALGARY IN CANADA



I graduated from university with an integrated Masters degree in Molecular and Cellular Biochemistry, which included 3 months working in a research lab. During my project I fell in love with research and decided

to do a PhD. I enjoyed the freedom of science research in an academic environment. And you get to use your brain a lot of the time!

In my job I study the nerves found in our joints. The lab I work in investigates the role of nerves in controlling inflammation and pain in joints, by studying disorders such as arthritis and injury.

I love it that science gives me the opportunity to travel – to international scientific conferences as well as for different jobs. It's allowed me to make friends all over the world.

MALAVIKA LEGGE IS A PUBLISHER



Right through school, the study of life science fascinated me, and led me to a degree in biochemistry that revealed a world of molecular signals and processes that shape and govern all of life. I then learnt more about the molecular structures and mechanisms at play when viruses bind to human cells during a Masters degree. A research component of the degree revealed to me that I was better suited to a communicative role as opposed to working

in a lab, and this is what led me to working in scientific publishing.

As a Publisher I now work with a team of editors to produce and deliver peer-reviewed journal articles. Understanding the information-needs of researchers and meeting these needs through publishing is a big part of the job. Skills needed for the role include collaboration, financial planning and communication, but perhaps most important of all is a commitment to creating quality content. I love the fact that what I do helps to further scientific research.

HELEN WATSON IS A LECTURER IN BIOMEDICAL SCIENCES AT THE UNIVERSITY OF EXETER MEDICAL SCHOOL



I wanted to be a scientist because I liked practical science at school and have always been fascinated by living things. I studied a BSc in biochemistry because it offered exciting topics to study like pharmaceuticals and genomics. I enjoyed the research aspect of my degree so I did a PhD and then worked as a postdoctoral researcher in a similar field.

I am now a lecturer in biomedical sciences with a focus on education. I help to design and implement our curriculum and I also stay up to date with my area of biochemistry as I supervise specialist research projects. I can now pursue my interests in biochemistry as well as education and science outreach. Studying biochemistry at university opened up this career path and gave me the knowledge and experience I need now.

RICHARD HINDE IS A PHARMACEUTICAL CONSULTANT



The best part of my degree was the freedom - you can choose how you learn and are encouraged to think about things in your own way. University really is the cutting edge where you have access to the best equipment, some fantastic lecturers and the most up to date information available.

After university I didn't want to do any further studies or lab work, but instead wanted a business role where I could use my scientific knowledge. The pharmaceutical industry seemed an ideal fit.

In my current role I get to work with some of the largest pharmaceutical companies in the world. Knowing that my work can impact the way they do business and the way patients are treated is one of the best parts of my job.

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