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 lead to the development of drugs to treat conditions such as ADHD (attention deficit hyperactivity disorder), Parkinson’s disease, and schizophrenia. Biochemists are also working on research looking at how we feel pain, and form new memories.

Biochemists have discovered that everyone has their own unique genetic code, or “genetic fingerprint”, which has led to huge developments in forensic and genetic investigations. Being able to identify trends within families’ meant that family trees could be tracked, and analyzing DNA could be used to help with criminal investigations. This has had a huge impact all over the world, with genetic testing being used within most police forces, in immigration cases, and helping us further understand evolution.

Biochemists have discovered 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 ground breaking new drugs and treatments, some of which can be tailored to the patients genetic make-up.

In recent decades there have been great scientific advances, which have changed the shape of the world we live in. They include the discovery of DNA, how cells communicate with one another using signaling, and the molecular basis of many cancers and other life threatening diseases such as HIV and Sickle Cell Disease. Today, research scientists over the world carry out novel research and develop new and exciting practical techniques to do so, all with the aim of furthering our scientific knowledge and changing the future.

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.
Biochemistry is the branch of science that explores the chemical processes that take place inside all living things, from bacteria to plants and animals. It is a laboratory based science that brings together biology and chemistry, by using chemical knowledge and techniques to help understand and solve biological problems.

Whilst other branches of biology deal with whole organisms, or even groups of organisms, biochemistry explores things on a much smaller level, the molecular level. Biochemists examine what happens inside our cells by studying how the different components of our cells (including proteins, nucleic acids and lipids) work together and allow the cell to function. They also look at how cells communicate with each other (for example to fight disease or to support our development).

Central to biochemistry is an understanding of how the 3-dimensional structure of a molecule relates to its function. This information allows biochemists to predict how molecules will function and interact with each other.

Biochemistry also helps us to decode the genetic information found in our DNA. This means biochemists can identify specific genes and, in turn, the proteins they code for. They can then investigate what functions the proteins perform within the cell. All this information helps to enhance our knowledge of how cells work and how processes are controlled, so that when things go wrong, we now how to fix them.

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.

“I ENJOY RESEARCH THE MOST, IT’S GREAT TO GET A HANDS ON FEEL FOR THE THINGS THAT YOU ENJOY LEARNING ABOUT.”

JENNIFER, AN UNDERGRADUATE STUDENT.
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.

- **Hospitals**: analysing samples from patients to help advise on treatments.
- **University Labs**: researching anything from gene therapy and new cancer treatments.
- **Pharmaceutical Laboratories**: drug development or carrying out research into different diseases.
- **Publishing**: commissioning, proof reading & reviewing scientific articles.
- **Sales & Marketing**: selling the latest technology to the right people.
- **The Cosmetic Industry**: creating safe or more effective products.
- **Law Firms**: dealing with scientific specific cases.
- **Food Industries**: ensuring the safety of our food.
- **The Government**: advising on the latest scientific issues.

**WANT TO BE PART OF THE SCIENTIFIC MOVEMENT?**

**Biochemistry can take you there...**

“**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**
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.

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
- Why Study Biochemistry?
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 a 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.

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.

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 Science degree. Again, check individual university courses for further details.

For more information on course types, visit www.ucas.com/students/choosingcourses
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 those subjects. 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/Careers for more information on entry requirements.

DO I NEED 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.fsmq.org/courses/fsmq
Assessment whilst at university is normally in the form of essays, exams, 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.

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

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.

“"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
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

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 unsure if a degree is right for you, there are careers related to biochemistry that you can access without having a degree. Some labs employ assistants and these do not always require someone with a degree, or you may be able to work as a lab technician.

A Higher National Diploma (HND) may be more suitable for you. It 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 courses than degrees. See www.direct.gov.uk/en/EducationAndLearning/QualificationsExplained for more information.
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.

Helen Watson is a Postdoctoral Research Scientist at the University of Manchester

I wanted to be a scientist because I wanted to do something practical and liked the idea of conducting experiments. I studied a BSc in Biochemistry as it offered a wide range of subjects to study, as well as cutting edge applications such as pharmaceuticals and genetic engineering.

In my current role, I carry out novel research into how cells make proteins and ensure they are ‘folded’ into their correct 3-dimensional shapes. I make proteins in test tubes and work with cells to investigate different areas of my projects. Studying biochemistry gave me a solid background knowledge in the biological sciences, which is essential for my job. It also gave me a chance to find out which parts of biochemistry I was really interested in.

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 includes 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 allowed me to make friends all over the world.

Beth Faircliffe is a Scientific Conference Organizer

As a Conference Organizer I plan and attend numerous events, meet co-organizers, edit our website, and arrange marketing. Being involved with every part of conference organization means each day is very different, which I enjoy.

I chose to study Biochemistry because I liked both Biology and Chemistry at school, plus it allowed me to increase my knowledge in an area that I was interested in. It taught me to think in a logical manner and I learnt how to prioritize tasks. These skills are essential in most busy work places - including in my current job!

David Rutter is a Lead Videogame Producer

What I learnt during my Biomolecular studies is incredibly useful in my current role. Working in a theoretical or practical science environment leads to a natural ability to analyse systems. It also teaches you to think logically and helps develop your creativity. These skills are really important in almost all workplaces - including in my current job.

Every day is different and challenging, but one of my favourite parts is seeing people in shops buying what we’ve just made, plus I work with the very best people in our field.