Biochemistry

NAME OF COURSE

(Molecular and Cellular) Biochemistry

LENGTH OF COURSE

4 years (integrated masters included)

A-LEVELS REQUIRED

Chemistry and another science or Maths are required. Maths and Biology are recommended.

MINIMUM A-LEVEL GRADE REQUIREMENTS

- A-levels: A*AA with A* in Mathematics, Physics, Chemistry or Biology, or a closely related subject
- Advanced Highers: AA/AAB
- IB: 39 (including core points) with 7 in HL Chemistry and 6 in two other relevant subjects at HL or SL

COURSE DESCRIPTION

"Biochemistry is about smashing open some of cells and looking at what they do." ~ Mark Wormald, Senior tutor. The senior tutor told us this at the beginning of first year and that biochemistry is the perfect blend of all sciences to understand the chemistry of organisms and their biological processes. This holds true since the modules don't single out a science as an entity but how they work homogeneously to ensure the cell and its biological processes stay intact. The broad subject takes a holistic view of all aspects of organisms from cellular and molecular level. If you're interested in immunology, metabolism, organic chemistry, physical chemistry and cell structure and function, this degree is for you! The course requires the application of theory to real-life examples and problem solving with the use of mathematics.

STRUCTURE OF MODULES

1st year: Cellular Biochemistry, Molecular Biochemistry, Mechanistic Biochemistry, Physical Biochemistry, Quantitative Biochemistry. Prelims at the end of the year, which you need to pass but don't count towards your final degree grade.
2nd and 3rd year: Toolboxes for biochemistry, Information Transfer, Molecular Processes in the Cell, Cellular Chemistry, the Cell in Time and Space. Part I examinations and assessments are 60% of the degree.
4th year: 25-week research project, current opinions review. Part II is 40% of the degree. You also have to pass the practical component each year for years 1-3, though this won't contribute to your final grade.

APPROXIMATE NO. OF CONTACT HOURS PER WEEK

Tutorials: 1-2 day per week with professor and 1-3 other students
Lectures: 10 per week, so around 2-3 one hour long per day.
Labs: 3-6 hours once per week
Seminars/classes: 4-5 per month
Private study: varies for each person

TUTORIAL TESTIMONIAL

In first year:
* A two way conversation based method of learning
* Around 1-2 hour session with your professor who is also a lecturer and usually in research in groups of 2-3.
* Asked to do around an essay (1000-2000) per week/ problem sheet/presentation based on a topic part of your syllabus with given guidance on the best resources to use.
* Your essay is handed in and then read and the tutorial is a discussion based on that work and you can ask questions on aspects of the topic you found difficult to understand and write about.

SEMINAR & LABS TESTIMONIAL

Seminars are for group work, where you go through a booklet of questions with fellow students and a professor in the room to help in case they are needed. In labs you will usually work in pairs to complete a procedure/experiment.

CAREER PROSPECTS

About half of graduates study for a higher degree and go into research. You can also do graduate medicine or enter industry or the health service. The transferrable skills such as data analysis, problem solving and quantitative reasoning are highly desirable in law, consultancy, finance, the scientific civil service or accountancy.

Course Structure

FIRST YEAR

CELLULAR BIOCHEMISTRY	Cell structure and organisation	Metabolism and its control	Cell sensing and signalling
MOLECULAR BIOCHEMISTRY	From DNA to proteins: Information transfer	From genotype to phenotype	Protein structure and function
MECHANISTIC BIOCHEMISTRY	Organic chemistry of biomolecules	Protein strcture and chemistry	Carbohydrates in biochemistry
PHYSICAL BIOCHEMISTRY	Thermodynamics	Atomic & molecular structure	Regulation of enzymatic reactions
QUANTITATIVE BIOCHEMISTRY	Differentiation & Integration	Graphical representations	Statistics and the scientific method

PRELIMINARY EXAMINATIONS

SECOND & THIRD YEAR

TOOL BOXES FOR BIOCHEMISTRY	How do I isolate and characterise a gene?	How do I understand protein interactions?	How do I visualise events in a cell?	How do I predict protein structure?
INFORMATION TRANSFER	How is DNA packaged in the cell?	How do cells copy and maintain chromosomes?	How is chromatin accessed?	How are genes expressed?
MOLECULAR PROCESSES IN THE CELL	How does cell signalling work?	How are proteins processed?	How do chemicals move across membranes?	How do neurons convey information?
CELLULAR CHEMISTRY	How do cells do chemistry?	How do cells make energy?	How do plants perform metabolism?	How do prokaryotes affect health and the environment?
THE CELL IN TIME AND SPACE	What are the principles of development?	When, how and why do cells kill themselves?	What are the principles of the immune response?	How is a nervous system put together?

PART I EXAMINATIONS

FOURTH YEAR

RESEARCH PROJECT	One of the most distinctive features of the course is the research project. Here, you spend 23 weeks full time in a research laboratory where you will be a member of a research team, gaining extensive first hand experience of the rewards (and frustrations) of research. A wide choice of research projects is available within Biochemistry or other University departments such as Molecular Medicine, Pathology, Pharmacology, Chemistry, Physics amomg others. Two additional weeks are allowed to write a short thesis on your project, that together with a related 10 minute presentation will make up 25% of your final degree.
COURSEWORK	Alongside the research project you will write a review article for specialists in an area of interest to you, with advice from an expert in this area. This also counts towards your final degree result.

PART II ASSESSMENT

WHY BIOCHEMISTRY?

Most people studying Biochemistry have Biology/Chemistry/Maths A-levels (of course Chemistry is the only requirement) but the alternative courses are Medicine/Biomedical sciences etc. The reason why I chose Biochemistry over Medicine, as an example, is that Biochem scales down to the molecular and cellular levels rather than the just the organ its interaction with the body. I've always appreciated the how molecules such as proteins/enzymes/dna work independently and synergistically and how they ensure genomic stability of the cell. Rather surprisingly there is quite a bit of physics in the course but rather, looking at energy transfer between atoms and the properties of atoms behaving as waves and particles.

WHAT I WISH I KNEW WHEN I WAS APPLYING

1. You don't have to be a genius (you can be), but if you have the grades you can go here!
2. The course is quite heavy on chemistry and physics in the first year, unlike other University biochemistry courses, so consider if you would like that
3. The masters is compulsory, so you cannot decide to do it in another subject

PERSONAL STATEMENT TIPS

- Talk about specific areas of science that interest you and choose your best experiences to talk about.
- Be specific; if you mention a book or documentary, say what you liked about it and what you learned.
- If there is anything in your PS that doesn't contribute to 'why I like biochemistry and why I would be a good candidate', then take it out. Every word counts, and there is only so much you can write in your PS, so you want it to resonate enough to get an interview.
- Be prepared to talk about anything you have mentioned in interviews. It is probably better to have fewer things and talk about each in some detail, demonstrating your interest, rather than loads of sources which you are then unable to remember.
- As a general rule, it should be ~75% biochemistry related (books, magazines, experience) and only a small paragraph at the end with other interests like DofE, sports, art etc. If you can relate that section to biochemistry with transferrable skills, even better! (super-curriculars)

INTERVIEW TIPS

- The format is the same as tutorials and the idea of them is not to test how much you know, but how well you respond to the teaching style and whether they think you will benefit from it. So don't think of it as a test; you are also there to see if it will work for you and if you like the teaching style.
- Tutors don't care about students who know everything, rather they admit students who they think would benefit from this kind of learning and if the tutors can teach them.
- Biochemistry interviews are usually quite fast-paced as they have a lot to get through in 30 minutes e.g. biology Qs about synapses, mole calculations etc.
- It is very much two way and you must be engaged and think out loud and draw or write your workings.
- There really are no wrong answers, even if you have no idea, ask them questions which will help you figure it out.
- Try to enjoy it! I know that is much easier said than done but see it as a great opportunity to talk to an expert in a field you are interested in and learn some biochemistry.

EXAMPLE TIMETABLE

Week	Time	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	Time	Wk
1 Week Comm. Mon 18 Jan	9.00	Cellular Biochemistry- Cell Metabolism (PH) [1]	Cellular Biochemistry- Cell Metabolism (PH) [2]	Quantitative Biochemistry- Principles of Statistics (JM) [1]	Mechanistic Biochemistry - Organic Chemistry (SJ) [2]	Molecular Biochemistry-From genotype to phenotype (AW) [2]	9.00	1
	10.00	Mechanistic Biochemistry - Organic Chemistry (JLK) [1]	Physical Biochemistry- Enzyme Kinetics (RGR) [1]	Physical Biochemistry- Enzyme Kinetics (RGR) [2]	Practical Biochemistry - Virtual Laboratory Shadowing OR Maths Classes from 09.00 see Canvas for your group time	Practical Biochemistry - Virtual Laboratory Shadowing OR Maths Classes from 09.00 see Canvas for your group time	10.00	
	11.00		Mechanistic Biochemistry Online Workshop from 9.30am see Canvas timetable for your group time - (JLK,SJ)	Molecular Biochemistry- From genotype to phenotype (AW) [1]			11.00	
	12.00						12.00	
	2.00						2.00	
	3.00			Quantitative Biochemistry - Online Maths Classes Groups 11 & 12 see Canvas for group times			3.00	
	4.00						4.00	
2 Week Comm. Mon 25 Jan	9.00	Cellular Biochemistry- Cell Metabolism (PH) [3]	Cellular Biochemistry- Cell Metabolism (MR) [4]	Cellular Biochemistry- Cell Metabolism (PH) [5]	Molecular Biochemistry-From genotype to phenotype (AW) [3]	Molecular Biochemistry-From genotype to phenotype (AW) [4]	9.00	2
	10.00	Mechanistic Biochemistry - Organic Chemistry (SJ) [3]	Quantitative Biochemistry- Principles of Statistics (JM) [2]	Mechanistic Biochemistry- Biol. chem. of elements (MRW) [1]	Physical Biochemistry- Therm. I solution therm. (MRW) [1]	Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]	10.00	
	11.00	Physical Biochemistry- Enzyme Kinetics (RGR) [3]		Physical Biochemistry- Enzyme Kinetics (RGR) [4]	Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]		11.00	
	12.00						12.00	
	2.00		Compulsory Quantitative Biochemistry- Maths Canvas Quiz - 1 hour 45 mins to complete				2.00	
	3.00						3.00	
	4.00						4.00	
3 Week Comm. Mon 1 Feb	9.00	Cellular Biochemistry- Cell Metabolism (PH) [6]	Cellular Biochemistry- Cell Metabolism (PH) [7]	Molecular Biochemistry- From genotype to phenotype (AW) [5]	Mechanistic Biochemistry - Organic Chemistry (SJ) [4]	Mechanistic Biochemistry - Organic Chemistry (JLK) [5]	9.00	3
	10.00	Physical Biochemistry- Therm. I solution therm. (MRW) [2]	Quantitative Biochemistry- Principles of Statistics (JM) [4]		Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]	Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]	10.00	
	11.00	Quantitative Biochemistry- Principles of Statistics (JM) [3]		Mechanistic Biochemistry- Biol. chem. of elements (MRW) [2]			11.00	
	12.00	Physical Biochemistry- Online classes from 09.00 a.m.see Canvas for details	Physical Biochemistry- Online classes from 09.00 a.m.see Canvas for details				12.00	
	2.00						2.00	
	3.00						3.00	
	4.00						4.00	
4 Week Comm. Mon 8 Feb	9.00	Cellular Biochemistry- Cell Metabolism (PH) [8]	Cellular Biochemistry- Cell Metabolism (PH) [9]	Mechanistic Biochemistry - Organic Chemistry (JLK) [6]	Molecular Biochemistry- Proteins (PE) [1]	Molecular Biochemistry- Proteins (PE) [2]	9.00	4
	10.00	Molecular Biochemistry- Dynamic Genome (NL) [1]	Molecular Biochemistry- Dynamic Genome (NL) [2]		Practical Biochemistry - online lab or Stats Online Classes (from 9am) see Canvas for group times	Practical Biochemistry - online lab or Stats Online Classes (from 9am) see Canvas for group times	10.00	
	11.00			Physical Biochem- Therm. I Atomic & Molecular structure			11.00	
	12.00						12.00	
	2.00				Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]	Practical Biochemistry - online lab [see Canvas for details 3-4 hours estimated time]	2.00	
	3.00			Quantitative Biochemistry - Stats Online classes Groups 11 & 12 see Canvas for group times			3.00	
	4.00						4.00	

Weekends can be used to read for essays, which can reduce the time spent writing to around half a day, but this can vary as some people write the essay & do the reading all in one go! Most people usually answer problem sheets over a few days (a few hours at a time) since there's tutorial work/ lecture notes to go over. Lectures are usually in the morning and afternoons are usually free, though you may have a class or tutorial. This year, since everything moved online, the lectures were mostly recorded with some live sessions as shown in the timetable! This timetable reflects a mainly online based schedule, with in-person sessions where possible. Small group teachings such as tutorials & classes were held in person. With good time management, you can make time for other commitments like sports/ societies and down time, while keeping up with the work.

Recommended Reading/Viewing

- **The Life Scientific** - BBC radio 4: find out about the life and work of leading scientists. This is good for understanding how scientific careers work. They also talk about their research so you can learn about interesting science.
- **Nature Podcast**: these are anywhere from 15-40 minutes and give a few of the key headlines and recent research in science and a deeper look at some of them. They are easy to understand and are a good way to keep informed about science.
- **Nature Briefing**: sign up for this free daily newsletter with a brief round-up of science news, opinion and analysis. It only takes a few minutes to scroll through the headlines, and if you have more time, you can click on them to read more if you're interested.
- **Compound Interest Chemistry**: website with interesting and digestible infographics explaining cool chemistry related to everyday life such as 'the chemistry of henna' or 'how is decaffeinated coffee made?'.
- The Bumbling Biochemist: a website that explains some biochemical fundamentals in an easy to understand and casual way with minimal scientific jargon
- **Oxygen, Nick Lane**: this easy-to-understand popular science book talks about all the research in oxygen in contexts ranging from the need for two sexes, how oxygen helped shape evolution, ageing and inflammation.
- **Junk DNA, Nessa Carey**: 99% of the genome is non-coding. This was once thought to be 'junk' but has now been found to have many interesting functions and uses, such as DNA fingerprinting. 'The Epigenetics Revolution' is also good.
- **The Double Helix, James Watson**: an oldie but a goodie! James Watson gives a personal account of the discovery of the structure of DNA, This is a seminal part of biochemistry history and you will learn a bit about it in first year.