

MEDICAL & VETERINARY SCIENCES TRIPOS PART IA

MOLECULES IN MEDICAL SCIENCE

The structure of the MIMS course

The understanding, diagnosis and treatment of disease is increasingly grounded in the molecular biosciences. The human genome sequencing project is but the end of the beginning - the challenge for the future, the post-genomic era, is to make biological sense and medical practice from the galaxy of data acquired. Your Molecules in Medical Science (MIMS) course aims to establish the principles and knowledge base of biochemistry and medical genetics - to give you the means to build your understanding of living things at the molecular level as both you and medical science progress. We want to convey how molecules, large and small, cooperate so that our cells are able to utilise food as fuel, to produce and respond to messengers that enable communication and coordination between different tissues, and to replicate their genomes faithfully and express them selectively. We also discuss how natural genetic variation can give rise to mutant genes, how this can cause both single gene and multifactorial diseases, how the natural transmission of genes occurs and what can go wrong and when, and how these errors are inherited by individuals and in populations.

The 'Aims and Objectives' of the course are stated more formally later in this handbook. Our overall goal as teachers is that you become intellectually self-reliant.

MIMS is taught by means of lectures, laboratory-based exercises with linked discussions and presentations, problem-based learning, and also supervisions organised by your college. Timetables are included later in this handbook.

The different methods of teaching are related. The lecturers, who belong to a range of Departments - Biochemistry, Clinical Biochemistry, Genetics, Human Nutrition, Medical Genetics, Pathology and Pharmacology - will refer to the experimental basis of the material they present. The senior demonstrator in charge of practical classes will discuss the theoretical and factual background to the experiments you will perform. In the problem-based learning exercises (PBL) you will develop your own skills of investigation using web and text resources, and report your findings orally. The college supervisor works with you to integrate all aspects of the subject and helps with any particular difficulties. The teachers in your practical classes are another source of assistance and advice. The senior demonstrator will be a departmental staff member - sometimes a lecturer in your course. The assistant demonstrators will be graduate students working for a Ph.D. research degree, or post-doctoral research workers who have recent and sympathetic memories of the difficulties felt by beginning students.

Your college library should have all the items on your reading list (see later), and the Biochemistry and Genetics departmental libraries also have reference collections of Part I material.

The lectures

As you will see from the lecture timetable, the course is organised around two themes: 'Metabolism in Health and Disease' for the Michaelmas Term and 'Macromolecules in Health and Disease' for the Lent and Easter Terms. We shall present the core material in the setting of two diseases, familiar by name to all of you - diabetes and cancer.

Each lecturer will distribute a handout, usually at his or first lecture. Your supervisors are also sent copies. There will be pointers to relevant sections of the recommended text books (see reading list later). Our general policy for the handouts is that they should reflect the structure of the lectures, and make compact statements about key features: tricky points may get additional explanation. The handouts should contain copies of all significant items displayed during lectures: they are not a literal script of the lectures, and don't include extended commentary or background reference information. That is the province of the recommended text books, which generally do a superb job. As you would expect, teaching and handouts styles can differ from lecturer to lecturer: much as learning styles amongst students.

TO GET MOST OUT OF THE LECTURES AND MAKE YOUR LEARNING AN ACTIVE PROCESS, WE RECOMMEND THAT YOU TAKE YOUR OWN NOTES IRRESPECTIVE OF THE NATURE OF ANY PARTICULAR HANDOUT. THIS WILL ALSO HELP WITH LATER CONSOLIDATION IN THE VACATIONS, AND AS YOU PREPARE FOR THE EXAMINATION IN JUNE.

The practicals and discussions

Biochemistry (and its close cousin, molecular biology) is an experimental science that advances from well-thought out investigations in the laboratory. The services of clinical biochemistry laboratories are also an integral and important part of medical diagnosis. Your course therefore includes practical experiments for you to gain some insight into how laboratory investigations are carried out and how data are processed and interpreted. It is important that you take time to understand the underlying principles and context of the practicals, and also to evaluate the results that you obtained. To facilitate this, there is a separate 2-hour session for discussion and presentation of results for each practical. These are lead by senior demonstrators, but students will also sometimes be called on to present findings to the group. Discussions are a vital part of the course and are your best bet for fully understanding the practicals.

There are three practicals, one in each term, and also a computer-based exercise in bioinformatics in the Easter Term. The practicals are 4-hour sessions (10-12 and 2-4) each for about 38 students, and you work in pairs. As well as a core of experiments common to all students the practicals may also include some variants assigned to particular groups, with the results being presented at the discussion session held in the practical classroom two weeks later. This is a realistic mixture of learning experiences: some things are encountered directly and some are mediated by colleagues - as in the medical and scientific conferences that you will take part in later in your careers.

Discussion of the Easter Term practical includes a general consideration of the use of molecular methods in medical genetics.

You should benefit from practicals and discussions in four ways:

(i) The practicals will introduce you to a selection of biochemical methods and have been designed to complement the lectures. The hands-on experience should link to the mental framework provided by the lectures, and give you a deeper understanding and more realistic perspective of the topics discussed.

(ii) You will learn to handle experimental data effectively, and to extract the maximum information content without falling into the trap of over-interpretation.

(iii) You will gain experience of student presentations to an audience.

(iv) You will be helped when it comes to the data handling questions in the MIMS examination (see later).

Safety and care in the laboratory

PLEASE be careful in the laboratory. Attend to your own safety and that of others around you: this is a statutory obligation - a matter of law.

PLEASE also extend your consideration to the equipment in the laboratory. Most of it is costly to repair or replace.

Policy, rules, and guidance on safety are given on the pages headed 'Safety in the Biochemistry Part I Teaching Laboratory'. You **must** read this before coming to the first practical. At the end of those pages, there is a declaration form, which you must sign to acknowledge that you have read the document and will abide by the rules set out. The form will be collected at the first practical.

Practical sheets

You are given comprehensive notes for each practical. They are colour-coded according to purpose. **It is very important that you read these notes BEFORE you come to the practical.**

Green sheets

The GREEN SHEETS set the context and state the learning objectives for each practical.

White sheets

The WHITE SHEETS contain the experimental plan and instructions. These are not recipes to be read for the first time when you are faced with the experiment. Make a practice of scanning them in advance, a day or two before the practical. Not to take in every detail, which will only make sense when you have the apparatus in front of you but to get an overview of the planned experiment.

Once in the laboratory, the senior demonstrator will give a brief introduction and you should then read and follow the instructions carefully. Take a few minutes to read through the instructions again at the beginning of the practical - don't just dive in, no matter how busy everyone else looks. Always try to think out the principles of what you are doing as you go along, and to understand what is going on in the procedures you carry out. Ask the demonstrators - they may well ask you first!

Probably the most important contribution you can make to the success of your experiments is in making up reaction mixtures. THINK about what you are adding, so you add the CORRECT components. MEASURE and DISPENSE the volume of component reagents ACCURATELY using the semi-automatic GILSON PIPETTES provided.

Blue sheets

The BLUE SHEETS are for processing the data and also contain questions about the practical to help you understand what you have done, and why. They are a form of self-assessment - we don't take them in and give marks, but demonstrators can advise and comment on your efforts. You will find them helpful when preparing for the end of year exam, so it is important to get them filled out properly. We shall give you overhead transparencies of the Blue Sheets to help structure any presentations at the discussion session. Going from raw numbers that come straight off an instrument to a meaningful calculated result is found quite difficult by most students, and may be tested in the examination. So take advantage of the help available. You should complete the Blue Sheets during the practical if that is feasible, or as soon after as possible after each practical. Bring your calculators to each session. Graph paper is available if you don't have your own.

Yellow sheets and discussions

The YELLOW SHEETS contain specimen results and, where relevant, examples of how to analyse them. They will generally be handed out at the corresponding discussion period. The discussion and yellow sheets should help you to understand the experiments, including any variants, not just the ones that your pair carried out.

The Faculty of Biology has developed a web-based computer-assisted learning package to help develop "essential mathematical skills for medical and veterinary students" and cover the types of simple manipulations and calculations that students commonly have difficulty with. This can conveniently be accessed (using your Raven password) from a link on the Course Information site for the Medical and Veterinary Sciences Tripos at <http://www.bio.cam.ac.uk/sbs/facbiol/mvst/courses.html>

Pink sheets

The PINK SHEETS contain important background material related to the practicals and practical aspects of biochemistry. They are put before the sheets for the first practical, as appendices to this introduction. They include an introduction to units, to pH and buffers, and to the principles of spectrophotometry. Try and have a look at them before your first practical, especially the ones about units (appendix 1) and spectrophotometry (appendix 3). Raise any difficulties with your supervisor or a demonstrator.

WE HAVE FOUND THAT IT IS SOMETIMES THE MOST BASIC THINGS, LIKE MANIPULATING UNITS, THAT CAUSE DIFFICULTIES FOR STUDENTS IN DATA HANDLING QUESTIONS. SO DO MAKE SURE THAT YOU KNOW THE DIFFERENCE BETWEEN AMOUNT AND CONCENTRATION, AND CAN HANDLE PREFIXES LIKE MILLI-, MICRO- AND NANO.

The Demonstrators

Demonstrators are there to help you. Rely on them not only to sort out practical difficulties but also to help you make sure that you understand what the experiments are about and what your results mean. They may well also be able to help you understand theoretical or lecture material.

Recording your results

You should bring your own notebook or loose-leaf book along to the practical. Record your results and interpretations directly into the notebook as you go along rather than on scraps of paper that will surely get lost. We have given you these notes in a simple binder so that you can incorporate your own pages. Try to write up what went on

during the practical session: there is no need to write out details that are already in the sheets. Concentrate on ensuring that you get down the key arguments and conclusions.

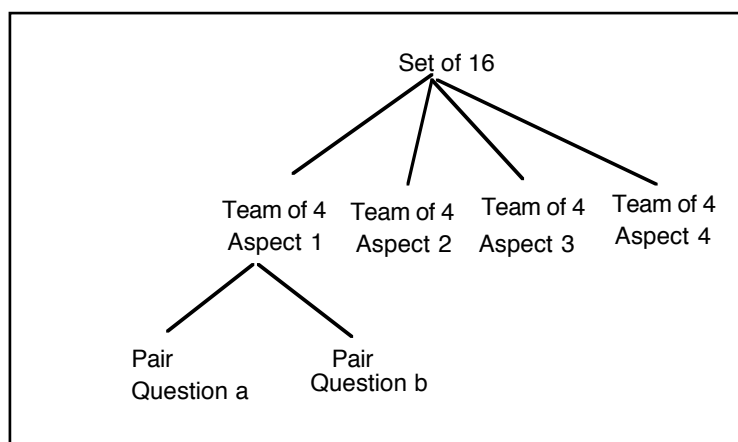
Graphs are often an essential part of the data analysis. Again, they are best plotted as you go along wherever possible. Remember to label axes clearly.

Your notebooks are not 'marked' as part of a 'summative assessment' or examination. Rather they are to help you get to grips with each practical as you do it and write it up so that you still understand it when it comes to revision later in the year. To help with this, we ask you to complete the Blue Sheets (see above). If you feel all at sea, or if your Blue Sheets are full of blank spaces make a point of asking a demonstrator for help.

Problem-based learning (PBL) exercises

These structured exercises are conducted in SETS of 16-20 students. They are intended to develop your skills of investigation in 'researching a topic', principally by means of the world-wide web, and in reporting the results. Each exercise has a launching session that is followed two weeks later by a reporting session. There are two PBL exercises, in the Michaelmas Term and the Lent Term.

The PROBLEM TOPIC is divided into four ASPECTS. Each ASPECT in turn has two QUESTIONS posed. The student SETS will be divided into four TEAMS and each team assigned an ASPECT to work on. Each of the QUESTIONS can then be looked at by two or three students. The scheme for a SET of 16 is shown below.



At the launching session, you will be divided into teams and introduced by a facilitator to the PROBLEM TOPIC, the ASPECTS and the QUESTIONS. We will provide some leads to sources for you to explore, principally on the web. There will be time for general discussion, and for the members of the teams to discuss how to go about their tasks in the following two weeks. E-mail is likely to be a useful means of exchanging ideas and information, and team members should exchange e-mail addresses and arrange an initial meeting before the session ends.

The reporting session (which will take 2 hours) will be lead by a facilitator. Each team of 4-5 students will have 25 minutes for a coordinated oral report, covering the two Questions posed in the assigned Aspect. Each student will participate in one presentation during the year, so if you don't talk in the first Term's PBL, you will in the second Term. (Note that if a team has five members rather than four, two of them will

need to share in giving a presentation in one of the Terms.) The Facilitator will record your attendance, and make a note of those who talked. We shall provide overhead transparency sheets (OHT) and pens during the Launch Session. A ten-minute talk should use no more than three or four OHTs. Experience has shown that it is not practicable to use PowerPoint presentations in the Reporting Sessions. The facilitator will briefly provide feedback, and invite comment after each Aspect has been presented.

Some students have asked if they could provide handouts for the set: this has both advantages and disadvantages, and the student liaison meeting decided that it would not be required, but could be a strictly optional extra. Once all students have completed the exercise (it takes 4 weeks overall), Yellow Sheets will be issued (at a lecture) that draw together and summarise the conclusions of the PBL exercise.

General guidelines on use of E-mail in the PBL exercises

1. You may want to make statements of fact that you have located (and where you found them).
2. You may send RELEVANT statements of opinion to team member, pose and answer questions.
3. Keep your contributions brief and to the point. Don't wander off topic.
4. Make your messages reasonably professional in tone - try to improve your communication skills - and use standard, if informal, English.
5. Observe e-mail etiquette (see the overview of how to use electronic mail at Cambridge at <http://www.cam.ac.uk/cs/docs/email.html>)

The Course Website

We expect to provide a MIMS website within a virtual learning environment called CamTools, which at the time of writing is awaiting its final release. Students will automatically be registered. We plan to provide information about the course and access to some course materials. You will be given more information about this at the start of the Michaelmas Term.

Some MIMS information will also be available via the Biochemistry Department home page (<http://www.bioc.cam.ac.uk/>) at <http://www.bioc.cam.ac.uk/teaching/mims/index.html>

Examinations

The Medical Students' and Veterinary Students' Handbooks (you have been given a copy) describe the examination system. They can also be found on the Faculty's Web Site, in the section on medical and veterinary sciences courses at

<http://www.bio.cam.ac.uk/sbs/facbiol/mvst/assessment.html>

There is also general advice on examination skills and on the criteria used for marking and classing.

<http://www.bio.cam.ac.uk/sbs/facbiol/examskil.html>

<http://www.bio.cam.ac.uk/sbs/facbiol/camonly/exam-marking.html>

Additionally, CUSU (Cambridge University Students' Union) provide comprehensive information about all aspects of examinations:

<http://www.cusu.cam.ac.uk/academic/exams/>

Some information is summarised below for convenience.

The B.A. degree and 2nd M.B. or 2nd Vet.M.B. examinations

After the preclinical course you will get a Bachelor of Arts (B.A.) degree, provided of course that you pass the necessary examinations and fulfil the residence requirements. At the end of each year you take an honours examination, known for historical reasons as a Tripos examination: MVST Part IA in year 1, and MVST Part IB in year 2. In year 3, most of you will take either a single-subject NST Part II or NST Part II Biological and Biomedical Sciences (BBS). The former includes a laboratory-based research project, in the latter you combine a major and minor subject and write a dissertation but do not do laboratory work. Your performance in each exam is classed - 1, 2, or 3. (In MVST IA the second class is undivided, but otherwise it is divided into 2.1 and 2.2). There is no carry over of marks or class from one year to the next. The B.A. degree certificate that you receive makes no mention of the subject or the class obtained in any examination, though that information is available as a transcript.

In order to progress through the course and go on to clinical training, you also need to satisfy the examination requirements of your professional bodies - the GMC and RCVS. These are the 2nd M.B. and 2nd Vet.M.B. examinations and in most subjects, including MIMS, are simply sections of a Tripos examination that you have to pass at a qualifying level. If you don't reach that level (historically, around 90% of students do) then you can have ONE further attempt at a separate 2nd M.B. examination, in late September, before the start of the next academic year.

Past question papers

Copies of past MIMS examination question papers are **available online on Camtools**. Answers the data-handling questions in Section II have been sent to your supervisors: although it's better for you to try the questions before looking at the answers! Also past exam papers are available in the bound collections in college libraries. Past papers for the MIMS predecessor courses (Biochemistry and Medical Genetics, set for the last time in Easter Term 2000...) are only helpful to a limited extent and indiscriminate use of past papers could be quite counter-productive. Courses evolve over time and the content. To keep your study (and efforts) relevant try to limit the use of past questions for revision purposes to those occurring within the previous 5 years.

IMPORTANT INFORMATION CONCERNING THE MIMS EXAMINATION

Minimum attendance requirement and attendance register

Award of the M.B., B.Chir. degrees or the Vet. M.B. degree depends on your diligently attending the various courses as well as your satisfactory examination performance. This is a real and serious condition and is required by the Faculty Board of Biology on behalf of the bodies that control your future professions, the General Medical Council or the Royal College of Veterinary Surgeons.

In MIMS we monitor your attendance at the practical course - experiments, discussions, and PBL sessions. **We expect you to attend all of these sessions**, and you will be at a disadvantage in the examinations if you do not. **There is a legal minimum level of attendance at the practical components of all MVST Part IA courses set at 60 per-cent, which you must fulfil: otherwise you would be at risk of not being entered for the 2nd M.B. or 2nd Vet M.B. examinations.**

In the MIMS course, the following sessions are compulsory:

- **The three experimental sessions**
- **The computer-based bioinformatics exercise**
- **The problem-based learning reporting sessions**

If you fail to register on these occasions, without grave cause supported by your college, you will not be certified to have attended diligently, which means that **you will not be permitted to proceed to a clinical course** (although you may, in principle, still proceed to the B.A. degree).

If you are prevented from attending a required session by circumstances beyond your control, you should inform your **Director of Studies** or **Tutor** at the earliest opportunity, and also the course organiser. As you will see from the practical timetable, all of the sessions are run on ten separate occasions. It is sometimes possible, given good reason and sufficient notice, for a student to attend a different session from that normally assigned. Because students work in small groups, this is potentially disruptive and we keep such arrangements to a necessary minimum.

The attendance register will be made available for all sessions at an appropriate time during the session. **You have to sign your name in person - others may not sign for you, and initials are not accepted.** These registers are checked each term, and any deficits will be reported in a letter to your college Director of Studies.

If there are any problems regarding your attendance at a particular practical, discussion or PBL session and/or you attended but forgot to sign in, please inform the Senior Teaching Technician (email slrb2@cam.ac.uk) as soon as possible.

General information

The MIMS exam has two papers. The first paper also acts as the 2nd M.B. and 2nd Vet.M.B. examination and lasts for three hours. It has two sections, and all questions are compulsory: Section I (one hour) consists of multiple choice questions (one hour) and Section II (two hours) has questions on practical aspects, including interpretation and handling of data. The answers to Section I will be computer marked. In the examination, there will be a booklet of questions for Section I and a separate answer sheet containing a matrix of boxes. You indicate your chosen answer by shading in the relevant box with an HB-type soft pencil. The answer sheet for Section I is collected by examination staff after the first hour of the examination. Section II also has answer booklets with boxes to write in for each question. The second paper (Section III of the examination) lasts two hours, and has a choice of essay questions. Each paper carries the same number of total marks. The 2nd M.B. 'resit' examination is held in late September for those who failed at the first attempt and consists only of Sections I and II, in the same format as for the June Tripos examination.

You can view your examination results online on CAMSIS.

Section I (Multiple choice)

The form and layout of the multiple choice questions set in Section I in 2011 will be the same as in 2009 (look at the question paper).

There will be a maximum of sixty individual answers to be completed in the 60 minutes allowed. Section I will start with between twenty five and thirty 'A-type' questions that ask for a single answer out of five OPTIONS, labelled A-E. (In 2006 there were 25 'A-type' questions.) Next, there will be ten 'R-type' extending-matching questions that have a TOPIC and an extended list of OPTIONS, labelled alphabetically from A. Below the list of options are three sub questions, i, ii and iii. Each correct response carries the same mark. Marks are not deducted for incorrect answers or failure to provide an answer. The OPTIONS are listed in strict alphabetical order in all questions, and there is no pattern as to which is the correct answer. In R type questions, it is not excluded that the same option may be the correct answer to more than one of the sub questions (i, ii and iii). The MCQ paper for 2010 has NOT been provided.

Section II (Data handling and interpretation)

Section II of the first paper, dealing with the practicals, will include a long sub-divided question that centres on a particular theme, as well as shorter questions (two in recent years). Boxes are provided for your answers (see 2009 paper, available on Camtools). Any of the questions may include calculations. The long question is worth half the marks available for Section II, but marks are not necessarily allocated equally to subdivisions within the question. Deductive skills will be needed to answer it fully and it is likely to test knowledge from the practicals and discussions overall. Like any other question from Section II, it may require background knowledge from the lecture course - especially that which deals with methods - supported by the notes provided in this handbook and the yellow sheets.

Section III (Essays)

When answering essay questions, take particular care that you have absorbed what the question is specifically asking for. It is a common fault for candidates to react unthinkingly to a 'trigger word' and simply write all they know in response – sometimes just unloading an essay that had been devised during revision and that is

hardly relevant to the question. Take a little time to reflect, rather than leaping straight in. This advice applies particularly to subsection C of the second paper, where the questions are broad and you need to plan your strategy - what to leave out, as much as what to put in!

Helpful diagrams are welcome as part of an essay. You are perfectly free to use abbreviations that are standard scientific vocabulary without definition (for example G6P, ATP, DNA, RNA).

The examiners will have regard to the style and methods of candidates' answers. You should write legibly and not adopt note form unless specifically requested to do so.

Formal structure

The formal structure of the MIMS examination in MVST Part IA (Form and Conduct) is set out below.

Form and Conduct – MIMS

Candidates will be examined by two written papers carrying 50 per cent of the total mark each.

The first written paper will be divided into two Sections, I and II. Section I will last one hour and will carry 33 per cent of the total marks. Each question is compulsory and will carry an equivalent mark. Some questions may adopt a multiple-choice format. The questions will examine the lecture material and the problem-based learning exercises. Section II will last two hours and will carry 17 per cent of the total mark. It will consist of questions on practical aspects of the course, including interpretation and handling of data. The questions may require knowledge of the lecture course whilst focusing on the experience obtained in the laboratory- and computer-based exercises.

The second written paper, Section III, will last two hours and will carry 50 per cent of the total mark. The paper will be divided into three Subsections, A, B, and C, each containing three or four essay questions. Candidates will answer one question from each subsection. Subsection A will relate principally to the lectures given in the Michaelmas Term and Subsection B principally to lectures given in the Lent and Easter Terms. The questions in Subsection C will be of broad scope and draw on the entire course of lectures and practical exercises. The nature of the questions in Section III shall be to test integrated understanding rather than detailed factual knowledge.

Student feedback and representation

We shall seek your views about the course by means of questionnaires and liaison meetings with your representatives each term. We take student comment very seriously in course development, and the higher the response rates from questionnaires the more helpful they are. Both positive and negative comments are welcome; the questionnaires are anonymous by design; but anonymity does not release you from the normal courtesies of communication. Questionnaire analyses and minutes of the liaison meetings are publicised to you on the course web site.

Study Skills

Here are some rather informal hints and comments that may be helpful in different degrees to most of you. Remember that Medical and Veterinary Students' Handbooks also include advice about learning. You need to integrate for yourselves all the 'wise words' (that's the intention anyway) that you get from many sources.

To state the obvious – the University is not like a school

The transition from secondary education to higher education has to be anticipated and worked at. You the student have responsibility for your learning and work patterns outside the set timetables. Your college supervisors will provide guidance and encouragement, but only you can actually do the work needed to attain the necessary knowledge and understanding of your subjects. Your supervisors will set you some tasks, but don't regard the week's work as over once you have completed them. It's not a good idea to do the minimum during term in the hope of catching up in the vacations: that simply doesn't work. You sometimes need to take comments from second year students with a large pinch of salt! It's important to keep up with the courses as they develop, and continually to review how new material relates to topics already covered – biomedical sciences are highly integrated.

The medical and veterinary courses cover a year, and are not modular: there is a University examination (MVST Part IA) at the end of this year, which will require you to write essays as well as to answer multiple choice questions and to analyse and interpret data. Copies of the MIMS examination papers from the last three years are included in this handbook.

Time management

Procrastination: I'll do it tomorrow - really!

Well - you might. But if you don't you get chased eventually. Edward Young, an 18th century poet, wrote 'Procrastination is the thief of time'. Make a start today, decide how to go about it. Make a plan. Then you'll feel better, and get off to a good start - tomorrow. Here's another quotation: 'Sufficient unto the day is the evil thereof.' – today's problems are enough for today!

The essay crisis

A rite of passage. Everyone has at least one. Supervisors will be understanding, provided it doesn't become a way of life. Don't let a backlog of set work build up, supposing you can catch up in the vacation. You'll have consolidation to do then. Do a decent job on the essay, but don't spend ages trying to go for total perfection. There is a 'law of diminishing returns' that anyone tempted to spend their resources on high-end lap-top computer should be well aware of.

But I've got to - train, row, rehearse, go home/Oxford/London, make up, break up etc

Yes - life has to be lived. But work is part of life. Plan and prioritise. Sometimes unexpected urgencies have to be coped with, and people will understand. But try to plan your commitments - keep a diary / appointment book (and don't lose it!)

It was only 5 pints...

The statistics on 'substance misuse' by Doctors are alarming - especially if you are a patient. Don't start young to form a pattern that you can't get out of. Beware of binges!

Learning and Understanding

Do I need to know this?

It is very common for beginning students to ask 'do I need to know this?' - after a lecture that may seem to have delivered a term's worth of 'A' level in 50 minutes. You shouldn't see lectures and practicals as giving a list of items that have to be 'learnt' in the sense of memorised in totality. Often lecturers will include topical examples of general principles, or mention a recent discovery that's just been published - this is not for you to 'learn', but to excite your interest and transfer their enthusiasm to you.

Your first priority should be to concentrate on '**understanding**', on building a mental framework that you can tie 'facts' to. That will help you prioritise what you really do need to know well, as part of the vocabulary of the subject - whatever it may be. After a while you'll find that 'facts' stick to the framework without conscious effort on your part to 'learn' them.

Lots of stuff will be useful in many contexts. It's much easier if you can relate new material to a framework of understanding. Tie information and understanding together. Only connect... (E. M. Forster, *Howards End*).

It's not like 'A' level!

Nor should it be! 'A' level is an important step towards higher education, not a final parking place for the mind.

Is there a syllabus?

More an agenda - not all of whose items have equal weight. We have included the 'Aims and Objectives' of the course in this handbook, but not as a tick list of factlets.

How do I know that I know?

Try it out. Talk to each other. Imagine explaining signalling or genes to your relations. Write down six important things about DNA (or whatever) on the back of an envelope, and then check them. Ask your supervisors. Be alert to feedback from supervision written work.

There's too much to learn!

If it seems like that, assess your priorities. Understanding is the thing! Try to communicate your understanding to others. Nothing like having to teach something to get you to understand it: students ask very sharp questions!

Horizons

Lift your eyes to them from time to time. What would you like to do in your third year? As you move through the course, you'll become more intellectually self reliant and an image of what sort of Vet or Doctor you want to be will gradually come into sharper focus.

Fear of calculations

Sometimes encountered! It's seldom difficult, for example, to convert raw data into a useful format. But there may be many steps to perform. Be clear about what you have to do, and why. Understand the algorithm (look it up - it's not a typo for logarithm!). Make sure that you keep track of the units that you are using (see Appendix 1), that you don't confuse amount with concentration, and can deal with dilution from stock solutions into mixtures. Practice helps of course, as do yellow sheets. Seek particular and timely help from your supervisor if you have problems with numeracy and calculations. It's very important for clinicians to be basically numerate. You don't want to prescribe or administer a therapy with incorrect doses (drugs, radiotherapy etc).