

Balliol College Chemistry Professor William Barford and Dr Rachel Quarrell - Video transcript

The tutors, Professor William Barford and Dr Rachel Quarrell are seated, facing the camera. The tutor's name and course subject are shown the first time they appear. The tutor answers the questions that are displayed on screen.

>>DR RACHEL QUARRELL (FELLOW DEAN AND LECTURER IN CHEMISTRY): My name is Rachel Quarrell. There are three branches of chemistry and my area of expertise is Organic Chemistry. I don't do research anymore but when I did in the Oxford department for 14 years I worked on Medicinal Chemistry, which is all about the development of new drugs against diseases and then working out how to make them in the laboratory.

>>PROFESSOR WILLIAM BARFORD (PROFESSOR OF THEORETICAL CHEMISTRY, FELLOW AND TUTOR IN PHYSICAL CHEMISTRY): My name is William Barford. I'm the tutor of Physical Chemistry at Balliol. I'm also a professor of Theoretical Chemistry in the Department of Chemistry. My research interests concern developing computational models and theories of quantum processes in macromolecular systems and then using a computer to calculate numbers which we can then compare to experimental observations.

[Question displayed on screen:]

What qualities do you look for in undergraduate students?

>>PROFESSOR WILLIAM BARFORD: We're looking for students who are intellectually curious, have enthusiasm, motivation and the ability to work hard and want to work hard on their subject.

>>DR RACHEL QUARRELL: I would add that we want students to develop the ability to learn for themselves and to see that there's no problem with putting a lot of hard work into a difficult idea and to understanding it. This is something that will develop during their time at university in particular. Sometimes, ideas don't come very naturally and something we would look for is that people are willing to put that effort in and to see the reward later when they fully understand an idea.

[Question displayed on screen:]

What type of work do you give students to prepare for a tutorial?

>>DR RACHEL QUARRELL: The type of work we give students will depend a little bit on the type of subject that they're doing, including which branch they're studying. So, for Organic, I want students first of all, to read about a subject in depth, so having done that and maybe made some notes which they will refer to later in their own revision, they're then going to

look at problems which I set them. I'd personally always set problems which are of the standard of the exams they're going to take at the end of the year, they will do those problems and hand them in before the tutorial and maybe have a further think about the ideas involved in them before we sit down and talk.

>>PROFESSOR WILLIAM BARFORD: Each course has with it some problem sets, so I set those problems for students to complete before the tutorial so like also in Inorganic and Organic, they will also do some background reading, they'll look through lecture course notes and relevant reading and then tackle the problems which may be just numerical problems or developing some theory for the subject. That gets handed in before the tutorial, which I'll then look at and mark and we go through those in the tutorial itself.

[Question displayed on screen:]

How are tutorials structured?

>>PROFESSOR WILLIAM BARFORD: Firstly, actually in tutorials, I ask them, are there general questions about the lecture course they've been attending on that tutorial problem sheet? So, we discuss any general background problems or questions about that overall topic. Usually, there'll be some difficulties on some particular questions on the tutorial sheet, for most students, so we go through those questions and work out what went wrong and then we try to develop some more understanding about the context of that problem in the subject.

>>DR RACHEL QUARRELL: It's quite similar for Organic. There are some slight differences. Like William, I would first want to know what they had found difficult, so we're looking for what are the areas they would have found difficult when they were reading, to understand if there are some particular things that they feel maybe aren't explained clearly enough and they want more clarity on, we might well start with those. I will probably also, having marked the work have some ideas in my head about general parts of the concept that they aren't getting right and perhaps where I want to give them more of an overview so they see where it fits together with other aspects of the chemistry we've studied or which they're going to study in the future. For Organic, where we're looking at mechanisms by which molecules react and it's not very numerical at all. The difficulties often arise in terms of how to start understanding a problem and how to get your head around what that problem means and how you would solve it.

[Question displayed on screen:]

How do you explore ideas with your students?

>>DR RACHEL QUARRELL: It's an interesting issue, how you discuss chemistry ideas, conceptual science can be quite tough I think. One thing I discover is that students don't have much of a chance at school level, to explore how to think rigorously. So, this conversation about what they understand of a problem is the general format of how we're discussing ideas,



but into that comes; What do we mean by what you've just said? What does that actually mean? And, what are the consequences of it and what can you logically deduce from that particular fact or experimental result that you've read about? It's getting people to see how the logical ideas connect together and get better at producing a logical explanation takes a lot of time, especially in the first couple of years and then, as you see students begin to acquire that ability then they are developing really great explanations of their own and then we're exploring you know, what might be a better explanation? How would you test it experimentally? And those kinds of things.

>>PROFESSOR WILLIAM BARFORD: Often a problem or question will spin out another idea or another concept which needs exploring so exploring ideas stems from answering the questions we set in tutorial sheets. That naturally leads to tangential questions which might arise from the students themselves or I might explore either concepts or ideas outside the kind of lecture course or the problem set itself.

[Question displayed on screen:]

What do you enjoy about conversations with your students?

>>DR RACHEL QUARRELL: I think the tutorial can be as enjoyable for the tutor as it is for the students. It's great to talk about your subject and to discuss ideas. I find that students very often end up phrasing something or seeing something from a slightly different perspective which then makes me think about it differently and that's a very positive experience. Every year which then makes me think about it differently and come up with new ones, particularly trying to find analogies that will help them understand something difficult is quite a lot of fun and, getting them to see that they can themselves just discuss on the same level we're looking for is quite a step on and people achieve that part way through the course quite often. So, I thoroughly enjoy that, it's a great part of the of the job and being able to have those conversations with small groups of students rather than the big class.

>>PROFESSOR WILLIAM BARFORD: The kind of teaching thing always leads to themselves, having students themselves contribute and for them to explain things to their peer group. Understanding things better for the tutors In my own tutorials, it's always interesting to see how they actually approach a problem differently from how I might approach it. Occasionally, I might actually pick up a few tips about things, seeing them approach the questions differently than how I do, so that's always also quite enjoyable, it's part of the conversation of teaching.

[Question displayed on screen:]

How do students get feedback on their progress?

>>DR RACHEL QUARRELL: Our aim in Chemistry is that students should always understand what we think of the level of their work and how well they're achieving. So, we give small

amounts of feedback in written form on their tutorial work. During a tutorial they should be left in no doubt of when we want to tell them they've done well or when they've got something they need to look at and perhaps work harder on, so we're aiming to give them that kind of feedback continuously as it goes through. At the end of every term, there are these occasions when each student comes to talk with the whole group of tutors about their progress in the term and also, at the beginning of terms after vacations where they haven't had an exam the previous term, we usually set some kind of exam, a small paper or a couple of papers which help them to test their understanding under exam conditions of what they learned the previous term. One of the main aims of this is to get used to the idea of exam technique. I think the format of university exams can be very different from those at school level. Then of course, there are the exam marks that every student gets when they do university exams, which are not marked by us unless one of us happens to be an examiner, and they will get those at the end of every year for Chemistry. So, there's a continuous process of feedback where we're hoping students will never be left in the dark about what we think and how they can improve.

[Question displayed on screen:]

Are there any other topics taught on the Chemistry course?

>>PROFESSOR WILLIAM BARFORD: In first year there's a maths course. In fact, that contributes to one quarter of the first-year examination and there's a weekly class to go along with that maths lecture course. In addition to that, there's also some lecture classes on physics and also particle physics twice a term. So, both those courses, math and physics underpin the more quantitative mathematical part of the Chemistry curriculum.

>>DR RACHEL QUARRELL: In addition, from the second year onwards, people are able to take supplementary subjects if they wish, which can explore things that are tangentially related to chemistry but not necessarily as directly overlapping. There are some areas of overlap with the course in some of these, so for instance, Quantum Chemistry and Heterocyclic Chemistry are studied, but there are also other things that you can go into such as Chemical Pharmacology.

[Question displayed on screen:]

How do students inform your own research?

>>PROFESSOR WILLIAM BARFORD: There's 12 weeks per term in the fourth year, and students do a full-time project with one supervisor in a research group. In my case, I have

one student a year normally doing a part two project and very often that's publishable research. So actually, the research itself is publishable and so, I benefit from having our undergraduates doing these fourth-year research projects with me. That's true of most of the research active academics in the department, they have these part two projects who help

those research ideas. But, for students it's also very motivating, in fact, Rachel can mention this herself, being a former part two student. It's much more in-depth, understanding the subject.

[Question displayed on screen:]

What is the best thing about teaching at Balliol?

>>PROFESSOR WILLIAM BARFORD: The best thing from point of view of the tutor is having these highly motivated students who inspire us hopefully to teach better and from their point of view, it's good for them because they are working these small cohorts, tutorial cohorts for the whole three years.

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