[MUSIC PLAYING]

INTERVIEWER: Well it wouldn't be a student hub live without some live science. So in this session, we have a range of very exciting things. Nick Turner, thank you very much for joining me. Now this looks very exciting. What is it?

NICK TURNER: OK, this is our prototype of our FTIR machine. But I'm going to come back to that in a little bit if, that's OK.

INTERVIEWER: That's fine. Right. We're talking about infrareds.

NICK TURNER: Yes.

INTERVIEWER: So fill us in, then. What is infrared?

NICK TURNER: OK. So if you imagine light, as we kind of see it, we see all the colours around us. And that's in physics, just part of the electromagnetic spectrum.

But the electromagnetic spectrum is more than just visible light. So you've heard of ultraviolet, which is one end towards the blue end of the rainbow, if you will. And you also have infrared, which is below red. And that's kind of where it is. It's the next section down from our visible light spectrum.

INTERVIEWER: OK. Excellent. So how can we then view it if it's right at the end of the spectrum?

NICK TURNER: Well we have the ability to study those wavelength, and kind of put false colours onto them, if you will. So the infrared section is where things thermally radiate. So if you've got something hot, that it kind of will give out thermal energy that is in the infrared spectrum.

And we're able to see that. So what I have here is a thermal camera attached an iPad.

INTERVIEWER: Is this like these thermal cameras you see in police chases in [? [INTERPOSING VOICES] ?] movies?

NICK TURNER: It's exactly the same. They are exactly those kind of ones. So in fact I should be able to tap it onto a kind of grey view, which is what you might actually see on the TV. But let's put it back to the colour, because it's prettier.

INTERVIEWER: Very nice.

NICK TURNER: So what we have is essentially a false colour image. So it's picking up the radiation that bodies are giving off. So the actual heat we're seeing, which is the infrared energy. So if I put my hand in the way, we can see my hand here. So my fingers are slightly colder than my hand.

INTERVIEWER: I've seen them do this kind of thing on *Springwatch.*

NICK TURNER: Would you like to have a go, put your hand in the way? A little bit more. There you go. So your fingers are warmer than mine.

INTERVIEWER: Yes. I've been in here for two days, Nick! [Laughs]

NICK TURNER: I've just come in, so I'm outside in the cold.

So what we have here is a hot cup of tea. And we can, if I put it down, you can see the water and the heat radiating from this. You can also see the difference in the cup. So the bit which is actually near the liquid is obviously hotter than the rim.

And we'll try it the other way around. I have a nice, ice cold cup of cola here. And it's kind of blue, so it's absorbing the heat, which we have right here, difference.

Now I've had this sitting on a piece of paper. So hopefully this will work, and the paper will have different colours on it. So you can see where the brightness bit is where the paper's absorbs heat from the hot cup of tea, and the darker bit down at the bottom is where heat has been absorbed by the paper, by the cola.

So these are really, really useful, because it allows us to see into the infrared spectrum. So for night vision, and as you said on police camera action, when you kind of see those police chases. And *Springwatch,* of course.

INTERVIEWER: Yeah. OK. So why, then, I mean, we can sort of see the relevance in those sorts of areas. But why at the Open University are you interested in this?

NICK TURNER: Well, it has lots of applications, as you said, with the ones we've discussed, discussed [INAUDIBLE]. But I'm a chemist by training. And we use this for analysing chemical compounds. So effectively, each compound-- and I have some--

INTERVIEWER: Ahh, I wondered what the model things were!

NICK TURNER: I have some models here. This is a model of caffeine. Will absorb infrared energy differently. And this is where our spectrophotometer comes in. So each of these bonds--

INTERVIEWER:

Your spectropho-what?

NICK TURNER: Spectrophotometer. So it's a machine that absorbs spectra and measures photons. So this is what we have.

So each of these bonds, if you will, and if you imagine a chemical molecule, will absorb differently, depending on how it moves within its structure. So different Compounds-- so I've got this is caffeine, and this is ampicillin, which as you can see is a bit more flexible-- will absorb much very, very differently.

INTERVIEWER: So would this sort of thing be able to differentiate between the two compounds? Is it that accurate, that you can tell which one is caffeine?

NICK TURNER: Exactly. And I'm actually going to show that to you, if possible.

INTERVIEWER: And this is on the Open Science Laboratory.

NICK TURNER: Yes it is. So this is one of the latest bits of instruments that we've picked up, which is going to be coming into different courses that we're going to be using. The idea is that students will be able to log on and run experiments from home from their iPads, and even their phones. So you'll be able to do your laboratory experiments on the move.

INTERVIEWER: It's very interesting, because as Hazel [INAUDIBLE] said the other day, we're no longer sending out chemicals to people for them to do at home, although that used to be the case with the OU. The Open Science Laboratory has got a massive range of various tools and things that students can do live science on.

NICK TURNER: Exactly. One of the benefits of using the Open Science Laboratory is that we have top of the range analytical equipment. So the kind of things that you would see in a proper chemical laboratory in industry or in a forensics laboratory.

INTERVIEWER: So this is the actual similar experience, or the same experience, even, that people would use

in terms of the data that they can actually input, and the tools that you can use to analyse it.

NICK TURNER: Exactly. So if we can look at the top, if we kind of look at the top corner up here, we actually have a camera focused on the instrument which is sitting in a lab about 200 metres away from where I'm sat. And I'm going--hopefully-- yeah. It's working. So I'm going to control it. And it's now going to go and position itself ready for our first sample.

So I will click the Sample button. So we have quite a simple, simple kind of interface for this. And each time one of the circle goes around, it's collecting data. So it collects data for 16 cycles.

And we get these peaks here. Now each of these peaks effectively is absorption of light by one of these bonds. So we can tell by the shape of the peaks and the pattern of the peaks what's actually present. So we can work out which atoms, which chemical it is. But also by the size of the peaks, we can tell the concentrations. We can tell how much is there.

So this is one of our compounds. And if I click another one, and it moves around, what we have, we've got two pure compounds that we've put in here, and then a mixture. So we should be able to see some of the peaks shared between the two.

So if we look in this region here, there's no sharp peak. But if I press this-- there we go-- we should hopefully be able to see a peak in that region on this next spectra.

INTERVIEWER: So do you have profiles and have samples from libraries that you can use to compare to see whether you've got the right sample?

NICK TURNER: Yeah. So a chemical compound will be taken, and have a range of different experiments run on it. And there's a database called NIST, which is the American database which is fully accessible to anyone. And you can put the information into it. So it's just N-I-S-T. And if you search that, you come across something called the Chemistry Web Book. You can click open that. You can then type in whichever chemical you're interested in. And it will give all of the physical chemical data.

INTERVIEWER: So you could then, I guess, identify whether your sample might be polluted, or have an issue with it.

NICK TURNER: That's exactly right. So what we've done is we've here, if we come back to these results. So we've actually got a peak here. So this is our pure ampicillin, which is this compound here. And

we now have a mixture which should have characteristics of both.

Now this might be of interest for situations where somebody has, perhaps, adulterated. So if you were looking to see if a drug was pure, and it wasn't a counterfeit, you might use a machine like this to analyse it.

INTERVIEWER: It's amazing that it's actually physically so close to us, and you can see it all happening.

NICK TURNER: Exactly. It's quite nice. And as I said, this interface has been designed for students to be able to use. And it's going to be coming online on a number of our chemistry, and chemistry and science courses in the next year or so.

INTERVIEWER: But could this be used in criminal cases-- for example, to identify drugs, and where they came from, maybe if there were sort of similarities in terms of impurities.

NICK TURNER: Yes. You should be able to, with the kind of compounds, because each compound, if you will, has its own spectrum-- it has its own fingerprint, if you will-- you can detect the presence of other compounds which are in that spectrum. So if you have something which is a mixture, then you can actually pick up whether it's there or not.

So currently, this sample here is quite wet. So you have this really big peak, which is attributed to water.

INTERVIEWER: That's really interesting. Are there any surprising uses of this, then?

NICK TURNER: Of infrared? Or this kind of spectroscopy?

INTERVIEWER: This kind of thing. Yeah.

NICK TURNER: Well it's used, as you said, it's used in drug analysis. It's used for measuring counterfeits. But infrared in general is used quite significantly in different types of spectroscopy.

One of the kind of recent things that has been developed, are really powerful infrared spectrum telescopes. So they're able to look at the absorption of infrared light by interstellar dust to be able to look at the chemical compounds that are just floating in the vastness of space, and not actually surrounding planets. What's actually in the interstellar medium.

INTERVIEWER: Fascinating stuff. Can we take a quick trip to the Hot Desk, where we could possibly not measure the amount of heat generated from the chat and discussion? We're talking about a

lot of stuff. But HJ and Sophie, how are you both hanging in there?

SOPHIE: I'm just about keeping to grips with everything. Science is never really my strong point. But it's so interesting. And we've really got a lot of people who are rally interested in it, and the molecules and all sorts. And we have got Gideon as well. He's joined us from Namibia in Africa. So, hi.

HJ: And Jeff says as well that through the Open Science Lab you can connect to a telescope, microscopes, and Mars rovers as well. So I'm sure we'll have to definitely have a look at that. And we posted all the links in the chat to NIST and the Open Science Lab for you to have a look at as well.

INTERVIEWER: Well, that's interesting, actually. So thinking of the topic of space, we often think of it as a vacuum, don't we? But that there's stuff in space, too.

NICK TURNER: Yeah. There's material floating around. And it's not just simple compounds, as you'd think, just gases like carbon dioxide, or nitrogen dioxide. Proper complex molecules are present.

And it's quite interesting, because we have researchers here who are looking at the origins of life. And actually being able to measure and find evidence of these kind of compounds floating around in space and around interstellar bodies is really exciting to those kind of researchers.

INTERVIEWER: So do things like this ever end up on things like the [INAUDIBLE] lander. I mean, we've been speaking recently about some of the initiatives that the Open University have been doing in terms of space. Would you ever use instruments like this to actually measure what's out there in space on particular planets or moons or asteroids, and send that back to earth?

NICK TURNER: So yeah. So infrared sensors would be on telescopes. They'd be very popular on telescopes. And certainly they would be on cameras. So rovers that are on Mars, for example, or if we do visit any other planets, will have infrared ability, because they'd want to be able to measure, again, the potential of the spectra here, or the general heat of things. So that's kind of where you might find them.

INTERVIEWER: Wow. Exciting. So are you working with many other colleagues, then, on things like this? Do you work with people who are developing the rover, for example, over the road there?

NICK TURNER: Not so much. My research here tends to be quite lab-based. So my actual what I do in the laboratory is quite lab-based. This kind of thing, I'm working on developing the Open Science

Laboratory with my colleagues.

INTERVIEWER: So what other things, then? We've heard from the chat about some of the things available in the Open Science Laboratory. What other things then are you working? Have we sort of finished this section, by the way? Because I don't want to interject if there's something else you want to dish out.

NICK TURNER: No. It's fine.

INTERVIEWER: Ah, brilliant. What other things are available, then?

NICK TURNER: So we have instrumentation for looking at chromatography. So you might have done the experiment at school, where you bought some ink, and then separated it out with water so it went into different colours. So we have sets for equipment in laboratory which allows us to specifically, with really, really high precision, separate out a mixture of compounds. So that machine is called a HPLC-- a high pressure liquid chromatograph. So we're bringing that system online.

I talked to you earlier about this being infrared spectroscopy. We also have what's coming into the Open Science Laboratory, an instrument called a UV vis spectrophotometer, which essentially does the same as this, but in the ultraviolet and in the visible range.

INTERVIEWER: So if you're doing a lot of laboratory-based work, what's the most exciting part of your job, then? If you're not going out on these missions and being involved in other things. Because you're looking at a lot of data. And that can be really, really exciting when you find something. But it must also be difficult in terms of analysing and comparing a lot of things.

NICK TURNER: I think working in laboratory, when you come up with an idea, and you've gone into laboratory, and you've designed your experiment, and you've tested it, and it happens, or you get something exciting out. It could be something that you hoped for with your hypothesis working, or something completely different. And you have the opportunity to go, why is this? What is this compound I've got? Perhaps, I don't actually understand what this is. And this is where this kind of instrumentation comes in.

INTERVIEWER: So what's your next big thing, then?

NICK TURNER: What? Personally, research-wise? My research is based around designing artificial antibodies. So what nature does-- and nature works through molecular recognition.

So your body is essentially proteins and small compounds that interact with each other, which produce all the body's processes. I look to mimic what those proteins do, but in plastics. So I'm working on methods for a low amount of chemical analysis. So trace--analysis-- the parts per billion level detection of toxins of drugs in the environment, or drugs for measuring whether people are cheating at sports.

INTERVIEWER: Wow. Fascinating. And a very topical area as well.

NICK TURNER: Yes.

INTERVIEWER: Excellent. Thank you bringing us such a hot topic. I'm sorry. I couldn't resist that. It's been really fascinating. And so nice to know.

Tell us then, the Open Science Laboratory, there are certain things that people can access on Open Learn, as we know, which are free materials that students and non-students can look at. And you've spoken about how some of this is embedded within curriculum. But tell us, can anybody access some of these?

NICK TURNER: Yes. I mean you can log on, and you can log on and secure an account using the Open Science Laboratory, where you can essentially come in and sign up. And there's a range of experiments that you can access for free.

As we build this resource up-- and you have seen, as you said, the Mars rovers, and the other instrumentation, the telescopes-- they start to get embedded into courses, and potentially as standalone experiments for students to interact with.

INTERVIEWER: It's exciting times. And it makes studying science at the OU not only practical, but you get so much hands-on experience.

NICK TURNER: Yes.

INTERVIEWER: We've got a question on the hot desk I'd like to answer before we end the show.

HJ: Yes. I think because today we've been talking about where our degrees take us, and all the different things we study. And Gideon's actually wondering what you did to get where you are. What was your journey into your field?

NICK TURNER: Well I started the University of Southampton. I studied pharmacology, which is drug design.

And I started off by looking at drugs that bind with certain receptors. But then, as my research progressed, I then started to develop receptors that actually bind ligands.

I've worked in three universities in the UK. But I've also worked in America at the University of Utah, and in Australia, where I live for 2 and 1/2 years. So I'm very lucky that my science-- my research-- has taken me all over the world.

INTERVIEWER: Wow. So from something quite broad, I guess, to something very specific right now. Excellent.

I hope that's answered all your questions. Unfortunately it's all we've got time for tonight. Nick, thank you so much for joining us, and showing us this fabulous piece of equipment that many of us are going to be accessing in their studies.

NICK TURNER: I hope so. Thank you.

INTERVIEWER: Right. That's the end of our two-day refresher event. So I'm going to take a trip to the Hot Desk, and ask Sophie and HJ what have been your best bits?

SOPHIE: Oh, winning the quiz, obviously. Easy question. It's the easiest question of all.

INTERVIEWER: But who won the quiz? Have we established that?

HJ: Ooh, I'm not sure that. There will be a bit of debate from Stuart, because--

SOPHIE: Team home are not taking my victory from me.

HJ: I must admit, we did say we had a bit of advantage [INTERPOSING VOICES].

SOPHIE: I will protest.

INTERVIEWER: I guess Stuart is still in the chat room, and is convinced that he won.

HJ: But I think overall the best thing is just chatting to everyone, and hearing everyone's stories, where they started off, and how they're doing at the moment. And it's great to see new people and catch up with people that have come before as well. So yes! Remember to come again to another one. And keep in touch. We have a Twitter account at Student Hub Live. And you can always email us as well, studenthub@open.ac.uk.

INTERVIEWER: You two have been absolutely brilliant. And so has Yvonne, who has gone home for the evening. But thank you Sophie and HJ so much for fielding all those comments. And thank you

to all our regular students who've welcomed our new students to the Open University. I hope you'll remember how many questions you had at the start, and how wonderful it is, and reassuring it is for new people to have you there in the chat.

And for those new people who've joined us, welcome. We hope you like being part of our community. This is something we do quite often. So if you'd like to find out when our next event is, you can select the Count Me In button, and give us your email address. So go back to the Student Hub Live website, give us your email address.

And while you're there, there's a quick feedback form. So you can tell us what you've enjoyed about the programme. And maybe if you've got ideas about other areas we couldn't cover, or even things we could do to make this even better for you, we'd love to hear from you, and let us know.

We've also had lots of things coming through. But I'm very interested in getting quotes about the best thing you like about Student Hub Live. So think of something inspired to say, pop it in the chat, which will be opened for another 30 minutes. Or if it's after then, you can always email us-- studenthub@open.ac.uk. We'd love to hear from you.

But that's all from us at the Student Hub Live. And thank you everybody for coming. We will see you very soon. And do stay in touch with us on the various social media accounts that we've mentioned. Bye for now. See you soon.

[MUSIC PLAYING]