Hello, and welcome to pathways, the Warwick chemistry podcast.

I hope you had a chance to listen to episode zero of pathways. Co-creator and co-founder of pathways, Matt Taylor and I talk about how the podcast was started. What was our vision and how would we like to invite contribution and wider conversations from you, our listeners. So before listening to this first episode, please do check out episode zero as well.

Our first guest is professor Mike Ward. Who's the head of the department and professor of inorganic chemistry. Mike teaches predominantly in second year, but will also be teaching on some of the first-year modules this year. And runs his own research group. Mike is also very active in the wider national chemistry community and with the Royal society of chemistry.

Mike speaks about his experiences, very candidly and through multiple stories. I hope you will enjoy listening to this episode as much as I did enjoy recording it.

Bo: Mike hello thank you so much for joining me today. How are you doing, how are you coping with the start of term?

Mike: Very well, thank you. Um, it's busy and frantic, but that's always the case, but so far so good. I would say, so I've got my fingers and toes crossed, but things appear to be happening in approximately the right order under the circumstances that's a win.

Bo: That's always reassuring to hear from the head of the department. Mike, tell us about yourself and your journey to becoming an academic and to getting where you are now.

Mike: Well, I always enjoyed science at school. I was the sort of archetypal science geek, I suppose. I made smelly things in the garage with the chemistry set and I played with batteries and crocodile clips and telescopes and all that sort of things while I'm doing experiments at home. So I always wanted to do something science-based so I did science a levels at school. I went to university in Cambridge to study natural sciences because I didn't really know what I wanted to specialize in. I thought I might want to do physics. I was open to other possibilities as well, and natural sciences allowed me to do maths, physics, chemistry, and biology in the first year.

And then, and then see how it went. And my mind was made up extremely quickly. Because my very first undergraduate lecture was an extremely unforgiving lecture on special relativity from an expert in the physics

department. And I remember well about 150 first year students exiting that lecture in a state of complete shock sort of whimpering in the corner and phoning their mummies because they weren't sure what had happened.

Um, so I began to chemist instead very, very quickly and I've remained there ever since. So I ended up graduating chemistry. I did a PhD in chemistry, which is what I'd always really wanted to do. So I spent three more years doing a PhD in the sort of interface between organic and inorganic chemistry.

The area that's now known as supramolecular chemistry. After that I did the sort of normal career progression things. I did a postdoctoral research fellowship in Strasburg for a year, which was great fun. I spent a year working in the lab of a guy called Jean-Pierre Sauvage. A lovely boss. He got the Nobel prize three or four years ago.

And I like to think that's all down to my contribution. I suspect it's possibly a little bit more broadly based than that, but after my year in Jean-Pierre's lab, I was fortunate enough to get a lectureship. Here we would call that an assistant professor. That's the entry level academic position, at the university of Bristol in the UK.

So the age of 26, I started as a shiny new lecturer in Bristol. Set my own research group up, did some teaching, started playing in the lab. I was there for 13 years. And then with my then growing family, we moved from Bristol to Sheffield and I spent 14 years in Sheffield and that move was driven partly because I fancied a change of scenery, but partly, also very pragmatically because Bristol is, is quite an expensive place to live.

And at that point I had four young children and moving somewhere where they were good state schools and bigger cheaper housing than we could get in Bristol was a significant priority. So we moved to Sheffield. I ended up there as a professor and I was head of department in Sheffield for a while and stayed there for 14 years.

And then in 2017 I got itchy feet again, and I thought, well, I could, you know, I could do one more thing before my dotage descends completely. And looked around and found that this department, chemistry department of Warwick was looking for a new head of department. And since I had experience of being a head of department in Sheffield and also the usual teaching and research bits and pieces, I thought I'd give that a go.

And here I am, and I've been here for four years now. So that's my journey.

Bo: That is quite a journey. It sounds very smooth and linear,

Mike: Yeah.

Bo: What was the biggest challenge that you had to overcome? If you would mind sharing that

Mike: No, not at all. No, it's interesting you should say that. It does sound like a very smooth and linear and archetypal academic career progression. And it's fair to say that that is probably true. once I was lucky enough to get the initial academic position in Bristol when I was 26, the rest was a process of what felt like natural evolution, I suppose. I mean, it wasn't easy, you know, one has to work hard and so on and be capable and publish papers and get grants and, and do teaching well, and so on. But subjects to that it always felt to me like a natural progression. The thing, the thing that was most complicated about the whole process was the process of moving from Bristol to Sheffield with four small children in time.

And that was frankly terrifying because we had to withdraw our children who at the were seven, five and two year old twins, if I remember right. So we had to give their schools for the older ones, notice that we weren't going to be there. And we weren't allowed to register with schools in Sheffield until we'd arrived.

You weren't allowed to do it from a foreign country, which is what Bristol effectively was. And we also had to sell our house extremely quickly. Somebody wanted to buy it and we couldn't not take the offer. So we ended up moving out of our house at about a week's notice into rented accommodation in Bristol, starting the process of hand hunting in Sheffield, remotely. Without knowing where our older two children, we're going to end up at school. So it felt very much like jumping off a cliff and hoping that there was going to be a soft landing. In the end it worked out. But I have to say that was the most stressful three or four months of my life in any, any context.

Bo: I can imagine. Do the children remember it?

Mike: Not really... the older ones have a sort of dim memory of Bristol. You know, when you're in your twenties, they're all grown up now. What happened when you were six or seven is, is a very fragmentary. So no, not really.

Bo: you've done a good job then. What about now? What are you currently working on?

Mike: My current research is based. It's still based in the area of super molecular chemistry and it's based around a phenomenon called self-assembly and self-assembly is very much the lazy man's way to do chemistry because you let nature do all the work for you. So we used in some aspects of chemistry, to people who go to a great deal of trouble to plan what they're going to do.

And there's a lot of really, really clever people in this department in particular, and many other places who decide I want to do this. I want to plan the synthesis of that molecule in some amazingly clever way and do something that nobody else has done before. Or you can take a slightly more Zen like detached view. Um, and what I found, what I was working on during my PhD and the general theme that I've stuck with ever since is that if you combine metal ions with relatively simple organic molecules that stick to them, we call those ligands. Um, sometimes the structures of the compounds you get are spectacularly unpredictable and really complicated. So anyone who's done any coordination chemistry at a level. So I'm talking to the students here. You will know that if you make some metal ion with, with water or ammonia ligans, you'll probably get six of them around a metal line in an octahedron. Okay. And that's been known for a long time.

If you use more elaborate organic molecules, the ways in which they can wrap around metal ions many metal ions to give really complicated metal ligand assemblies can be completely unpredictable and really quite spectacular. Um, a simple example would be, imagine taking two simple types of Lego brick, a lot of each, putting them in a sack, shaking it up, opening the sack and find that you got a castle, right?

So that's what self assembly can do. In many cases it's sufficiently unexpected and complex that you don't know what's going to happen. And that's what I really like, is, is the lack of predictability. But some of the structures that come out of this are really unusual and interesting, and we've sort of focused on those and developed further their applications. In particular, a lot of our large metal complexes are hollow. They're called coordination cages. So the metals and ligans basically assemble into a big hollow football shape. And there's a space in the middle where smaller molecules will bind. So you can get a small molecule inside a big one to which it's not attached, just like, um, a small Russian doll inside a larger one.

If that rings any bells with

Bo: yeah.

Mike: Um, and when molecules do that, they can undergo unexpected and unpredictable changes in their properties. So then reactivity might change. So in a small molecule sits inside a big one it will suddenly do something that you wouldn't do otherwise, it will react in an unexpected way.

And so basically my work at the moment revolves around putting small molecules inside big ones, um, which, uh, for which the technical term is not Russian doll chemistry. It's, it's hosted. It's host guest chemistry. So the big molecule is a host and the small one that sits inside it as a guest. And once you figured out how to do that we're then looking at the consequences of host guest chemistry, in terms in particular of changes in reactivity and catalysis.

So that's in a nutshell, the area of research that I'm playing with at the moment,

Bo: That's amazing. And of course the research, like you said, that goes on in the department by all the brilliant researchers and academics in the department is innovation. We don't often talk of it as innovation, but there's so much happening. And the impact that department is having is immense.

You know, what is innovation to you? How do you define.

Mike: What is innovation? That's a really good question. Innovation is simply doing actively or bringing about, something new. It may be something apparently useless. It may be something of immediate and obvious real world value. And that sustainment about research in general, I would say. But anything that is new by definition is innovative. And, uh, you can see in many of the research groups in this department focus on doing research towards a particular target. So for example, several groups in the department in different ways are interested in medicinal chemistry. And how to get drugs across the skin, how to get drugs across cell membranes, all that kind of thing.

And that's very, very focused. You know what you want to do, and you think about it and you have some really good ideas. That's the sort of traditional inventor model, if you like. I'm going to have a really good idea. I'm going to focus on that and think hard about it and then pursue my goal. And that's the kind of research that tends to be focused towards identifiable target. I know what I want to accomplish, and I will work towards that goal. The other way round that I described earlier, which is more the approach that I take is to realize that I can't possibly predict what the outcomes of some of the experiments are going to be. So my job as an innovator, isn't to decide what's going to happen, but simply to let it happen.

So if we combine. Our metal ions and our ligands in the right way, we can sit back, let nature do its thing and see what the elaborate structures are. And that's innovation as well in that we have created the conditions for something new to happen, even though we had no idea what that new thing was going to be.

So it's not aimed at a specific goal. If you like, it's just let's let's explore this space and see what comes out of it and either way you can do new things and that's all innovation.

Bo: I love that. And of course it builds so much on our ability to stay creative, you know. I see chemistry is such a creative discipline. I'm wondering, how are you staying creative and dealing with that uncertainty and complexity in your work? Where do you look for ideas?

Mike: That's a good question as well .Now, I would say I haven't had that many lightening bolt ideas, you know. There's the sort of traditional model that the light bulb goes on and you think Eureka, I've thought of something amazing. That can happen. In my experience it's extremely rare. And most creativity is actually a process of incremental improvement.

Um, so we try out some metal and ligand combinations, and sometimes we will find that something unexpected and beautiful happens. So we'll focus on that. So look what we've got. We didn't expect this molecule order, its properties. What can we do with it? What host guests chemistry does is show. And then out of that will come some unexpected result.

I remember the day in Sheffield several years ago, when one of my students showed me some spectroscopic studies that showed when a simple molecule, the guest bound inside the host. So the mother Russian doll, if you like, it reacted about a hundred thousand times faster than it did when it was floating around in solutions and that's a spectacular result and it remains one of the best examples of supramolecular catalysis that's known, but I didn't invent that. I didn't plan it. What I did and my group did was realized that there were possibilities and create the opportunity for it to happen. So the insight there doesn't come from, I've had a brilliant idea. The insight comes from realizing, hang on a minute.

Something funny has happened. That needs chasing up. That's unusual. That's unexpected and realizing when you're onto something. Even if it's not something you were expecting, it's just a different approach from the traditional sort of inventor model. Um, You know, you can, you can look at the papers that I've published this year, and you can look at the papers that I've published 10

years ago and say wow you jumped into a completely different field that must've taken an amazing amount of brain power.

And that's not actually true. It's just a series of logical steps, coupled with an awareness of when something funny has happened, because those are the, those are the Eureka moments. If you like. The most interesting thing that scientists can say or hear is, hang on, that's a bit odd. Because that's the point at which you're innovating.

That's the point at which something is happening that goes against your grain, what you were expecting, what the textbooks say. And an awareness of when those moments happen and seizing on them is a form of creativity. That's my form of creativity, I would say, rather than having a brilliant idea and directing things from the start.

Bo: Yeah, I love that. And of course what strikes me in that story is the power of diversity, cognitive diversity, and working with other people to be able to notice and discover some of these insights. Has that been something that you found that is of value to you as a research and academic?

Mike: Absolutely. Yes. And I mean, we all, we all work in teams. No, no academic or very few academics. These days follow the sort of brilliant individual man scientist model. Uh, there are a few they'll sit around, but we would all acknowledge that we get a lot of inspiration from our collaborations, and that can mean collaborations with other research groups in different fields or collaborations within your own research group, your PhD students and post-docs.

I've worked with 50 or 60 by now, PhD students, who've done an amazing job. And a lot of good ideas come from them. So the idea is that I have to provide all the brilliance and they have to do all the donkey work, if you like, is really not true. And a lot of the insights and excellent thoughts, plans for what to do next ,arise from within the research group, from the postdocs and PhD students because they are innovative too.

So it is very much a team effort. I conduct the orchestra, I suppose. Uh, but it's got a lot of excellent soloists in it.

Bo: Yeah, that's great to hear. This takes me on to the next question, which is so important to discuss, and we hear a lot about it in the department, but there are a lot of silences around it and it's the one on failure.

Mike: Mm.

Bo: could you tell us about something that perhaps you tried and failed in, but it taught you something very.

Mike: Yes, absolutely. Um, and the, the lesson is simple. It sounds kind of trite and obvious, but it's really worth saying, because you know, you have to remind yourself sometimes, which is that effort is never wasted. So I can think of two cases where I was really shocked and upset by the outcome of something that I'd tried.

One was a grant application for quite a lot of research equipment in Sheffield. And I was head of department there. And, uh, there was a research scheme at the time. The funders have said, you know, we've got this much money available for some nice equipment. And the implication was that if you ask nicely and you write a reasonable grant proposal, you'll get your share. We've got some money that we need to give away. So I coordinated that on behalf of the department, expecting a positive result. And I was staggered to find that they allocated something like 20 grants and three or four departments missed out.

And Sheffield was one of them. I couldn't understand why, because what I had written was just as good. And it was basically the same as everybody else had written all over the country. I still don't know what the problem was that. I felt it was a very personal failure because the department was expecting to have this nice influx of money for equipment.

But a year later, what happened was that they found a bit more money and came back to the people that missed out the first time and said, would you like another go? Well, yes, obviously. Um, and because I've done all the spade work first time round, it was a question of blowing the dust off it, polishing it up, tweaking it, and we did get the money a year later. And that was a massive relief. So although I was really upset at the time that something that I thought was almost definitely going to work was slapped down, if you like, it worked in the end.

In a similar vein, I remember submitting to a very good journal for publication what I thought was my best ever piece of work. It probably was my best ever piece of work. It's just that I was overestimating it, which is a different thing. So I submitted it to a very prestigious journal, full of confidence that this was going to be accepted with great enthusiasm. Uh, and it was rejected.

And I was thinking how can you reject this wonderful piece of work, you know how clever I am, you know, it happens to all of us. It had happened to me before. I was just particularly annoyed at that one because I did think it was a particularly good piece of work. So I rewrote the paper, submitted it to a slightly less distinguished journal where it was accepted and published quite happily, but you know, the effort wasn't wasted because that work underpinned what I'm doing now and has led to many more good papers in high-impact journals.

So the sort of very obvious lesson in both cases is, you know, okay, get over it. Be upset and that's fine. Have a beer, whatever it takes. But the effort you put in is not wasted. A well-written paper can always be used somewhere. A good idea can always be used somewhere. If it doesn't get funded first time round, it wasn't a waste of time doing it. That's the lesson. I would say.

Bo: I really like that. And thank you so much for being so candid and sharing the stories. I'm wondering, did you believe in this idea of sort of the perfect timing and being in the right place at the right time?

Mike: Not in a kind of, how can we put this as sort of Disneyfied, fate way? You know, there's going to be one perfect combination of circumstances and trumpets will sound and something spectacular will happen. It's more like what I was saying earlier about being aware of possibilities. If you think of the circumstances that we all find ourselves in, in our everyday lives, there are countless interactions, countless opportunities for having research ideas or writing papers or giving a good teaching session.

Every moment that you're alive and doing something is a moment of possibility. And it's almost inevitable that out of all that potential something nice will happen sometime. So you think of it wow, this is an amazingly good coincidence, but given the number of times that we roll the dice in what we do every time we take a breath, it's almost inevitable that sometimes the stars will align. So it's just statistics.

Bo: I love it. A true scientist. Mike, what are you excited about right now? It could be personal academic, a Netflix show, a book, or, you know what what's keeping you excited right now?

Mike: So there's two things. One, one work related and one personal.

The work-related one is that we are starting, as you know, a review of our syllabus and our teaching. It's early days yet. It's going to be complex, but I really think we've got the possibility to create an extremely flexible degree

program with lots of optionality built into it, lots of links to other departments. And what I would like to come out of it is to completely lose the idea that we have lots of different degrees. We've got chemistry with medicine. We've got chemistry with industry, chemistry with this, we've got chemistry with that. Let's forget all that. And just have one point of entry into the department and we could call it chemistry with anything you like. That's basically it, that's all you need to worry about. That's the only course a 17 year old needs to apply for. Because once you get here, all options are open and then you can start the process of diverging and tailoring your educational experience according to how you get on in your first year. So just come here.

Uh, this will be the message to the sixth formers. Don't worry about excluding yourself. Your cell from something by making an inappropriate choice, you don't have to choose a, rather than b, or worry that you've made the wrong choice. There's one choice. Come here and then you'll be able to make a fully informed decision about how you diverge after that.

So that could really be powerful. I'm excited about that. From a personal point of view, my daughter is a third year undergraduate, affiliated with the university of Birmingham, although she's not there at the moment because she's doing a degree in history with Spanish. Because she has a language component she's in Spain and she's having an absolute ball, I have to say. So she sends home regularly photographs of her and all of her new friends, drinking sangria and eating paella and exploring pretty old cities under the Mediterranean blue skies. And I'm excited to go and visit as soon as it can be arranged. I want her life for a week. Cause I have to say it looks absolutely fabulous at the moment. So I want to be that as soon as ever possible.

Bo: Amazing. I hope you get the opportunity very, very soon. Turning to our audience. The majority of our audience would be the students, whether current or prospective, what is your key learning or perhaps top piece of advice that you want to pass on to anyone listening?

Mike: Right. I have had a few conversations over the last week with students, mostly first year students. Not all, but this is mostly directed at them. I've just got two words of advice, which come from one of my favorite books, the Hitchhiker's guide to the galaxy, which you've probably never heard of, but the two words of advice.

Don't panic. Okay. We all know how difficult things have been. And. It's also true that when you come to university, it can feel like you're being punched in the face with some really hard and complicated stuff that you don't understand.

But here's the important point. Nobody understands their first week of lectures, unless they're a certified genius.

So you might be sharing, you know, a flat or a house with someone who gets it all. But the normal experience like I had with that first physics lecture, when I came out sort of whimpering and wanted to lie down and go home. Your immediate experiences that this, this feels too hard. I don't think I can cope.

And the way that university works is that people start throwing bucketfuls of what feels like difficult material at you without the expectation that you can do it straight away. You know, the tutorials will follow, the maths support is in hand, the opportunities to go through question sheets and talk over it with your colleagues or senior students in ChemCafe, or members of staff will follow. So at the moment you've got lots of notes of stuff that's worrying you and you don't understand it. And you think I'm failing. I'm a bad person because I don't understand this, but that's not the model that we work on. It's not like at school where you might be able to get to the end of the lesson and think, yep, I can do all that. We expect that it will take you a week or two or three to digest everything and get your head around. It is completely and utterly normal to feel poleaxed at the end of the first week and think this is far too hard and I can't cope. You will, it will just take a little while to sort of achieve the new university style equilibrium.

So don't panic and don't worry.

Bo: Absolutely agree with that. And I think I often say to my students that if you're not feeling challenged, if you're not feeling confused, you're not learning. So that's all sort of just part of that process.

Mike: Yeah.

Bo: I'm wondering what about the students who are perhaps on the other side of that journey who are maybe due to a graduate this year or looking for jobs?

Maybe our recent alumni, what would you say to them?

Mike: Well, the circumstances at the moment because of the pandemic of course mean that it's difficult and it's going to be more difficult than it would be usually. But you are in a good place because you are coming from a department and an Institution that's really well-respected. I mean, this is something that we say on the open days to the 17 year olds, and their parents, who are contemplating studying here, Warwick regularly features in the top handful for

reputation amongst employers. I remember a statistic from a year or two ago that put us in something like the top 30 universities in the world for reputation amongst employers. That's not top 30 in the UK, that's on the entire planet. And there are a lot of very, very good universities on planet Earth. So to be up there as one of the institutions that employers recognize produces good people is something that's very, very much in your favor.

This is one of the places where a lot of graduate employers will come shopping for the next generation of employees and trainees.

You do have the advantage of coming from a very, very well-respected institution and a very, very well-respected department.

Bo: Brilliant. We're recording at the start of term, at the start of academic year, it all feels so daunting. It's still like a mountain ahead of us. What's your hope for this academic yet?

Mike: Very pragmatically, my hope for this year is the same as my hope for last year is that it works. Last year was frankly terrifying, um, because we were doing it all for the first time. A chemistry degree is particularly complex. Everybody does lectures. Everybody does tutorials workshops or whatever, but we have labs and we have particularly complicated labs because of the whole apparatus of fume cupboards and safety associated with chemical materials.

So it's fair to say that managing a chemistry degree, the delivery of a chemistry degree under pandemic conditions is probably about the biggest problem that any department faces on campus. Our colleagues who've been responsible for doing that, particularly all of the teaching planning and all of the lab planning and the delivery of the face-to-face teaching last year.

You know, we got to the end of the year and I was very grateful that it had worked and we produced a class of graduates with a completely unremarkable, and an entirely normal, good set of marks. And my hope for this year is that we do not only the, we do the same, but we do it with a much greater degree of confidence. We know we can do this, we've done it before, we can do it again. And we can even out of this year take some lessons for how to manage teaching in the future. My year two students, if you're out there listening, you spent last week listening to my first set of CH267 lectures and we will have a live face-to-face workshop to go over that material and answer any questions.

And if that model works, the sort of inversion of the traditional model, where people do absorb the content in advance and then come to a problem workshop

and a problem solving session, that's not unknown in pedagogical circles. I've never tried it before myself, if that works and people like it, then we might stick with it in the future. Who knows. So as well as simply coping this year and giving the students the best possible experience we can, with any luck, we will take a lot out of this that we can use in planning teaching for the future, because we've had to learn a lot by force of circumstance.

Bo: I love it. Innovation never stops.

Mike: Yeah.

Bo: Mike, how can our listeners connect with you and your work? Where can students expect to see you in their experience as well?

Mike: Well, my second year students will see me in workshops on Fridays for the next few weeks. Next term, I'm going to be doing some first year lectures. I'm taking over electricals for someone who's going to be on parental leave, taking time off with new family. So I'm going to be covering some first-year lectures and I'm looking forward to meeting with first year students face-to-face. Then we don't know exactly how teaching in term two is going to be organized.

So year one and year two students would also be able to catch up with me at a teaching session. Other than that you can walk along the fifth floor corridor and come and say hello. I have an office and I'm always susceptible to knocks on the door. to talk about something much more interesting than whatever meeting I'm supposed to be paying attention to at the moment.

Bo: Brilliant. Thank you so much has been such a pleasure and hearing about your story and your work. I always find conversations with you, so reassuring and like everything's going to be okay. Things will work out. You just keep going, keep calm and carry on don't panic and do your best.

And I think there's something so beautiful and powerful in that. I hope there our students will agree with me and I hope that this episode will give them some of that reassurance and help to see a different side of you.

Mike: Good. Thank you very much Bo.