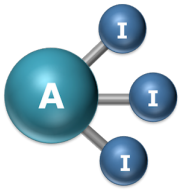

Artificial Intelligence and Augmented Intelligence for Automated Investigations for Scientific Discovery

AI3SD Interview with Dr Jennifer Hiscock
30/11/2020
Online Interview

Michelle Pauli
Michelle Pauli Ltd

16/09/2021

Humans-of-AI3SD:Interview-8

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Network: Artificial Intelligence and Augmented Intelligence for Automated Investigations for Scientific Discovery
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1 Interview Details

Title	AI3SD Interview with Dr Jennifer Hiscock
Interviewer	MP: Michelle Pauli - MichellePauli Ltd
Interviewee	JH: Dr Jennifer Hiscock - University of Kent
Interview Location	Online Interview
Dates	30/11/2020

2 Biography

Figure 1: Dr Jennifer Hiscock

Dr Jennifer Hiscock: 'Science is a creative process and that creativity needs to be nurtured'

Dr Jennifer Hiscock is a reader in supramolecular chemistry at the University of Kent and a UKRI Future Leaders fellow. Her research is focused on a new approach to antibiotic and anti-cancer drug design. In addition, she is also co-founder and current Chair of the International Women in Supramolecular Chemistry (WISC) network.

In this Humans of AI3SD interview she discusses the marginalisation of women in chemistry, alongside the use of AI to handle huge amounts of experimentally derived scientific data, the power of interdisciplinary work and the surprising value of having an embedded social scientist on her team who encourages playing with watercolours, glitter, coloured pens and modelling clay!

3 Interview

MP: What's been your path to where you are today?

JH: My scientific career started as an undergrad at the University of Exeter where I obtained a BSc Hons in Biomedicinal Chemistry. I then moved to the University of Southampton to study a PhD in Supramolecular Chemistry under the supervision of Mike Hursthouse and Professor Phil Gale. I then stayed on to do a postdoc under the supervision of Professor Gale and researchers at the Defense Science and Technology Laboratory (Dstl) at Porton Down. In 2015, and then moved to the University of Kent as the Caldin research fellow. I was promoted to Lecturer in Chemistry in 2016, Reader in 2018, Director of Innovation and Enterprise for the School of Physical Sciences and launched WISC in 2019, and became Chair of WISC and a UKRI FLF fellow in 2020.

MP: What are you currently working on?

JH: At the moment my research interests are focused in applied supramolecular chemistry, specifically the invention of a new approach to antibiotic and anti-cancer drug design and agents to enhance the activity of current antibiotics and anti-cancer agents to which cells have developed resistance. I'm also focused on my international Women in Supramolecular Chemistry network, which currently has arms in the UK, across Europe, America and in India.

MP: What is the Women in Supramolecular Chemistry network?

JH: I founded the Women in Supramolecular Chemistry network with three friends of mine, from the supramolecular chemistry community across Europe who were early career researchers, we were all having a bit of a tough time of it and feeling lonely. We started supporting each other with bi-weekly meetings. Through this, we were able to help each other secure permanent employment across Europe. As we were working within our different universities, other late-stage PhD students, postdocs and early career researchers started to hear about what we were doing and ask to join in, but there's only so many people you can fit on Skype at any one time. So in November 2019, as demand became quite apparent, we decided to form a network. The first tweet for that network reached 26,000 people in just under a week and we received a small grant from the Royal Society of Chemistry (RSC) to set up all of our graphics and media. Since then, we've won about £150,000 as part of my UKRI fellowship and Royal Society grant looking at interdisciplinary research in this area. We're currently kicking off a programme studying how women within supramolecular chemistry achieve success and support their research groups, using an interdisciplinary chemistry and social sciences approach. We've published our first book chapter, and survey results from our first study have been published in Angewandte Chemie, which resulted in the writing of six news articles in publications such as the RSC's Chemistry World. We have a website with resources for early career researchers plus support and mentoring facilities. We're also producing a new skills workshop in September 2021 where we're teaching skills to PhD students and early career researchers, which is gathering particular interest in low- and middle-income countries.

MP: Are there particular issues for women within chemistry?

JH: Women within chemistry are a marginalised group. The Royal Society of Chemistry (RSC) looked at a study comparing the number of women going through from undergraduate

and postgraduate study to professorial level in chemistry and physics. Physics has always been deemed to have more of a problem than chemistry but it retains the number of women through the ranks. So, although the percentage of women in physics is low, it stays low throughout, with less proportional loss. However, within chemistry, there's a huge drop-off – from around 46% down to 10% or 11% as you move through from post-doc research assistant to professorial level. There really aren't many women professors in chemistry, specifically supramolecular chemistry. I can only think of two, one in the UK and one in Australia currently. The RSC study showed that, continuing at current rates, chemistry will never reach gender parity because the drop-off is too big.

MP: Why is that?

JH: Everyone has their own stories to tell and they're quite personal. As much as people try to help and do their best to promote women within science, and a lot of work has been done up to those early career, independent researcher levels, that's when the numbers drop off. The problem's definitely around that area. We're researching right now to understand why that is. We're using a community-led approach where we go out and we ask the community what they think and what they want, and we gather responses through surveys, through talking to people and through reflective auto-ethnographic studies. Then we collate that data and we call in the community to help. So, when we figure out what the problem is, it's a case of calling in the community, rather than calling out any individual. We're not highlighting any specific people. We're not shouting, we're not screaming, we're just highlighting the problems, giving people a platform for their voices and stories to be heard, relieving the feelings of loneliness and isolation through the creation of a supportive community and enabling the wider supramolecular community to support these efforts.

MP: What about your own research work?

JH: In 2016 I discovered a new antimicrobial construct. There are now over 100 compounds in this library and they are really cool little things. You can trigger them to stick together and form dimers; if you put them in another solvent environment they form hollow spheres and then you just pour a bit of table salt in and some members from this family of compounds turn from spheres into strands and act as materials to gelate things. We can see all this using conventional fluorescent and transmitted light microscopes because these compounds are intrinsically fluorescent, and they appear at present to maintain their antimicrobial properties whatever form they're in. We have also shown that they are able to increase the efficacy of known antimicrobial compounds and, very recently, that they might have other therapeutic implications. However, in trying to figure out, firstly, how these molecules stick together and, secondly, how they work, we started generating a huge amount of data. A small-molecule chemist might normally make four different compounds, do a few studies on them and then publish that data. In the last paper we published, we had 50 novel compounds in and each compound had 14 physico-chemical parameters derived for each compound that was gas-based studies, solid state studies and in silico studies and solution state studies. Then on top of that, we had the antimicrobial efficacy of these compounds against both MRSA and E. coli. This led to a spreadsheet not being quite good enough. So we started looking into machine learning and artificial intelligence to help us and reached out to AI3SD.

MP: Aside from dealing with that amount of data, what other challenges have there been with this work?

JH: I think the main problem we've had is the speed with which this technology has taken off.

For me personally, dealing with multiple disciplines is not that difficult because it's about speaking in a plain language, using terminology that anyone can understand, and knowing that you can ask questions, however simple, and not worry about being deemed an idiot. I've never been afraid of doing that, so interdisciplinary research has always been more of a go-to for me than a run-away-from. I also really like working with industry because some of my industrial collaborators are some of the most intelligent people I've ever met and the most helpful in my academic research. So I rather enjoy working with them and they teach me skills like project organisation and project management, which you don't typically pick up in academia, and which allow the projects to work more effectively.

MP: Has anything surprised you?

JH: If I'd looked at myself two years ago, I didn't think I'd be bringing together the consortium of individuals that I'm bringing together. I certainly didn't think I'd be bringing research and mixing it together with approaches to improve equality and diversity across the chemical sciences. I honestly didn't see myself having an embedded social scientist on my team either and playing with watercolours, coloured pens and modelling clay! We use auto-ethnographic approaches to understand how we do science using artistic materials and, in my case, FIMO to model small unicorns and the like. I didn't see that one coming, I have to say, but it's really helping the stability of my consortia, WISC network and my research team.

MP: How is playing with glitter pens and watercolours helping your chemistry?

JH: Happy people do good science, miserable people tend to do not so good science, in my view. Especially with the current Covid crisis, which is affecting an awful lot of people's resilience and general mental health. A couple of my collaborators and I were all in on this auto-ethnographic thing where we play with watercolor pens and stuff. So we just started phoning each other up and saying, "Do you want a quick Skype session? We can just have some fun painting and drawing and using glitter." We start off by drawing and making each other laugh, and then it can go into some quite deep discussions and it ends up with scientific drawings and brand new interdisciplinary projects because people are feeling a release. It's a completely creative process and that's what science is, is a completely creative process at any level. So it seems to be a new avenue to enable that to happen.

MP: Is that because that creativity sometimes get lost too easily? Does it need to be fed in that way?

JH: I think it does because we're all inventors, we're all creators. I don't know anyone that does science from a completely cold, step-wise approach.

MP: What advice would you offer to early career researchers?

JH: Everyone's going to have their own opinion on you, but the only opinion that matters is your opinion of yourself – there'll always be someone who says you haven't got enough papers or you haven't got enough funding yet to go for X, Y, Z, or your idea is not good enough. There are certain times when constructive criticism is fantastic, but also you need to believe in yourself. If you believe that your idea's good enough and if you believe that your CV is strong enough, then all you can do is keep trying and keep reflecting on yourself and keep working to improve that little bit more every day and you will eventually get to where you are meant to be. Whether that's in industry, academia, whether that's in science or outside of science, it will eventually happen.