Science – ANSTO – Dr Maggie Aulsebrook transcript
 (Duration19minutes 10 seconds)

(soft piano music)

Chris Bormann -: Welcome to this resource for supporting HSC science students. In this series of interviews, we investigate the role, application, and operation of particle accelerators in contemporary science research. In this interview, you will be hearing from Dr. Maggie Aulsebrook, as she discusses her work as a radiochemist, specialising in the development of new nuclear medicines to diagnose and treat disease. I hope that you and your students enjoy this resource and that it assists in adding context and depth to the scientific concepts in your Stage six science courses. So we have with us today at Dr. Maggie Aulsebrook. She is a radiochemist who investigates the development of new nuclear medicines as part of the biosciences group at ANSTO. She specialises in the use of radioactive isotopes to label and trace the movement of molecules through the body. Her research supports the development of new and improved radiopharmaceuticals to be used in diagnosing and treating diseases. Thank you, Maggie, thank you very much for being here today. Could you please describe your area of research, its purpose and, and how it might influence our lives?

Dr. Maggie Aulsebrook -: Absolutely. So, as Chris said, I'm a radiochemist and I work as part of the radiotracer development and translational team here at ANSTO. So that's just a subset of biosciences. But we specialise in the clinical translation of nuclear medicine. More specifically, what we actually specialise in is the incorporation of radioactive isotopes into molecules, which, when administered to a patient, will elicit a biological response and carry these radioactive payloads to a specific organ or disease tissue in the body. Once they've collected there at that specific site, they will give up their decay and we can use that in imaging or therapy application. So it's a really huge growing field and the therapy is quite young, but there's really a lot to do. And it could potentially revolutionise the way we treat and approach many, many indications.

Chris Bormann -: If a student were to come into a laboratory like where you work, what would they recognise? And what might seem quite different for them?

Dr. Maggie Aulsebrook -: So look, a lot of what we do. So, it will look pretty much the same as a synthetic laboratory. So we still use fume hoods. The only main difference is the fact that we have lead lining those fume hoods. So the lead is there to attenuate, so absorb the radiation, and protect us from excessive radiation exposure. But again, a lot of what we do looks exactly the same as potentially an analytical laboratory. We do a lot of pipetting of solutions, a lot of high performance liquid chromatography, a lot of thin layer chromatography, which is just ways to determine if we've actually made what we say that we have made. The only, I guess, main difference that we have in our laboratory, are these things that we call "hot cells". So these are big lead containment chambers that you completely close and they have a little leaded glass window, which you can peer through to see what's happening. In those hot cells, we have automated radio synthesis modules, so they will actually run through a synthesis and at the end, just spit out our nuclear medicine, which we will then dispense out of the cell directly into another lead pot. And then that's what we ship off to hospitals. So it's all very much contained by lead, but that's the main difference, I would say.

Chris Bormann -: Would you describe, maybe, what your science lab was like at school or what the young Maggie was like in science? Like, was this something that was always on the cards?

Dr. Maggie Aulsebrook -: Look, I definitely always loved science. I always had a passion for science in high school. I took chemistry, physics. I did a lot of maths as well, just because it kind of helps with the understanding, but in my university career, I gravitated towards chemistry. Disappointing to my dad who was a physicist, but yeah, I just love chemistry and I just followed what I love. And I absolutely think that everyone should do the same. Don't think that they're, I guess, are pressures for you to, I guess, find yourself in a specific field, do what you love and I guess that's what I would say the secret to success. if you love what you're doing every day, you're not going to, I guess, feel like it's a burden going to work, so.

Chris Bormann -: How important is it to be validating those synthesis processes?

Dr. Maggie Aulsebrook -: Before anything goes to an animals trial or a human trial, we absolutely need to make sure that what we have made is what was said that we've made. So there's a lot of, a lot of assurance that goes into what we do.

Chris Bormann -: Yeah. I can imagine the regulation is something which as a researcher, is reassuring as well as it is something that you have to deal with.

Dr. Maggie Aulsebrook -: Yep. It can be quite tedious sometimes I would say, but it's, as you say, it's very important.

Chris Bormann -: We have this idea of, of science beginning in the early years, with curiosity and wonder as a real driver, right through to intense and elaborate scientific inquiry, questions are really important in that process. Can you describe the importance of questioning in your work and work life.

Dr. Maggie Aulsebrook -: Questioning is so, so important, you know, there's no one in our department that knows everything and it is so important to continuously ask questions because that is how you drive innovation and you come up with the next big thing. So questioning is so, so important and it's still something that myself and everyone here does. It's so crucial to our jobs.

Chris Bormann -: Great. So that idea of not knowing everything, does not knowing everything and acknowledging that, is that a key element to being a scientist?

Dr. Maggie Aulsebrook -: Look, I do think it's important because, you know, I have seen people in the past who have, I guess, tried to pretend like they do know everything, but then they miss out on the opportunity to actually learn and learning is so important.

Chris Bormann -: Is there a question that even in your work, if you haven't been able to answer it immediately, it still sits there as a challenge for you?

Dr. Maggie Aulsebrook -: So in my opinion, alpha therapy is a huge, huge emerging field. And I would love to help solve all of those questions that we have about those types of radiopharmaceuticals and drive research in there, in that space. What alpha therapeutics are doing at the moment are huge. You know, you see patients who have been given a terminal sentence and they've been administered with an alpha therapeutic and you see their diagnostic scans and their cancer is pretty much gone. They're doing amazing, amazing things. And I think it's definitely one of the future aspects of nuclear medicine.

Chris Bormann -: And when identifying new radiopharmaceuticals, what is it that the factors that you might consider in choosing those?

Dr. Maggie Aulsebrook -: So if you're thinking about developing an imaging or a therapeutic, you do need to select your radio isotope based on the type of radioactive decay that it does give off. So that's one factor. But again, there are all different types of energies, you know, gamma rays that can be given off. So you do want to choose a radioisotope that actually can be picked up by cameras that are currently in hospitals and they have a specific range. So the energy of decay definitely is another factor. I guess accessibility in the radio-nucleide as well. If you are, I guess, trying to drive this into patients, you don't want to, I guess, choose something that won't be that accessible or has, I guess, a higher cost to produce. It again, depends, if you wanted to access radio-nucleide off the cyclotrons or a nuclear reactor. Half-life can definitely come into effect there. If you are producing radionuclide off a cyclotron, because they tend to be around hospitals, you can actually have a radioactive with a shorter half-life. But if we are talking about reactor products, you do need, I guess, a little bit longer half-life, so you can actually ship it to where you need it. So there are a lot of factors that come into play when we're talking about what radiopharmaceuticals we do want to develop. Often we are guided by commercial companies. So if a commercial company will come forward and say, we have this potential candidate that we want to go into clinical trials, we'll develop their product. That's mainly what guides us, because at the end of the day, they are the ones with the resources to actually get these products into humans. In terms of researchers, we are guided by what commercial companies want, essentially.

Chris Bormann -: I guess. So they might identify a particular molecule that should be tagged and how to do it. And then your job is to optimize that production process?

Dr. Maggie Aulsebrook -: Yep. That's absolutely correct.

Chris Bormann -: Are there environmental and other social factors that might be involved?

Dr. Maggie Aulsebrook -: Potentially when we're talking about producing radioisotopes, there might be concerns about, maybe, radioactive waste if it was producing a lot of waste. So something like that. There are potentially issues just with nuclear medicine anyway, just because of the fact that it is radioactive. And there is, I guess, maybe some perceptions around, or, I guess, negative connotations with radioactivity. I mean, look, they have obviously been really terrible nuclear disasters in the past, but, you know, I think that as a society we have learnt from that, I mean, our nuclear reactor is absolutely state of the art, one of the safest with many, many safety protocols and levels of safety. So I think it is just about focusing on what, I guess, the positives of radioactivity, or I guess what radioactivity can bring. So nuclear medicine, which is, I guess the pinnacle of that, is doing amazing things. So, I love radio activity.

Chris Bormann -: Often we get physics students who might say, "Oh, well, why is this important?" And nuclear medicine is probably one of the clearest examples of a direct, valuable purpose for investigating science, so.

Dr. Maggie Aulsebrook -: Absolutely I think the justification for us is so easy. It's about the health of, yeah. All of Australia, essentially.

Chris Bormann -: Products from the ANSTO National Research Cyclotron, is there an importance there in terms of that consistency and the trust of the supply of materials for you?

Dr. Maggie Aulsebrook -: That is absolutely the case, you know, a lot of the time we'll be delivering to preclinical trials. So we do have animals that are essentially waiting to be administered. Also when we're delivering to clinical trials, we have patients that need to actually come into the hospital and wait for their nuclear medicine dose. So if we can't deliver, it does throw out a lot of planning and a lot of organisation, but I don't think that that's so much of a problem for us at the minute. I mean, a lot of time and effort goes into developing and validation of our processes. So it's definitely not a one-off. You just try it. There are a lot of trial runs that go on beforehand. So you can, I guess, iron out any issues that might arise. So it is really about just doing it over and over again until you're at a point where you can, I guess, you know, 95% of the time guarantee that you can supply. But there is definitely a lot of that goes into the work and the guys out at the cyclotron are so dedicated to making sure that that happens. And yeah, their absolutely great.

Chris Bormann -: What about aspects of your work do you take great pride in and that is acknowledged by your peers?

Dr. Maggie Aulsebrook -: Look, I would say that what I would take pride in is actually delivering a product to a study. I think that that's what, you know, all of the radiochemists here want to do. I think that that's yeah, I guess our goal? And that's what I take great pride in. But for me I've always just really wanted to, I guess, contribute and help in the health space. So that's, I guess why that's kind of my career goal. We are all working as teams, you know, we all help out each other. We're all working for the same goal. It's really a team here and I absolutely love the people here.

 Chris Bormann -: Science and technologies are linked in a sort of cycle of development. How is improvements in our understanding of how the body worked led to new approaches in nuclear medicine?

Dr. Maggie Aulsebrook -: Yeah, I think this is a great question because you know, you're right, it is a cycle. Absolutely, the way that we understand the body and how it works now have absolutely changed our direction in nuclear medicine. So, you know, when we're talking about prostate cancer, we now know that there is a molecule which targets antigens that are expressed by that type of cancer really, really well. So we can actually graft a radioisotope onto that molecule, which can then be used to target specifically those cancer cells and that type of cancer. So without these types of innovations, nuclear medicine, I guess, can't itself grow. But I think it also is important to say that nuclear medicine has itself revolutionised how we understand what's happening in the body as well, just because of the tracer principle. So if we administer a radiotracer, we can map where it's going in the body, and it can tell us how the body is working as well. So it is that cycle of innovation and understanding.

Chris Bormann -: Is there a lot of reading and collaboration that's required?

Dr. Maggie Aulsebrook -: Collaboration is absolutely a large part of what we do. You know, we collaborate with clinicians, we collaborate with commercial companies. I said, before, we collaborate with universities, academics there, it is really, you know, everyone bringing together their research to further everyone's fields. Without these new biological sectors, we wouldn't have anything to label. Yeah, it really is a collaborative effort in nuclear medicine.

Chris Bormann -: You know, in terms of optimising the processes. What value do we get out of improving an existing process or pioneering a new one?

Dr. Maggie Aulsebrook -: So, okay. So in terms of radio chemistry, the way in which we incorporate radionuclide into molecules is really important. And it's crucial at the moment, especially with F-18, so F-18 and has a really short half-life. Or relatively short half-life of 109 minutes. So a lot of the synthesis is actually taken up by steps in the synthesis that they just take up a lot of time. So it could be heating and cooling. It could be drying. They just take up a really large amount of time. And actually the whole synthesis can take up to one half-life or even more. Which is not ideal. So in terms of radiochemistry, optimizing the way in which we actually incorporate radioactive isotopes into a molecule is really important. And that's something that people are working on, especially with F-18 but as well, Carbon-11, that has an even shorter half life of 22 minutes Or maybe 23, I could be wrong. 20-ish minutes. So again improving the way that those types of radioisotopes are incorporated into molecules is really, really important to get the most out of your radio tracer.

Chris Bormann -: What sort of reaction conditions might you be altering to try and drive the reactions faster?

Dr. Maggie Aulsebrook -: So heating is definitely one that we do look at, but heating is not ideal for certain biological vectors, such as antibodies. They have a really specific temperature range, which they are happy at and if you go too high, you can essentially cook them and they can break down. So our radio syntheses are very reproducible. So when we have, I guess, optimised the chance of it working the next time and the next time is very high, but for every batch that we make, we still need to go through all of those validation processes to make sure that we have made what we've said that we've made. And it is safe to go into humans or go into animals. So it is every time the validation process does occur. Every time we make a new batch.

Chris Bormann -: Can I ask you again, just for, if there was like one piece of advice that you might give to an HSC student?

Dr. Maggie Aulsebrook -: Well, I did a postdoc overseas in Paris. It was an amazing opportunity. I learnt a lot about myself. I learnt a lot just in the field as well. So that was in the same field that I'm in now. So it was an incredible opportunity and I definitely wouldn't be here today if I hadn't taken that opportunity, but it was very scary at the time. And I wasn't sure if it was right for me, but I'm so, so glad that I took it. What I've learned is that you need to take time to refresh yourself. You know, you need to have that work-life balance or else you will just burn out and you will not, I guess, produce your optimum work, but you know, you see that there just happening online now. I think it's really great because you can actually open up the audience and it gives a lot more people, the opportunity to learn and participate. And I think that definitely this online revolution that's happening at the moment will absolutely be for the better.

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