**LabMed Podcast Ep9 - Alexander Lawson - FINAL**

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**VO - Welcome to *Life in the Lab*, brought to you by the Association for Laboratory Medicine. I'm Kamaljit Chatha, and I'm a consultant clinical scientist at University Hospitals Coventry and Warwickshire NHS Trust. In this series, we bring you inspiring stories of clinical scientists and medics working in laboratories in the UK and around the world.**

**Today, we're chatting with Alexander Lawson, Clinical Service Lead for Biochemistry, Immunology, and Toxicology at University Hospitals Birmingham NHS Foundation Trust.**

**So what does all that actually cover? In his words... quite a lot!**

I'm registered with the Royal College of Pathologists as a clinical biochemist, but my job's also developing tests to support patients who present with perhaps an overdose or poisoning to emergency departments, and also develop tests to monitor drug levels on patients who have prescribed drugs that need monitoring. But also working in post mortem toxicology. So, receiving blood samples and urine samples from the coroner, analysing them and then measuring drug levels to determine whether they could have contributed towards death. And that has to be worded, you know, in a way that's understandable to someone who's not a non-specialist in science.

I think it's slightly unusual to have such a broad role, but in each role I have to have very specific knowledge about the area I'm working in.

You could end up in a situation where you're advising a doctor on what the liver function test results mean, answering a question about a scan to see if someone's had a subarachnoid hemorrhage - so a bleed in the brain - and then the next day, being caught defending your results against another toxicology expert, and then developing guidelines of how to treat a poison patient. And that's just what I've done this week! So, it's quite a, yeah, an unusual situation to be in.

**It does seem a bit unusual, especially considering the completely different career path Alex originally had in mind.**

I had a dream of becoming a medical doctor. But unfortunately, I think when I was in my GCSEs and A levels, I didn't perhaps work as hard as I needed to to get into medical school first time round. So, I did a degree in biochemistry at the University of Birmingham working with proteins, trying to purify them.

And that led to PhD. And I found that really, really interesting.

But what changed halfway through is that there was a couple of patients who lived in Sheffield and they had what we call precocious puberty. So, they were going through puberty early and Sheffield Children's Hospital looked at a number of steroids in their urine.

They thought this was a really unusual pattern. And so, they were working with the medical school in Birmingham. And they asked the group I worked for: could we try and explain why these children presented in this way? And it just so happened that the protein that they thought was defective in these children was the protein I was working on.

So, my PhD changed from a very, very basic science PhD to trying to model what the protein would do using the mutations they found in these children. And we found out that protein they had was deficient, which meant that one of the side products is they had a high amount of androgens, so, things like testosterone, which meant they went through puberty quickly.

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It really led me to wanting to use these kinds of skills I learned from my PhD, but apply them to a more clinical setting. And then that led me to clinical biochemistry.

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**Biochemistry is a part of laboratory medicine that uses chemical and biological techniques to study the body’s chemistry and help diagnose diseases.**

**Alex initially wanted to become a biochemist specialising in endocrinology, focusing on hormone and gland-related conditions… but then, his path took another unexpected turn.**

An opportunity turned up, just as I finished my training, to start a toxicology laboratory.

So, I thought, well, there weren't many jobs around at the time, so I thought: that sounds like a good mix of practical science and application of that to a clinical field.

I applied for it, I got it. Obviously the development of a toxicology laboratory, we started off with two people and no machines. And now, we have countless machines (and I'm being told off all the time for buying new things), to detect drugs in biological fluids. So that can be urine, blood, serum.

So, if someone presents to an emergency department with symptoms of agitation, they may want to do a drug screen to see whether that person has had access to something that may have made them agitated. The flip side is someone may be unconscious in the emergency department, and we may want to find out if they've had access to opioids, or maybe they've ingested a toxic alcohol. So, again, that's a very important analysis because there's an antidote to that.

**These days, you’ll often find Alex at Birmingham Heartlands Hospital, where his toxicology lab is. He and his team have been working on cases that have really made an impact on the community…**

**… like the rise of a new synthetic opioid that can be deadly even in small doses.**

What we've seen from the U.S. is an explosion of synthetic opioids over there. Primarily related to the use of oxycodone, and people who couldn't have access to oxycodone moving to heroin and then moving to fentanyl. What happened in America is that when people couldn't get access to fentanyl, or fentanyl wasn't available because of its legal status, people tried to change the structure of fentanyl to get around legal controls.

So, this led to a number of different what we'd call fentanyl analogues. So, versions of fentanyl where the structure's been changed. And it's more potent than heroin.

And some of these analogs of fentanyl were more potent still than fentanyl. It was a real health concern of people dying from fentanyl use. In the UK, we've had one or two outbreaks of fentanyl analogs, but certainly we never saw the explosion in synthetic opioids that you saw in the U.S.

That was until relatively recently. So, around 2021, we had a call from the coroner, and we were asked about a particular case where someone was found unresponsive. They'd taken a pill they'd bought from the internet, and then suddenly collapsed. Our initial toxicology showed that they'd taken a synthetic benzodiazepine, a potent form of valium. But that wouldn't have resulted in death on its own, it's very unlikely.

So, the coroner sent us the tablets this person had access to, and we did some analysis and we found out that one of these tablets was a nitazene drug.

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Nitazene is a very potent synthetic opioid. And it turned out that this gentleman had bought what he thought was oxycodone off the internet. And it turned out it was nitazene.

And this drug is, you know, probably 50 to 100 times more potent than oxycodone. And so, what he'd done, he thought he'd taken Valium and oxycodone, which turned out to be nitazene. And he ended up in death. And we had a spate of around four or five of these cases in Birmingham within a couple of months.

And what we had to do to detect these is set up specific methods to get the required sensitivity to detect these drugs reliably, in blood and urine. And then, what happened is they went away again. There were lots of reports of nitazenes being found within heroin. We didn't see that in our casework.

But in the U.S. we did see that fentanyls were largely being replaced by nitazenes as the main synthetic opioid within the U.S. And we're always looking to the U.S. to see what happens and where this information could come from.

So, we were still looking for these drugs and we detected them, now and again. But what happened in June 2023, we had a similar spate of incidents where a number of people died over a single weekend in similar circumstances within the region. And we were asked again by the coroner, could you look back at these cases and see if there's anything relevant in them?

So, the coroner submitted a sample for analysis, a brown powdered sample. It didn't look particularly like heroin, so we analysed it. And what we found was, again, another nitazene drug that wasn't part of our screen.

And what we found was that heroin within the region had become contaminated with this drug. And it was responsible for a large number of deaths and acute admissions in the region.

We could detect the same fingerprint of this drug in a number of samples, it only took us two days.

It did lead to me all of a sudden being in meetings with West Midlands Police and Ambulance Services and Public Health England to try and give an idea about the health risks this presented with. So, it was a very busy week. And I think it really did actually save lives because it meant that the ambulance crews knew that there was a potent scenic opioid in Birmingham.

So, that meant they could administer more naloxone, the antidote to opioid poisoning. It meant that police officers were then instructed to carry naloxone. So, it's not often you can really tie quite complex chemical analysis of things that have been submitted to you to a real output for ambulances, police officers, when you're working within a clinical laboratory. So, it was a real success story, I think, for the lab.

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**Alex’s lab has also been digging into a new issue that’s popping up all over the country: contaminated vapes.**

 There's been a recent case of vapes that have been contaminated with not just cannabis, but also with synthetic cannabinoids.

So, synthetic cannabinoids are much more potent than cannabis and they can cause severe acute toxicity. So collapse, seizures, and you know, in some cases, death. And we had a case recently where someone was admitted with seizures without any… they didn't have any history of seizures. And they were being investigated for unusual infections. They thought it was some sort of infection that caused the seizure.

But they did find out that this person had smoked a vape just before they collapsed. And I'm on the same corridor as the consultant microbiologists, and they came over and just asked whether we could look at this vape.

And it turned out that the vape fluid was contaminated with a synthetic cannabinoid. So, this person had no idea their vape would have a synthetic cannabinoid in. But again, it just shows how analysis of materials can be really useful in management.

No one would have known that this patient may have had access to a synthetic cannabinoid. And certainly that fits with what we're seeing in the country that we are seeing vapes contaminated with both cannabis and synthetic cannabinoids.

In this case, the patient survived, but it shows that those services are really complementary to each other, both in terms of helping find out perhaps why someone died, but also finding out why someone's in hospital and hopefully affecting their management.

**The technology Alex and his team have mastered in the toxicology lab has been key in studying overdose and poisoning cases.**

**But now, Alex is looking to use those same tools for something a little different: figuring out how much - or how little - patients are actually taking of the medications meant to help them.**

That technology that we're using is very advanced, it's very cutting edge, but that can be used for clinical purposes as well. We've got the expertise and the equipment there that can answer that kind of question and as time has gone on, we've used that to answer lots of different unusual questions, which you wouldn't be able to do if you'd kept those services quite separate.

And an example of that would have been 10, 12 years ago, we were approached by some specialists in hypertension, so high blood pressure within the trust, to see whether we could develop tests to screen urine samples for prescribed drugs that are used to lower blood pressure.

The reason for this is that estimates have put non adherents, so people not taking their tablets, at around 50 percent.

But at the time there was no easy objective test of non adherence. So, what people would do is they'd ask them, have you taken your tablets? They'd count the number of tablets people had left over.

Doctors would take a patient and they would measure their blood pressure and they would give them their tablets and see if their blood pressure came down. So, again, if the blood pressure came down once they were given the tablets, that would indicate they were non adherent.

But that's pretty costly in terms of clinic time, nurse time, inconvenience to a patient. So, what we want to do is develop a really quick and easy method to look for prescribed medications in urine. So, we set up a test, and then we did a small trial. So, we found patients who were attending the clinic. And we tried to measure these drugs in urine and we found it worked and we also found that the estimates were correct around more than 50 percent of patients weren't adhering to their medication.

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For patients who are inherently not taking their medication, what are the barriers towards non adherence? So, it could be that actually taking six tablets, it's quite difficult remembering to take them each day. And can we do polypills? So, can we do multiple medications in a single pill? Or can we work on text reminders to tell the patients to take their medications or an incentive to take their medications.

So, it changed how we treated resistant hypertensives, in that we put the necessity to look for adherence, as part of that pathway of management of those patients.

And over time, we've refined the tests, so we've expanded the number of drugs we're looking for. And what's been really nice is a number of other labs around the country are doing this, and we've worked together to develop guidelines of how these tests should be implemented. And use of this kind of test is now recommended by the European Society of Hypertension.

So, we've gone from no test existing to a European recommendation within around ten years. And that's been a real positive of how I and the lab have approached using these machines. We haven't just kept it for poisons or drugs of abuse. We want to be able to use it to look for prescribed medication. And we've been asked to do similar things for other disease groups. We've been working for some years to look for inhaled steroids in asthma. So, we know that in asthma people don't really take their long term medication for asthma very, very well.

And so, we've been looking to develop a test for inhaled steroids in asthma. And I am hopeful that within the next year we should have some pretty good data on these patients for looking for inhaled steroids.

But it just shows, you know, that we can use these techniques and use the knowledge we have to apply to pretty much any disease process and hopefully change patient management for the better.

**There’s never a dull moment in the lab for Alex, that’s for sure. But how does he manage to juggle so many things at once?**

It can be a stressful environment, and there are a number of challenges. What I'm very lucky about here is I have such a great team around me. I'm definitely not a one man show. I'm not doing this all on my own.

So, it really helps to have my colleagues who can support with some of the specialist interpretation. Even within toxicology itself, we've got five Senior Clinical Scientists and one Principal Clinical Scientist who support me with all the reporting.

So, you know, we've expanded from one or two people to a big team who are able to offer specialist clinical advice. I've got another consultant working in clinical biochemistry. And we've got a big team working there. And we've got some really talented biomedical scientists who are doing the analysis sides from the management of the lab.

It can be, yeah, unenviable sometimes with the demand on our services, but yeah, we've got a really good team.

**With all this amazing work under their belt… what’s next for Alex and his team?**

We're looking to use our techniques again to push forward what we can do in the clinical lab. So, a lot of things I've spoken about our measurement of what we call small molecules, so, drugs, small hormones. But what I really want to do is change what we're looking for. So look for larger molecules like proteins.

One of the things we've developed and is live now is measurement of thyroglobulin. So, this is a protein that's measured in thyroid cancer. And it'd be really nice to kind of use that experience to move out. So, looking for insulin. What incident has someone taken, we can look for other hormones that perhaps aren't very well standardized, using the technology to try and move that forward.

I think the future is not AI, but using clinical decision support. To streamline our processes, so help with intervention of requests that's a bit more intelligent.

And just trying more and more to integrate ourselves in process both within the hospital and within primary care within the integrated care system to increase the visibility of healthcare scientists, so, clinical scientists, biomedical scientists, and how what we can do can really change their pathways. Yes, some lab testing may cost a bit more, but if it's paid for and resourced appropriately it can make massive differences in lots and lots of different pathways. And I think a lot of people put a lot of focus in diagnostics but don't sometimes want to pay for it, and I think if they can pay for it they'll save in other ways. And I think it's just making sure the importance of quality, timely, and appropriate diagnostics is appreciated.

I think the only way we're going to be able to do that is by increasing the visibility of healthcare scientists and what we can do and what the lab can do for them.

You know, we have a place on all these different boards, and we have a real voice on how we can affect change within our healthcare system.

**For a transcript of this episode or for more on Alexander Lawson and his work, visit our website at** [**www.labmed.org.uk/podcasts**](http://www.labmed.org.uk/podcasts)

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**And we’ll be back next time for more stories of *Life in the Lab.***

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