Prof. Jim McLaughlin OBE

Interviewed by

Richard Sharpe

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Via Zoom

Welcome to the Archives of Information Technology, where we capture the past and inspire the future, and this is going to be an inspiring contribution from our contributor today. It's Thursday the 18th of November 2021, and I'm Richard Sharpe, and I've been covering and researching what became known eventually as the IT industry since the early 1970s.

[00:26]

Making his contribution today is Professor Jim McLaughlin OBE, and he works in the area of trying to bring the benefits of IT to medical science and to other areas, and he's based currently at the University of Ulster.

[00:44]

Now, Professor Jim, you were born in 1960, in Coleraine. In 1960 there were 5,500 computers in the world, 4,400 of them in the US. COBOL was run for the first time, and Digital Equipment Corporation shipped the first PDP-1. So things were moving along steadily but not fantastically fast. What were your parents doing?

Well, my parents at that stage had recently got married. My father was a, a draughtsman and a part-time architect, but he, he designed our house, and my mum and dad built the house, and I suppose I was born then into this new bungalow in the seaside town of Portstewart, which is just beside Coleraine. A sleepy seaside town is the best way to describe it, beautiful in the summer, very north-facing in the winter [laughs] weather-wise. But my, my father at that stage being a civil servant in Northern Ireland working as a draughtsperson in the planning office, I suppose was finding it difficult, you know. At that stage in Northern Ireland wages weren't great. But there were issues in Northern Ireland, and we'll not go into the politics of that, but, this is sort of pre-Troubles, but you know, there were civil rights issues et cetera. My mother was also in the Civil Service, but after the war there would have been a ruling that if you had a, a child, you weren't allowed to work. That was, that was changed I think by the time I got to the age of fourteen, and at that stage she rushed back to work. So my mother was always at home, you know, to, to look after us from, from childhood, the whole way up, a family of three, a brother and a sister that are younger, two years younger, my brother, and then further, four years younger, my sister. So I suppose they had the job of raising us. There was no TV in the house, there was no central heating in the house in the 1960s. I have still pictures of me looking at a radio as a child, God knows why I was looking at a radio, but it was a big,

a big radio. I have to say, it fascinated me why it lit up in the back, at a young age. Of course that was the valves in the, in the radio. I loved the sound of that very bass-y radio system, so I think as a child I was always fascinated with the, the music off it. It was called a wireless in the house, and, you know, I suppose at that age I wasn't asking why it was wireless. It was very different to the meaning of wireless of course these days. But, that was the, it was the entertainment in the, in the evenings, was listening to music or listening to that radio system. And we were slow to get, because my mum and dad were, I suppose, or my dad at that stage, was a civil servant, not bringing in a lot of money, we were very slow in our household to get a TV; at the age of, I think eleven we got a TV. So it was quite common practice to go out to the golf club to watch football, to watch matches et cetera, you know, in the town. Heating was an interesting one. I mean, you know, we, we had a, a stove in the house, and, my uncle was a, was a plumber, and we eventually got one heater and then two heaters and then three heaters, and gradually the house over many years started to heat up, which was necessary if you're living on the north coast of Northern Ireland, or north coast of Scotland or wherever, you do, you do need good heating during the winter. So our lifestyle improved as heating improved effectively you know.

[04:39]
What did you think, in hindsight, that you got from your parents?

Well, my father, first of all was a very creative man, he was an artist in his own part-time way, and I suppose as a part-time architect he designed, you know, houses. I helped him, and I think there was an expectancy I would go into architecture. I, I… It was quite interesting actually, in those days, there was no CAD, so, my dad would have brought me round to measure up a house. I suppose, you know… Those sketches were then converted into a drawing, and then eventually a drawing was converted into a plan, which was a bit strange, how you did the plan in those days was basically, very large tracing paper, and you started to draw with pencils on the different dimensions and the, the shape of the, the rooms et cetera. And… And then you took a very, it was called an Indian ink pen, a black pen, and drew lines over the, the pencil markings. And then… And my father eventually set this up in our garage. He eventually did the whole process that was… But when I understood it, it actually influenced me quite a bit in life. It was like a photolithography type process. It was a

process basically where you are taking that tracing paper with the black ink on it, exposing it to UV light, photosensitive paper in behind it, and you start to produce the plans like that. The plans were then taken out, and with paintbrushes the whole family got involved in colouring in the different sections of the, the house with sable paintbrushes. And, I, I suppose that, just that whole process of, of doing plans, being creative with them, being very methodical in your, your approach of actually planning out a process of designing an extension, or a new house, or whatever it might be, it impressed me. And, you know, there was quantity surveying in that; there was a, a strong element of regulatory in it, you know, the, as the new regulations came in for buildings and heating and light coming through windows and all the rest of it, I got involved in some of the [inaud] of that. So that, that was, that was important.
[07:01]
I suppose my, my mother's side, she was, again, arts and crafts, seemed to be in every society that was going in the town. And, that busy-ness level of my, my mother, always being creative, and, you know, making do with what she had, but making life, you know, enjoyable, that, that inspired me I think a lot. She was from a family of fourteen, you know, always had to make good, you know. She's still, still alive, over 100. Actually my, my mum and dad had us very late in life, which was a, which was a strange one, it was just coming out of the war, I think, there was a lot of people maybe enjoyed themselves and dances, and didn't get married for a while. So we were, we were later in their lives. But she celebrated in October her 100th birthday there, so she's, you know, pretty…

[inaud].

…resilient. Mhm. Mhm.

[08:00]
Now, I wouldn't bring it up normally, but you are from Ulster, and you are a Catholic, or were a Catholic. You were raised in Catholic schools. And, obviously, in the 1960s, 1970s and 1980s, you were a minority in, in there. How did that affect you?

Yeah, I mean, it's an observation you make probably from the, the schools that we were at, and it is true, yes, I had a Catholic upbringing, a Catholic background. And the minority bit was, was difficult, it would have been difficult in the workplace obviously for my father and mother. We're not from an extreme part of the country, you know, Portstewart wouldn't claim to have had its share of the Troubles. We did, we did have a few bombs going off. But, the tension was in the air. I do remember pre-Troubles. You know, I, I remember society being very very free and open, but it was, it was what was happening in the workplace, what was happening with housing, is where the civil rights issues developed. And of course, that did come in to discussion in the family about whether or not this was a good place to bring up kids, and, you know, when the Troubles started, and, you know, in Derry or, sometimes known as Londonderry in different places, but, when it got pretty heated there, that was just 35, 40 miles from us, and that, when I mean heated, it was bombs every day, and it was, you know, bad stories, and, the, the press was not good. And of course Belfast as well, and many parts of Northern Ireland, you know, suffered. So it really did feel as if it was home. I mean a thing I always remember during the Troubles, and I think this was actually true for both sides of the community, you know, when you cross the border, or when you went over to England, your shoulders dropped, you know. I, I do remember that exact feeling of, you must be living in tension all the time, worrying about what you say, worrying about your future, you know, worrying about, is this the right place to be? But, [laughs] the strange thing about Northern Ireland, it's still a beautiful place to live, and it always did during the Troubles, throughout it, there was a, a resilience and a community feel that you probably don't get in many other parts of the world, or in other parts of the UK itself. You know, I do recall during the Troubles our front door would have been left open, all the time, and people would have walked in and out, and there'd be no worries about security. So that was a side-effect of, [laughs] of the Troubles, it actually was very secure from the point of view of burglaries and car theft, it wasn't, wasn't heard of at all. So we had that sort of openness. The difficulty just was that political piece that was moving on. But, things have, thankfully, dramatically changed, you know, the Good Friday Agreement changed all, and it's a very progressive society, and I think it's, you know, it was starting to become a society now that, while there's still sectarianism, definitely, steeped in communities, and stuff that maybe reports itself quite bad out in

the press, if you were over here, you wouldn't, I don't think, feel that to anywhere near the same extent that it used to be. So yeah, I mean it…

[11:10]
I imagine from their background, your parents were keen on your education.

Extremely, yeah. I mean I think they, in some ways, definitely at the height of the Troubles, wanted us to get, you know, well educated, and get a job, maybe elsewhere. They weren't even sure if it was good, you know, to be brought up in Northern Ireland. Because my education went right through the worst of the Troubles. Now, again, I, I remained, you know, my primary school was, was 100 yards up the road; my grammar school was 300 yards up the road. And when I moved to university, even though I was keen to go to England at the time, to Manchester, in fact, my father died then at a young age, and I felt the need to, to stay at home, so, I actually went to University of Ulster that was four miles up the road in those days, this is the, it was the Coleraine campus at that stage, to do physics. So, it was supposed to be a temporary position, I was going to do it for a year, just until we got over the, the death of my father et cetera, but I liked it so much, for so many good reasons, you know, that I decided to stay, and I completed the degree there. And strangely enough, then, I mean when I went to, then, be employed and do a PhD at the University of Ulster as it's now known, strangely enough it was known as the New University of Ulster then [laughs], that's how complicated it was, in Jordanstown, which is the Belfast area, I, that was the first time I was sort of, really moving away from home. I had a couple of years in between all of that going to Michelin, but that's a, a story I'll tell you about separately.

[12:52]
You did ten O Levels and three A Levels in the Dominican College.

Mm.

400 yards from your house, is that right?

Mhm. Mhm.

According to its own website, it overlooks the Atlantic, just as your house did.

Mhm.

So you are wedded to the Atlantic. You had a good time at school. You were, you were interested in sports, but also quite academic, is that right?

Yeah. Yeah. I mean, I, it was a beautiful school. It's an old castle perched right above the town of Portstewart itself, overlooking a two-mile sandy beach, swimming pools, you know, the wild Atlantic Ocean and the beautiful Donegal mountains, [laughs] so, you know, there was a distraction, you could have spent all day looking out at this view, and particularly, you know, watching the pilot boat go out in extremely rough seas to meet up with liners or ships that are coming in that have to work their way up to Coleraine. So there was a fascinating process there, putting pilots on to boats, the most stormy seas in the world you know, and, and everybody seemed to drift off and, and watch this from time to time. Yeah, it was fun. Golf and football were probably the two big things, I played for the school football team and then golf, there was the school golf team as well. So that took up a lot of time, and it took us away from some of our classes certainly as, maybe at times that I should have been there. I mean academically, yeah, I mean, I was always keen on the sciences, and I was keen on maths, less keen on arts, even though we had to always perform in school plays, and, even though I did play the piano, I wouldn't say I'm a great player, I wouldn't even call myself a pianist, [laughs] player of the piano. I also played saxophone as well in the school orchestra, not the most difficult instrument to play in an orchestra I would add, but we had a bit of fun actually playing with it. I still play the piano, so I thank both my parents for putting me through, you know, piano lessons, and the school also for encouraging it. But, no, my passion really would have been on physics, chemistry, maths, and it probably goes back to that wireless system in the house, and then, summer jobs with my uncles and stuff like that there that I can tell you about.

[15:17]

You went straight from school, I understand, to the Michelin tyre company, as a trainee product process manager.

Mm.

You didn't think about university then?

Oh, the, the year that I was doing that was, 1979, and that was an interesting year. Margaret Thatcher would have been very passionate about going and getting a job, even apprentice jobs, and, and getting a job, and maybe less worried about sort of, the university scene. So there was a big push to, to actually go and get jobs. That was the first thing. The second thing would have been, there would have been a lot of big opportunities and new thinking in these types of modern companies. I mean, in those days Michelin would have been a very very, still is a progressive company, but a company that wanted to do something very very different with its product, and therefore wanted to do something different with people that it would take on and train in a very particular way, to know that, to be very knowledgeable about the whole company. Which was unique thinking from a Michelin point of view. So the point I'm making is that they, they came in and interviewed, this was a two-day interview, which, I went for a bit of fun just to experience interviews, but then they offered me a job at five and a half thousand pound a year. My dad was on £4,000 a year at that stage. Five and a half thousand pound a year to an eighteen-year-old was unheard of. I, I also applied to Plessey and a few other companies at that stage, and managed to get the interview, so I became quite confident with this idea that I could get an interview [laugh] whenever, get money, and I didn't need university as such you know. So, that would have been the thinking, right. And, I was sort of happy enough to progress that route. What really happened, why I changed my mind, is, after a couple of years you start to realise that industry is not just as stable as it maybe should be, and Michelin were downsizing and moving us around the world to different places. So there was no big issue with that. But I felt that instability in the company, and I was looking for that safety net, and where is it, and, even though this process engineering job taught me a lot, it was very specific to the company. And the, the safety net of a degree wasn't there. So I decided to go back and, and do a degree. I, I was to get a sandwich degree from the company, but the company wasn't good at

sorting out all the, the crossing the t's and dotting the i's to make that happen, and when I expected it to happen, it suddenly wasn't there and they postponed it for a year, and that wasn't god enough for me. So I, I went, I went and, left the company and went then to university.

[18:12]

I mean, work there was a great experience in the sense I've had two years of very very intense work at a company that really, you know, made you do everything from learn French, to the whole innovation side, to, you know, process engineering, which was heavily materials-orientated, to production engineering, to lean manufacturing. And then, on top of that, it was a very unusual management company in the sense that, you were psychoanalysed every week, and, industrial psychologists sort of, watching your behaviour and your attitude and your leadership quality. So, they were very good to me in the sense that they, they helped me a lot with the leadership piece, and that idea of being able to communicate, you know, your ideas in a, in a minute, or, you know, get, get your, your documents for report writing, you know, across to senior management, or the whole idea of managing, you know, financial cases, you know, that you're making for the company. That, that stood me well for the rest of my life really, because, you know, I, I knew how industry ticked, I knew what industry wanted, I knew how it worked. And later in life that became so important to me, and I probably would, would tell anybody, if you ever do get an opportunity, that's the type of thing that you should do, you know.

So many academics don't know that.

No no, no.

[19:36]

So in 1985 you got your applied physics BSc.

Mhm.

And you decided not to go on and do a PhD right afterwards, but to carry on in, in research. So that you've got, on the one hand this experience of being trained in

management and leadership, and also now, you're doing research, thin film and flat panel display research. What was that about?

Right. Well that was, that was an interesting one. I did my final year project with a highly prestigious and innovative professor called Professor George Walmsley, who has since passed away, and he had asked me to look at a technique called surface plasmon resonance. It's quite the in thing these days, but, he was thinking, if we could get tunnelling and plasmonic resonance working, we could create a, a flat panel display. Because, you know, way back in 1985, '84/'85, when I was doing that, everybody was trying to get a, a flat panel display that really would work. You know, liquid crystal was around the corner, not working perfectly, there were a lot of issues with it in those days. Electroluminescent displays, which are… I mean I suppose, the way I would describe it to students these days, we… By that stage we had a computer of sorts, we had an awful display, it was a cathode-ray tube, which wasn't going to ever be sustainable, certainly not mobile. So there was a lot of effort just, just as I was starting to do my research, massive effort globally, in Asia, in America, there was a massive Societies[of Information Display set up called SID. So when I was doing my final year project, that was really aimed at one, one angle on a flat panel display. So when I, when I looked for a job straight after a degree, I wasn't thinking of a PhD, I applied to the other campus, the University of Ulster campus at Jordanstown, and, there was a Professor John Anderson, who had a really interesting background history at that stage, who was offering a job, and the job was in thin film electroluminescent display. So when I was able to go in and talk about display systems and dot matrix systems and all the rest of it, I think it impressed, and he offered me the job, just a two-year research job. I was going up to Belfast in the middle of the Troubles, coming from quiet Portstewart I suppose at that stage, didn't have my heart in it. This would do until the professor, George Walmsley, would get some funding to bring me back to work in his great labs. All that John could offer me was a lab with one vacuum cooling system in it that was barely working, in fact it had been used to make test, test pieces [laughs] by the technicians in the university at that stage.

[22:36]

So, what John's idea was, that, and I quickly found out what it was all about, John worked quite closely with Professor Pantridge to develop the world's first portable defibrillator, and John would have been the main engineer, the senior engineer, and

very much the innovator behind that portable defibrillator. The portable defibrillator, 1966, would have been trialled right up to 1973/'74, before it was properly used as a CRT, a cathode-ray tube system, a handful of logic devices in there that basically measured impedance, another one that maybe measured arrhythmias et cetera. And, then tried to portray that on a flat panel display, which was a CRT, and it just meant that it wasn't really portable, these displays were breaking all the time, et cetera. So John realised that this portable defibrillator, it wasn't really suitable for ambulances, so, he thought, right, we would need to get some research going in Northern Ireland here on proper flat panel display systems that were a wee bit different than liquid crystal or anything else that was coming through, that had to emit light properly so that you could see them in all sorts of conditions, in sunlight et cetera. So he asked me to start working on zinc sulphide and, and thin film zinc sulphide, electroluminescent displays. So, yeah, I worked on it. Every time I sort of thought of leaving, John came up with more money, better ideas, and big industry links. And, what surprised us was that, some of our approaches when we went to some of the conferences were quite novel. So we picked up money easily, and grant funding easily from American companies in particular in those days And we were able to get another piece of equipment to add on, and I eventually hand-built a clean room. You can imagine it wouldn't have been the most sophisticated clean room, but it was a clean room that actually worked for us.

[24:46]

We were… The story really after that was that, we felt, within about two years John and myself, that we could maybe set up a bioengineering centre. Because by that stage, getting these grants in, we could, we could actually build up a decent team here, and maybe get a degree going within the School of Engineering, maybe a biomedical engineering degree. So that was some of the thought process to try and sustain, you know, what, what we were doing. There's a whole history then of innovation that started to happen from nearly, that point on. But establishing, you know, a thin film laboratory with some characterisation equipment, mainly focusing on electronic and medical devices, really opened the door for, for so many things after that.

[25:36]

What was the first computer that you met, and what did you use it for?

Well now, I need to get back to the age of, I suppose it's probably, fourteen, fourteen or fifteen. I need to just check this out properly. But it was a ZX81, like many people my age; eventually went up to a Spectrum. And, I used it to basically, I bought magazines and copied the code into the computer effectively to get different things working, you know, so it might have been a, a game; it might have been a, a betting system for racing horses; or control systems for some of the, lights, or systems in our house which I eventually got into in a funny way. I was big into sound systems and audio systems, so I found that I could do quite wonderful things with audio systems by controlling, you know, pulses and, and phases et cetera to, to the audio system, so I created a whole, you know, room mood systems. I remember a ghost train system I set up in the, in our garage at home, and charged people to go into it. Part of it was these really strange sounds that would come out of these audio systems. So the ZX81 and the Spectrum really was, was doing that. I had a, I had a colleague who was, who actually went on, he was a good mathematician, and, sort of, he was pretty fast at programming. So between the two of us we managed to sort of program then some pretty good systems. And we did get a, we did get a betting, a horse betting system going quite well at one stage. [RS laughs] We brought people round and they would bet on it [inaud] there. So that was a bit of fun. Strangely enough, the two of us ended up being attracted to working our summers in the local bookies. You know, bookies are more interesting than the first look, because in those days there was no computers, and you had to work everything out mathematically. And they eventually brought in a little calculator called a Scepter[?]. But at the same time, you know, you had to have your wits about you all day, working out bets and odds and understanding risk management in the, in the whole system, because you're part of a team when you're doing that. So, I'm not saying that we ended up, that that was a, a vice or anything at all associated with gambling, but, it was just, that was the, that was a challenge, to be able to understand how to, I suppose create an interface, you know, which would, there was a visual interface, work out an algorithm, and at the back there, to actually, you know, adjust odds, or to adjust the, the system based on track record, whatever it might be, and then organise a, a system, a control system to actually feed back a value. So, fascinating. So that was my, my first introduction to computing.

[28:27]

Do you like programming?

Pardon sir?

Do you like programming?

I'm not… I'm not big into programming, no. I mean, we did FORTRAN at university, machine code. I don't mind tweaking at the edges of a program. But it wouldn't, it wouldn't be my big thing. My background in physics means I'm a lot more interested in the, more interested in all the fringes around what a program actually does, the, I believe that you have to have the, the data actually correct before it goes in to a program, for the program to do its signal processing or tuning. I believe that the [inaud] is hugely important, and I believe that you have to in some way, you know, always be validating and find methods of validating what that system is actually doing. Sort of, at the heart of it, you know, I understand all the concepts of programming and data analysis and, and you know, even where machine learning or AI is playing a role, my, just, previous conversation was a diagnostic system that we're developing at the minute, and, you know, I wasn't getting into code speak or in, you know, doing any walk-throughs in a code, but I know the piece of code the person's working on at the minute, and I know that it needs optimised, I know roughly how to optimise it, for that person then to go in and iteratively get that right so that we see the end result. So… I suppose, you know, I, I missed that phase of having to sit down and be a hard programmer, but I understand the general concepts behind it. I've done plenty of walk-throughs in life, if that helps in any way [laughs], to give you an idea, that you have, somebody has to walk through the code, and you have to generally understand it, and I've done those.

[30:15]
The late Sir Clive Sinclair was convinced that AI would take over from human beings. Are you?

No. I think it would… I mean there is obviously a lot of emphasis now on the ethics of AI et cetera. I mean AI is there to, to help, it's an enabler, and it's a tool. And I think very much like the role that even computing plays on an aircraft or a car, I think

there is, you know, safety enhancement, performance enhancement, all of that, but absolute control and decision-making, and critical decision-making, may, may get prompts from the AI world but I don't think it[?] [inaud] ever left to, to control it you know. You know, it's the same… It's… There's, probably a fear is that it might go in and do better than a human. You know, it, it could be argued in the area of, say, clinical diagnostics, if a clinician has to make a decision, and there's quite a few parameters in there, just a basic computing system fed the right data, will probably get a better result than the clinician. Now the clinician may of course be able to bring something extra, but, you know, as time goes on we'll learn from our lessons, build a better system, more robust diagnostic system, and it'll eventually get to a point that, yes, it's better than an average, say, clinician at making that decision. However, you know, clinicians have another role [laughs], and it's that, the whole, the passionate piece[?], the whole piece of then, what do you do next, the whole piece of then, you know, the proper referral type work. It could be argued that could be done, I think that's going to be the role of the clinician, is that, that smart piece of actually knowing how to deal with situations and people and their emotions, their mentality et cetera, how they progress on. But there is a tool in there, just in the same way that a clinician takes some blood and the lab returns the blood samples, there's no issue, there's no reason that the next step would be that the clinician doesn't go near you, and you walk in, you know, you give your blood, you take a few vials, and it pops up on the screen, the clinician, it's undoubtedly, 100 per cent, you know, cancer, or it's 100 per cent diabetes. There's, there's no reason why that's not round the corner. And AI can help that. There's no reason that an autonomous car, you know, could be a possibility, and questions are asked still, you know, should there be a reasonable amount of control still given to the driver? And I think the consensus would be, there'll always have to be that, that level there, you know, and that the, the AI system will make some decisions, how much control to give et cetera, based on things like age and capability of the person actually driving it, and stuff like that. But yeah, it's a, it's big, big question. I think it applies[?], different, different areas, but I don't think it's the, I don't think it's… I think it's too dangerous to, to allow it to be the absolute system that takes over from humans in every area that we, we need.

[33:29]

I'm reminded of a story, if you've just got a moment, which was about expert systems, when they were the coming thing.

Mhm.

And somebody was building an expert systems to do plating, you know, nickel plating and silver plating.

Mhm.

And who they watched this man do it, and, and then they produced a system to do it, and it was coming out, and it was rubbish. And they got him back in, and, and they said, 'This is what you do, isn't it, you've described it to us.' And he said, 'Yes, that's, that's all that I do.' 'Well that's what we've implemented, and it's coming out really bad.' He said, 'Oh well, let me take you into the shop, workshop, and I'll show you what I do.' [inaud] slowly[?] doing this [inaud]. 'Hold on a minute, what did you do then?' 'Oh I spit in it. I always spit in it for good luck.' [JM laughs] He was a tobacco chewer, [laughs] and it was the tobacco that was a very important part of the process. So what humans do, sometimes very hard to actually capture what they do.

Oh yeah.

[34:31]
Now, how do you balance this enormous portfolio you've got, Jim, which is research, teaching, management, presentations? That's a huge portfolio, demanding very different skills. You seem to be adept at all of them. How do you manage that?

Well, I mean, first of all I would have learnt a lot from John Anderson. I mean I maybe having said enough about the great man. The man went on to, you know, develop the, a range of new defibrillators, and, and manage companies et cetera. I did some of that jointly with him, but, at the same time he was a, an absolute born leader. [laughs] So I would have watched very closely what, what John would have done. I think there's times in life, particularly at a professorial role, that you have to be light

on your feet in certain areas, in other areas you have to dive deep, and actually fully, fully understand. So, there is a team around me. Now, you know, certain things come easier, and I've been giving a presentation, sometimes I'm, I'm writing the presentation about half an hour before I'm actually giving the presentation, and everybody would say, you know, 'How do you it?' Well, you know, we, we sometimes spend, maybe those ten hours doing a presentation and getting it right, and then that becomes a template for different application areas. So sometimes I can do presentations a lot easier than, than it might, it might actually, you might think, or it might look. The… There is… I have in my head that a lot of what I do is a big platform, just like a software platform, or a hardware platform, but there is a platform there that's got a genesis, it's got a… You know, these days, the, the type of work that I would do would be, you know, IoT diagnostics, Internet of Things diagnostic systems. So, there is a software platform there in the cloud that handles the data. There are apps that allow the UX, the user, to do it. There's an algorithm at the centre of what we do, and then there's a range of tests out there that we do. I'm expert in the diagnostic test, the centre[?] piece, I fully get that, I know a whole range of solutions and a whole range of areas, and therefore I'm attractive to the standard companies, the diagnostic companies, and the Boston Scientifics and Medtronics et cetera. But strangely enough, when the likes of an aerospace company would knock the door, what they are looking for might be help with monitoring of composites in aircraft, and they suddenly realise that my platform would do their platform, because, it's a strain gauge as opposed to maybe an optical gauge that I, I would use on the body, but the platforms can work quite similarly. So what I would do is, rather than manage that, I would allow somebody to come in and work with me, become expert in, in what's required there and take some of the platforms that we, we work with.

[37:35]

The management piece, I look after the School of Engineering at the minute, and I will be stepping down in the next six months, but, you do four years in that. I think… I have been through a phase of about fifteen, twenty years involved in setting up the companies, the spin-out companies that I have set up, some with John, some of my own. Once you do that, and you've been involved in boardrooms, and you've been involved in sort of, you know, all the CTO, the CEO issues, and the funding and raising of funding, and selling off, and exiting, and taking, taking you through that, there is a little guilt feeling that comes in to many academics. You've done this, right.

There's always a desire to put that knowledge back in to the university, to [inaud] in to the students, or [inaud] in to staff, you know, and try and inspire the next generation to, to do that. So, I always keep my hand in on teaching. I typically have a two-hour class every Friday, and they'll hear about you probably this Friday, or they'll hear about the, the company that I've maybe last dealt with, last week. As well as learning the basics, they'll, they'll hear about the latest developments in AI or whatever it might be. So I feel I have to impart that back. But we have a school, there's 28 staff, and I've managed to get it up to 45 staff, in engineering, that's electrical, mechanical and biomedical engineering. There's a lot of young new lecturers from around the world, some local, some from the rest of the UK, you know, India, China, et cetera.

[39:16]

Now, there is a sort of mix that you learn that, you know, the research, the teaching, and the admin, and then trying to impact[?] into society. There is a mix, and there's a sort of, [inaud], not a secret to doing it, but there is a methodology, if you pay close attention to balancing that and getting that exactly right. So I fancied being head of school to try and see if I could impart that knowledge into the staff, to know when to take things lightly, and, you know, not worry about the, the depth, but get in there, you know, that marketing piece, and that piece where you're out doing outreach. You know, you don't have to get everything 1,000 per cent right; you need to be sure about your quality, you need to be sure about, whatever. But you know, take that in your stride and, and just do it, because that bit's very very important. Make sure you look out for areas where you can join dots, and don't be duplicating and whatever. You know, use your platform, you know, concept, whenever you can. Teach… You know, the students want the basics, but get the basics, but apply it, apply it as well, and keep the students interested, and, and you know, get the good… A lot of academics get into trouble when they get into that very bad feedback look[?] where, you know, students don't like them, and they pick on[?] them, and, that stresses them, and that, that creates lots and lots of problems. So you have to make sure you, you think like a student, and in the way that they want. So a lot of that comes from, you know, I suppose experience that some of us will have. So I think going on be Head of School, I took that on to see if I could create better leadership skills within the staff of the school, and, you know, I would feel that some of that's coming through now, and

maturing quite, quite nicely. And I see more potential leaders in the school than probably I've ever, ever seen before.

[41:01]
What's the quality of students nowadays, in your opinion?

Well they're, they're… The students are very different to students of my day, let's say. Now, are they better, or do they work harder, whatever? You know, I, I don't know that it would… It's a very difficult comparison to draw. I mean, students these day are highly digitally aware, you know, have information at their fingertips. Did I waste huge amounts of time, you know, going to the library, spending quite a lot of time looking through books to get the right information? And when I got it, you know, I read it, I took it in, and I applied it back. What we're doing with students these days, we, you know, we don't allow pledges[?], and that, that's completely fair, but we're asking students to trawl for information that's maybe much richer than the information that we were looking for. It'll be a lot more accurate. We train them how to, to look at published work, and, and textbooks et cetera. So that… And I suppose they employ, build these skills, or the, you know, those transferable skills I think are much, much better in students these days, you know, in the sense of, how do they do a presentation. I think the presentation qualities are absolutely unbelievable. I think the transferable skills from the point of view of how you search databases and, and pour information back. The quality of coding has gone up, you know, it has to have gone up, Python's made it easier, so you get into it much, much deeper, deeper ways, so we do a lot of that. So I think students come out a lot more programming-aware across the disciplines as well, mechanical sees as much, nearly, as electrical, as electrical, and biomedical engineering is starting to see now as much nearly as well. I think the, the other bit is the, those innovation and leadership pieces are instilled more. I think we, when I was growing up, I wouldn't say, I wouldn't say innovation and entrepreneurship were a great word. It was deemed that, you know, if you maybe had nothing else to do, you might do that, or, if you felt lucky, you might do that. But now, that's encouraged, so I think students come out that way. With students, maybe, the, where the, the digital world has spoiled them, has been basically, you know, where you have to put some data into a system and out pops a graph. You know, the actual understanding of what that graph really means, or having any sensitivity of, of

that graph and its, and its, I suppose its, you know, I suppose the sensitivity of that graph at low levels or high levels, or having any feel for if it's good, or weak, or whatever, or if it's significant or not. I think, you really get to PhD before you're understanding that. But I think that, when I was doing my final year project and I was having to, you know, work out from, not always first principles, but, you know, trying to work out mathematically how to produce a graph, and actually produce many of them on graph paper, you know, you got your head round what was innovative and what wasn't. And I think there's bits in there that are missing. It's actually something in engineering we do try to address at the minute, with other electronic tools, but again, students find easy ways round electronic tools to press buttons and, and get the result that they want anyway. I think, you know, it's just, that, that piece is just a real, real worrying piece. Yeah, just… Students do also expect to be hand-fed a lot more, you know, these days; with this digital world and social media and all the rest of it, there is an expectancy definitely of, we're not performing or giving feedback, if[?] they come in[?] [inaud], and then we have to respond, obviously, quickly and in a way that maybe gives them a better chance. Now that might be a better chance at, a better mark, maybe a better chance at getting through the course easier, or lighter, or whatever. So we have to watch that, that we keep the, the courses as high standard as possible, but at the same time, you know, respond to this faster world that a student expects, which of course is what it's like out in industry anyway, so, academics have to change quite dramatically on that front.

[45:25]
I noticed this when I was teaching at university, the students were beginning to change, and almost consider themselves to be customers, because they were paying £9,000 a year, and they wanted to know, [laughs] what were they going to get for it? Now your university is charging three thousand-something a year, doesn't it, for undergraduates?

Yeah, you're right. Now, you're, you're 100 per cent right as well, that the, that that step change, the students would see, even if they're paying whatever it is, £4,200 I think at the minute, they, they would see that, themselves as a client, and as that grows, that amount grows. I, I… There is probably a difference between £4,200 and £9,000 to a student, particularly if you multiply it by three or four, it's a big

difference, you know. So you're right, ours is a lot more manageable, so you don't see, you probably just don't see the stress levels that you would see across the water in England and, and Wales in particular. But, it's still there, we, we do have it. We, we would find, we would have a students' union that would obviously support students in that way. And other[?] students [inaud] that would[?] support students in that way in the first line[?] would always be our, our fee-paying students, demand this and this and this and this. So you're right, that's just an ethos that's come in, but it's our job to balance that, mhm.

[46:47]
How does your university survive on so little income from students, given that others have to charge £9,000?

[pause] Well the university would argue that it's having a very very difficult time in doing it. I mean we first of all have to take, you know, something in the order of about 24,000, 25,000 students, which is a lot of students, and staff-student ratios, you know, are just, just at the edge. So that makes it, that makes it very very difficult to do. There's, you know, you do end up, then, with staff difficulties in being able to teach at that sort of level and sustain it. So the university is under a lot of pressure on that front. Our capital projects, we, we can't fund from our budgets; we have to go to the Government for, for capital projects. So, the building you see behind me is a new £350 million campus. We're moving from the campus I'm currently on, Jordanstown campus, we're moving, it's the biggest education construction development in Europe currently, but as we move this whole campus of about 12,000 students into the city centre of Belfast, that's probably one of the biggest that I've had in my lifetime as an educationist at the university. So that, that's had to come from external sources to be able to do that, but we have to do it, just the nature of the building meant that we had to do it. So it's difficult. And we're just about managing, but we certainly don't have the surplus that we, we sort of have[?].

[48:17]
Professor McLaughlin, what is the Jim McLaughlin style of management?

Right. It's funny, even though I'm coming to the end of my Head of School position, we've just started actually last week a new leadership course for all heads of school. I think many universities have recognised the heads of school have to learn on the job. You know, the head of school might be regarded as one of the hardest jobs in the university, because, you are dealing, you are dealing with 45 staff, academic staff, and probably about 50 research staff, 50 PhD students, eighteen technical staff, six admin support staff, and 1,000 students. So it's a, you know, if something goes wrong, you're going to hear about it in style, you know.

[49:07]

So the… Well my management style, you know, going back to, again, John Anderson, and some other people in life that I've admired from a leadership point of view, I think the bottom line is, the communication piece is probably *the* most important bit, is to keep communicating so that you keep people included. That inclusion piece is absolutely core, right down to, you know, the, the various levels of staff that we would actually have. I mean, we have people that have just started in these last two or three weeks, right through to, technicians that would be grade 3 technicians, grade 4 technicians, right up through to, you know, the very highly paid professors that would be prima donnas and believe that they can, you know, do, do what they want, and to some extent in academia you do have a fair amount of freedom. So I have that to manage. But I think the communication piece, out to all those people, is absolutely key. I think, simple messages is my style, so that everybody knows the mantra, and that, that everything sort of fits in within that. I may have mentioned before, but, at Dominican College, I suppose one of the big things was, do the right thing, you know, *veritas*, do it with truth. So do the right thing. So very often you've a decision to make, and in some way you have to turn to your values and your core values, and you have to turn to help from a, an executive team. And the decision that you make though, some of those vary hard decisions, is, you know, do, do whatever is the right thing, and don't get it, don't get it clouded with anything else that might be political, or financial, or whatever. Do what's right to that person, or do what's right for the school. After that, I have a school executive team, there's five of us, and we, it's a slight… I don't, don't, this is not exactly how it is, but it's a sort of permit system that you've five looking after key aspects of the school, and then they would have a team of five to ten below them, as it works its way down, so that I can get some communication going quite quickly. But, I'm, you're

asking me in the middle of, of, you know, a sort of, we're still in the COVID period, so we, we would be hybrid-based as I would call it, we would, you would find us in the office face-to-face, but you would also find me at home. So, the use of teams has changed our lives. Is it a good thing or a bad thing? You know, nothing's clear yet, if it's a good or bad thing. I think the teams piece is very good for operational…

You mean[?] [inaud] teams?

Yes, mhm, like a sort of…[?] It's very good for teams or Zoom, whatever, but it's actually very good for, you know, a communication piece out to the school. I met them live yesterday, you know, at three o'clock, and we had a two-hour meeting, and people could do their bit and say their bit and all the rest of it. So it's good, it gives them that[?], and I think mixing that with face-to-face is extremely important as well.

OK.

I think empowering, empowering people is the, just the other bit that you have to get right, and when I speak to anybody, I tell them to go off and do it themselves, and make sure they keep me informed, but at the same time, it's their thing, make it happen, and do it, do it so that you're actually, you know, you don't create barriers, you don't create difficulties.

[52:39]
Are you a good butcher?

Pusher?

Butcher. Chop chop chop.

[hesitates] Well what, what I like to do when there's a lot on the table is get something focused, and going, and not, not sort of, try and boil the ocean. So I am definitely, you know, one thing at a time, focus, get it done, on to the next thing, on to the next thing. If you can do some parallel work, that's fine. As regards staff, you know, we, we, when we have difficulties with staff and all the rest of it, I try and talk

them through it. We don't have any powers to be, you know, to, to move people on, or, you know, those sort of processes aren't very forthcoming in the university. So there's not, you don't get any of that. But what I, what I have to do sometimes with staff would be allocate them different jobs. So, I've had to do, you know, that from time… Stop them what they're doing, it's not working; move them on to something else. So I, I am softer than a butcher [laughs], I wouldn't, I wouldn't say that's my style, but if I have to make a decision, I will, I will definitely talk that decision over with other people and then eventually make it. Not eventually, I'll make it quite quickly, but I will talk things over before I go in and make a firm decision.

[54:06]
Now you're a holder of over 30 patents.

Mm.

What are you most proud of in that portfolio?

Yeah, it's a strange one, that one. I mean, the portfolio of patents, [inaud] help with setting up HeartSine, which eventually was bought over by, by Stryker. The portfolio of patents [inaud] help setting up Intelesens, a company, a wearables company, where I was CTO, you know, the complete founder of it, and, taking that company off to eventual commercial success, we're still doing well. And then, it was exited just about two or three years ago. And, and then, you know, a range of other patents that, most of them have actually gone on to impact and, and be valued and have a valuation associated with them. But strangely enough, the one that was, was, was before all of that, there's a very short story in this, but, I suppose it goes back to the flat panel display work that I was working on. And we had a problem with edge connectors, and, I had read about, you know, a screen printing method for, for putting silver inks on the edge of tin oxide on glass for flat panel display applications. I was sitting wondering about screen printing and wonder, could I do it or not, and you know, serendipity as it has[?], my sister phones me up and asked me, could I come and help her in the art college with, with some screen printing. So, I said, 'Ooh, that's interesting.' Right, so I went over, and I met this technician, and he explained the whole process of, of printing and screen printing and preparing a screen and

photolithography. This was actually more for, you know, graphic design et cetera, but, I sort of said to him I was interested in some precision printing, and he said, 'Well, it's slightly different. You have to work with different materials and whatever. But I'll help you.' So, the two of us had a go at working with some of these precision materials and exposing them, and I got these, I think it was a, a tenth of an inch [inaud] on the screen printing system, and I took it out to work and tried it. And, it worked a treat on the flat panel display work. So that was fine. Sister, I sorted her out with her bits and pieces, and that was fine. I then decided, the next day I think, to, to go out and buy a high-precision screen printer based on my confidence at being able to do that. I bought it, got the work going to the flat panel display work. And my colleague, who was working on medical electrodes, was always sitting with [inaud] machines making up electrodes, and putting silver wires in them, and everything. I said, 'I wonder[?], could I[?] screen print you[?], all that you are doing just on to polyester?' And he said, 'Oh, it[?] wouldn't[?] have the interface properties, and, [inaud], on to the skin, the medical electrode, it wouldn't, wouldn't work this way well[?].' So we, we, I went and did it, I got some of these special silver inks formulated, tried screen printing it. Bingo, it, it worked, and it worked even better [inaud] one of these eureka moments when we did the impedance analysis, we did ECG, and it just all worked an absolute treat. And John said, 'Let's patent that immediately, that's so good.' So we patented it. And in fact we, we came up with this thing where it was an annular shape as opposed to a disk; the conductivity and the impedance properties were so good that we didn't need all the inks, so we just needed a small bit. So we're going from something that was quite difficult to make, maybe about 30 or 40 [inaud], to something that was one [inaud], and it worked better. This was just too good to be true. And, the patent went through quite quickly. And, again, serendipity in that a company called Ludlow were just touring round Northern Ireland looking to see what was going on. Spotted this, and sort of said, 'Are you really into that?' I said, 'Yeah, I've just got a patent.' 'Let's see the patent.' Within a week [inaud] were on to us, sort of saying, you know, 'This patent's very important; we want to license it from you.' We did a licence deal with them, and, the company, Ludlow, ended up producing the largest selling ECG electrode in the world from, from that patent, using that technique, selling and licensing it, further licensing it out to HP, Philips, Spacelabs, and many other medical companies around the world. So very often when I walk into a hospital I see these electrodes discarded, and those are

developed from ourselves. The patent's run out now, but we, we did OK. I would argue that the university solicitor should have forced the decimal points a wee bit closer [laughs], and we, we might have been better off for it. But we, we learnt a big lesson from that one ever since that, we've got our decimal points exactly right.
[58:52]
So even though it was a very simple design patent, there was a bit of science[?] in behind what we were doing, but there was a lot of serendipity, and of course my sister asks me from time to time, [laughs] for her recognition in all of that. And strangely, that, that was the basis, that screen printing technology was the basis for HeartSine, and now employs 270 people making defibrillators, because the defibrillator pads are all screen printed, and without that, you wouldn't have had some of the uniqueness that was required. It was the basis behind Intelesens and Heartscape, all companies that have done very very well for us. So, that, that bit of serendipity in those early days, because we had a very multidisciplinary lab, was, was absolutely core.

[59:38]
[inaud] you had, of course, a very important famous lab called Bell Labs.

Mhm.

Lots of things happened there. And, they [inaud]… So, we've got some very very clever people here. What's the difference between the really clever ones and the, the OK ones? And the OK ones were, you know, also pretty clever, and they found out it was two things, one, the really clever ones were making connections sideways.

Mm.

They were not in a silo. And also, the really clever ones had what they called helicopter vision. They could see a whole field and see the connections between it. That's what you've got, isn't it?

Yeah, that's exactly what we've got. Now the coincidence there is that my supervisor was Professor Seamus Laverty[sp?], who was one of the senior fellows at Bell Labs, and in fact helped Moore with a lot of his early work on microprocessors and

fabrication associated with that. And that's a recognised help, because Moore, More difficulties with reactive ion etching, which was an absolute core process behind some of the, the microprocessor work that Intel was doing in those days. So my, my supervisor was a very smart man, and very innovative and very, my PhD supervisor, very innovative in his thought process as regards detail et cetera. The… I was touring Korea about 25, 30 years ago, and I've seen some similar examples in America, where, you know, the president of Samsung would have handed me his card, and he was president, and that was fine, but he called himself the information manager, you know. There was, I think it was different names for it, but effectively, his job was, [inaud] to be the helicopter, and, and put the things together. So I, I think, as I moved on and I run] these labs that are quite, quite big these days, tends to be, my job now is, because I do know quite a bit of the detail, but I do know the, the sideway bits et cetera, and I know how to make the connections. And there is funding available as well to make these things happen. But, you also, at the same time, I suppose with just history of working with electronics and materials et cetera, you can, you have some new people in there that are good, and doing things, but, you know, you listen to what they're doing, and you can quickly say, 'I did that 20 years ago. That will not work. That's not the approach.' Or, you know, 'All you need is, this packaging material,' or, 'All you need is,' you know, this particular approach with an algorithm. Or, 'I'll get you help with that immediately and stop you worrying about that.' We can pull that in, and that can make a big, big difference. So, my role is like that. I do set demos quite a bit, you know, I've actually set a demo for next Tuesday week, and I sent an email out, and we're bringing in Randox, which is a local diagnostics company. So, the, the type of things that that creates is a multidisciplinary approach to be getting a demo ready, so I need this [inaud] electronics team, I need some of the diagnostics team, all to come together to glue to, and to get the demo actually working. So you get frantic bits then from everybody saying, 'My bit's not just quite ready'; 'My bit [inaud] three weeks.' And I said, 'Well, I don't, [laughs] don't care [inaud], it's nothing to do with that. It's, I want you to make the best attempt now to gluing it, and to make the whole thing come together and work, and then we'll see what the pitfalls are, and those are the areas that we can sort of fix up.' But Randox, or any company that comes in to look at these type of things, it's important we communicate with them so that their expectations are met properly you know. Has that covered it?

[01:03:47]
What's the biggest mistake you've made in your career, and what have you learnt from it?

The biggest mistake?

Yes.

Yeah. Well, there's probably lots of small ones, as you go along, definitely. I always look back at how long it took for, for some of our spin-out companies to mature. You know, the, you know, fifteen years for Intelesens, HeartSine seventeen or eighteen years, even [inaud], a company that I had got involved with at the beginning of… You know, why, why do those, what's, what is it in the system or the set-up of those companies that take so long? And we do things maybe with this iterative role without user feedback at the right, at the right time. So, you know, there's something about, maybe researchers and academics, just like the conversation I had before, they don't want to show it to anybody until it's complete, while you should be showing it to somebody who is a user, and somebody that really wants to have valuable input into it at the very early stages and co-idea, and co-develop properly. Now, to remedy that, I'm, I'm just about to launch a new £43 million Centre for Digital Healthcare Technology, it's a City Deal, or a Belfast Region, City Deal project. And as part of that we've incorporated a living lab. So, a clinical living lab and a community living lab. So that means we co-idea it properly, with clinicians beside us, so that they will be able to continuously iterate that systems feedback to us, and tell us that, this is not a project worth working on, or this project, you need to accelerate it immediately, and I'll get you clinical trial patients, you know, ethically approved, and all the rest of it, but we'll get you patients. [inaud] that, because we're doing a trial next week. So, serendipity, networking, and all sorts of qualities start to appear once you work closely with, with the user and the end user particularly. You'll get your UX piece perfect if you do that. You'll not come close to getting it right if you don't. So I, I, I have made mistakes at not involving people early enough in the process. The Tricorder competition, and I can talk to you about the XPRIZE Tricorder competition, who ended up third in the world out of 400 different industries and institutions, meant

that when I ran that project, I had to involve a team of 22 engineers, and, I [inaud] taught[?] me[?] and everybody involved, but, we didn't really have the patients[?]. We did, we did patient trials, and we did, we did lots of lab tests to check accuracy, but of course the test was going to be the win, to get that £10 million prize at the end of the day, was going to be Joe Bloggs coming off the street, [inaud] wasn't even sure how to turn a phone on, [laughs] you know. So we, we didn't go that extra degree at bringing a real Joe Bloggs in. I mean, in a university we, we've lots of people to test things on, even students and stuff, to get their, test them. I don't mean ethically we would approve if it's a proper trial, but say it's just testing something that involves an app or a smartphone or whatever. Of course, you know, they're, they're, you know, that's ten or twenty per cent of the cream of the population that are obviously bright and digitally aware, but, there's many many people out there that aren't. So if it's lateral flow testing, which we've got involved with a lot over recent months, to any form of testing, it's just, that mistake we, we continuously make, but hopefully are putting it right now with these living labs.

[01:07:43]
And, in the main, Europe in the IT sector is often criticised for not producing really big beasts. Do you think there's something structural about the structure of European research and development that stops us?

Yes, I do. I've got various views on this. You know, I think, I think Europe has so much potential; it's got some wonderful laboratories, it's got some very basic research, UK in particular, and Germany and France et cetera. I mean I think, I think we can't be overly critical of Europe, you know, when you do think of innovation in the UK, and some of the great stuff that's come out over the years, right, and the great, the great people that have brought it forward, and some of the great developments. You know, you can't be critical of German engineering. But I think, what you are seeing is, you know, we don't have quite what Asia maybe has matured as regards some of the, the major companies. You know, we do have the Philips, you know, to look up to, in the sense of doing extremely well on the medical device area. But then you look at America where there are very business-orientated companies et cetera. So what have they done right? Well they've worked very closely with Asia at getting manufacturing and getting the business piece right. What I… Europe's not

quite sure of its identity in that area, what it really, really wants to do. Does it want to, you know, does it want to invent, and does it want to do the big research, and does it want to fabricate and manufacture? And what is its relationship with Europe? Because you might find that, for instance… Sorry, Asia. You might find that Finland might have a great relationship with China and Japan et cetera, but then look at, look at the UK and we, we maybe haven't matured that relationship to the, the same level. So it does vary a bit throughout.

[01:09:39]

There is another important bit, is the, the way you fund translation, and the way you fund, you know, research through to scale-up to, to manufacture. And in America there are particular funding schemes that are, that have worked extremely well, and we don't seem to have taken them on board in Europe. These would be innovation programmes. Qualcomm have come out of some of these, that's just one company as an example, and[?] SBRI[?] schemes et cetera. There are schemes that look very intelligently at the, at the concept and the innovation and the patents. They allow the thing[?] that are bringing forward these ideas to move at pace through the various TRL, or technology readiness levels, without them having to worry all the time about funding. Because normally, when I spin out a company, [inaud] spin-out companies, you get two or three months going before you have to worry about where the next money's coming from, and you spend all your time worrying about that, that financial, that business piece, and hiring and all the rest of it right, but you don't, you don't get to the kernel of, of what has to be done to make your, both your project, I suppose function, work, and how you would scale it up, and how you would build those partnerships properly to, to actually do that. But these projects in America are totally focused on that scale-up piece and getting it to, to market and getting it right. And then, and then after that, the big funding is available, and the trust is there, and, you know, that culture is there to make that work. If there's a failure in there, that culture is there to, to bring that on. I think Asia has adopted that. Now there is a work ethic in Asia, in many countries in Asia, that will, even if it doesn't work they'll get it to work, you know. And then, you know, I suppose over the years they've invested more and more and more in quality systems et cetera. So as China has particularly invested in that, we start to see very good companies coming through that can produce good quality medical devices, good quality diagnostic systems et cetera.

Whilst we in Europe have all the opportunities for doing that, but don't seem to just get that together to the same extent.

[01:11:49]
Now I'm a man in his seventies, early seventies, and, as men in their early seventies with the type of life I've led, I have a number of medical conditions. I won't list them, and bore you with them, but what I want to know from you, from your great and deep knowledge of this area of, of medicine, of healthcare, what am I going to be nicely surprised about in the next five years, about the technology that is applied to me, my body, and my concerns?

So I suppose the, you know, one of the, the big dreams would be personalised medicine, but, that's becoming a little bit difficult to realise in the timeframe that you've just talked about. Personalised medicine might be, that we actually know all the data about you, and we're looking for small changes and trends that would occur in your body that might be different to other bodies as such, but we would know it's all about you, and, and therefore it would be very specific. So your blood pressure might be quite normal to be sitting at, you know, 140 over, you know, 85 or something like there. There's no big worry about that. But then, of course if it, if it plies up to 160 over 90 or, there's something has changed there. Now that might not be a red herring – that might not be a, you know, a red flag to a clinician always, but, but we know a lot about your other conditions, we know a lot of your conditions, and that would be one thing. So that would be a dream to get right, or, you know, that concept where, I know it's got some people into trouble in the past, but, that concept that a drop of blood, we'll get a complete profile of your medical, both history and, and anything that's gone wrong, just from the drop of blood, would also be a concept that's been aspired to. But you've asked me for the next five years, and I think we have to be realistic. I think, this what we call healthcare 4.0 revolution, which is trying to digitise the healthcare system, there's been more troubles than everybody has imagined, because of patient data security and patient data issues. So, I think, we, we've watched the pandemic, and the difficulties with home-based diagnostics. I think there had been a hope early on in COVID that you would have been able to do your own COVID test, be it your antibody test, and do accurately, you know, your COVID antigen test, right. And possibly you would use an app; an app would give

you, would allow you to do some symptom checking, in other words, have you got a fever, have you got taste and smell? You would fill that in, and what the app then would do with that test is give you the passport, you know, the, the red or the green passport with the barcode on it to allow you to enter an app. So we, we've had that concept around from ZPRIZE days, for about the last five, five years, trying to get that sort of concept, actually for other pandemics, right, that concept sort of through fatal[?] areas of heart failure and pandemics, SARS would have been one that we'd have looked at, et cetera. And of course with COVID, you know, come the, I think the 14th or 15th of March we put up on the website an app and diagnostic systems that would do all of that. But, you know, that whole piece of digital engineering world, not just academia but in industry as well, and a trust from the regulatory bodies, MHRA, FDA, CE marking et cetera, that trust built up that digital can, can fit into a system where both clinicians will totally trust to make decisions, and that hospitals will benefit, and it'll be economically viable. There's a whole big piece that slowed all this innovation down, and that's what, that's what Government now, the UK Government, have promised in their most recent spending review, they'll spend the money on trying to get right. You've seen through COVID, you've seen little bits of it. You've seen pregnant mothers in Scotland getting SpO_2 devices, to be able to measure preeclampsia during pregnancy. You will have seen anybody with long-COVID, you know, getting, again, it's mostly SPO_2 devices, and some heart monitors, to measure…

SPO_2 is what?

It's pulse oximetry. So that will measure the oxygen concentration in the blood, giving you an indication of your lung condition, or blood condition, but it's typically lung condition. It's very easy, just pop it on to your finger, and that's it. So that, that of course has meant that patients don't have to come in to the hospital, they can be monitored off-site. You know, the, the video consultation has deemed to be generally very popular amongst various patient groups, and amongst various GPs.
[01:16:54]
So, that is a mindset that we're hoping to, to build on, you know, dramatically now, now that clinicians are more acceptable of that sort of security of the digital piece, the connectivity, the interoperability. So now we're continuously [inaud] vital[?]

sounds[?], or blood [inaud] going[?] [inaud] of how this could be done. Just, just an example, and you've probably done a lateral flow test, and you'll get a, you get a colour change. What we have to do with that is, allow your phone to read that, or, or a reader to read that, so that we get a much more secure, yes or no. Joe public will make lots of mistakes, and I think we see the control line sometimes and they'll say they're positive, and the control line is nothing to do with positive or negative. So there's, there's a set of instructions there under[?], you know, there's only about 75 or 80 per cent of people get that right, and that needs to be 100 per cent. So we have to work out much better ways of… So once you get that platform right, of vital sound[?] monitoring, blood monitoring, saliva monitoring, once you get that platform, that user interface right, you know, you will start to see, you know, what we call multiplex kits, right. So multiplex kits would be a, a family of disease groups. So if you are have diabetes, you know, we'll, we'll be interested in measuring, you know, glucose and insulin on that. We'll be interested in measuring a thing called CRP, which is an inflammatory marker. We'll be interested in looking at your heart condition and your peripherals, et cetera. So that, that one drop of blood across that multiplex strip will give us immediate indication of your, your health and any feedback that's required or medication. You've seen, in the area of diabetes, a big breakthrough, and that's a, it's a little microneedle that goes into your, your arm now, and you continuously wear that for fourteen days, so there's no pin pricking or anything needed. That's been a life changer, because of its ability to continuously monitor. So we have the same sort of technology coming through in other, other areas. Now, cardiac monitoring, AF would be a condition, atrial fibrillation, the condition, it's a big worry in later life, it's associated with heart failure and stroke. So, people will want to eventually measure that condition as an ongoing basis, if it's getting worse, or better, depending on how you're being medicated. So that, those are the sort of, those relieve anxiety big time when you can actually do proper monitoring pieces and that. Because it's becoming more and more difficult to run to the doctor, back and forward.

Yes.

[01:19:38]
So that, that concept of diagnostic kits coming to the home, it's what's called self-management of your own health, using electronic devices to record that information,

so it's a backup to electronic care record systems, is what I would hope you will see. I personally can get a lot of my health monitored just as I sit here, and communicate back and forward with the clinician. The next big stage is, what can we learn from your eyes? There's quite a lot of information in your eyes about your cardiovascular and diabetes health. You know, what can we learn from a simple ultrasonic device on your carotid artery here? Just a device that does that. And there's a lot of information on your carotid artery, early heart disease et cetera. And there's lots of blood flow as well from very very small devices. Electronics has a lot to, in fact the smartphone has a lot to offer the medical world. The camera, there's a CMOS camera, as you may well know, we can do a lot of image analysis with eyes, with fingers, and, et cetera. [inaud] analysis gives us early warning systems, predictive analysis systems et cetera. So, you know, the processing power, the miniaturisation of those CMOS imagining sensors that are in those devices, are all adding up now to a platform that really allows us to move forward.

[01:21:01]
The object of the Archives, Professor Jim McLaughlin, is to capture the past and inspire the future.

Mm.

That ending is an incredibly inspiring ending. Thank you very much for a very inspiring contribution to the Archives, Professor Jim McLaughlin OBE.

[End of Interview]