Paolo: We're here today to talk about genomics. And can you tell us, what are you working on now?

Lucy: So specifically, we work on brain cancer genomics. So we are trying to understand what it is about the genome of a brain cancer cell that causes it to act in the way that it does. So that means what causes it to divide when it shouldn't be dividing, what causes it to move in the way that it does into the surrounding brain, which means that we can't remove it with the surgical knife, but also why it's able to resist treatment. So we grow these cells in the lab. And we throw treatments at them. And they die. But then within the human brain, they just don't.

So we're trying to understand, what is it specifically about the genome in those cells that allows them to behave in that way? Because ultimately, your genome is the instruction manual for how to behave and how to act. So why has something gone wrong? What's the typo within that? What's the error in the instruction that means that that cell is behaving in the way that it should, which obviously, ultimately, is fatal for the patient.

Paul: I'm a consultant scientist working in the Leeds Genetics Laboratory. I've been there about 30 years or so. So I've seen quite a lot of changes over the time. There are several different technologies used in genomic testing. Probably the oldest technology involves cell culture. So this is where we'll actually grow cells from samples. And the reason why we need to grow cells from samples is to enable us to analyse their chromosomes, because you can only analyse chromosomes in cells which are actively dividing, which are actively growing. So we analyse the chromosomes by light microscopy. Now, this is a technique we don't really use so much these days. It's been superseded by more DNA-based technologies.

Now, for DNA-based technologies, we can either use what we're calling it an in situ approach-- so this is where we will actually analyse the DNA within individual cells themselves. And then the other approach is to extract DNA from the cells, from the samples that are sent to us. We can use a mixture of either fresh tissue from tumour samples which have just been removed. Or we can even go back to archived, stored material. And sometimes, that can be tissue that's been stored for several years, which is something we weren't able to do up until recently.

Paolo: The genomic intervention, what is the process, actually, for the genomic intervention in a brain cancer patient?

Lucy: So specifically, for people with brain cancer, we don't yet have any treatments which are tailored towards their genomic mutations. But what we do have is the ability to take the tumour after it's been surgically removed, extract the DNA, and get other pieces of information. So this includes how long they're likely to survive, which, of course, allows, then, their clinicians and the people treating them to prepare the patient for what's ahead. It can also give us some information about how well they're going to respond to a certain drug.

I have to be honest, though, even in those patients that are not going to respond as well to a drug, as one clinician said to me, what else do we have to give them? So the patient still receives that. But again, we can inform them as to how likely that is to increase their survival.

The whole point, really, of my kind of research and my whole group's drive is to try and better the information that we can get from those genomes-- so to unlock the secrets within it which tell us why they currently resist the treatments that we throw at them, and whether or not we can identify or develop new drugs which will better target the specific changes that we see in their cancer cells.

Paul: So in the last year or so, NHS England have been looking at the genomics service, and recognised that there has been some variation in terms of the range of services delivered, the quality of services delivered, throughout the country. So we're undergoing a national reconfiguration process, where the country's been divided into seven different networks. I'm presently part of the Yorkshire and Northeast network. So working in Leeds, we've formed a partnership with Sheffield and Newcastle. And certainly, the idea locally is for us to try to harmonise our approaches to genomic testing, with a view to making sure that all patients in our particular geography have equal access to the same kind of quality of genomic testing.

Paolo: Who would benefit from more standardised, ideally faster and cheaper genomic testing?

Lucy: Currently, what happens is, because of the types of tests that we have to run and how expensive they are, we often have to wait until there's quite a few brain cancer samples before we can run these tests. So you can imagine, for the patients, that's a wait. And that's an awful lot of anxiety to find out, am I going to be someone that survives a year, two years? How much time have I got left with my family? For the clinicians themselves, they want to know, what's the best treatment? Or is my patient going to respond to this treatment? Can I start them on this treatment?

So by having tests which can run more rapidly and for better value for money, that's going to benefit, of course, the patients and the clinicians. The other thing is that actually, for each NHS Trust, because the tests are expensive, there's different types of tests they can use. And actually, for those that maybe don't have the budget, they might use tests which don't give an answer which is very clear, or at least it's subjective. And again, the clinician then has to look at a test result and say, well, is that A or is it B? So if we could have better, more accurate, more robust testing.

It's going to benefit the NHS as a whole, clinicians treating these patients, and of course, the patients and their families.