Reducing Inflammation In The Brain After Stroke – Professor Stuart Allan

Professor Stuart Allan is at the coalface of stroke recovery research and is leading a team of researchers working on the next generation of clot-busting medication.

Professor Stuart Allan's Profile

Highlights:

Transcription:

Professor Stuart Allan 0:00
Those who have had an ischemic stroke will know that they've been given a drug called TPA tissue plasminogen activator. So this is a drug with a clot buster. So it's the one treatment we've got for stroke which is given to people with ischemic stroke not hemorrhagic and it breaks down blood clots.

Professor Stuart Allan 0:13
And it's very good, it can work very well, but it doesn't always work in all people. It's one reason we think it doesn't always work is because of the obviously blood clots are made up of different things, different proteins and different cells come together to form a clot.

Professor Stuart Allan 0:27
So therefore, the composition of that clot what it's made up of determine how it breaks up in reaction to a drug. And so it's believed that TPA doesn't break up some types of clot, for example, platelets, or blood borne cells that are particularly present in clots. So we've developed a drug a new drug here in Manchester, which is at it's early stages which will basically break up clot the TPA doesn't.

Intro 0:55
This is the recovery after stroke podcast. With Bill Gasiamis, helping you navigate recovery after stroke.

Bill Gasiamis 1:03
Hello, and welcome to episode 230 of the recovery after stroke podcast. If you'd like to support the show, the best way to do it is to leave a five-star review and a few words about what the show means to you on iTunes and Spotify. If you're watching on YouTube, please comment below the video like this episode, and to get notifications of future episodes, subscribe to the show hit the notifications bell.

Bill Gasiamis 1:32
My guest today is Professor Stuart Allen, a professor of neuroscience in the Faculty of Life Sciences at the University of Manchester, United Kingdom, who is working with people from around the world to find new treatments to decrease the impact of ischemic and hemorrhagic stroke. And it is such an insightful episode because it provides hope for people for better outcomes after stroke all over the world. Professor Stuart Allan welcome to the podcast.

Professor Stuart Allan 2:04
Pleased to be here.

Bill Gasiamis 2:06
Thank you for being here. We got in touch because on Episode 187, I interviewed Fiona Moss, the sister of Natalie Kate Moss, who passed away due to brain hemorrhage. And in memory of Natalie, her family set up the Natalie Kate Moss trust. And they're doing amazing work, raising money to fund some research programs.

Bill Gasiamis 2:36

I believe, at the University of Manchester in the in England. And a lot of times Stuart, what happens is we hear from all the people doing all the great work, raising money and funneling it down all the correct avenues to get it to people like you to do some research. But we very rarely hear from the research about the kind of research that we're doing.

Bill Gasiamis 3:03
And I feel like we're missing that opportunity to connect with the people who are at the coalface of discoveries and tried to come up with new ways to support stroke survivors and other people with neurological conditions. And that's why I'm really pleased to have you here on the podcast. Before we get into the conversation. Tell me a little bit about you and your role at the University of Manchester.

Professor Stuart Allan 3:30
Yeah, absolutely happy to do so bill. So I'm Professor Allan, I work here at the University of Manchester, I've been here for 29 years, I came to Manchester after I'd completed my PhD in University Aberdeen in Scotland, and I moved to Manchester to continue or to really start researching a topic which at the time in the 90s was poorly understood, which is the contribution of inflammation in the brain to brain disease, particularly stroke.

Professor Stuart Allan 4:07
So a that was a John area started back in the 90s. And so over that time, I've obviously secured an academic position and now I lead a group. So I lead a group here in Manchester that has a real focus on understanding inflammation. What happens in the brain in stroke, why stroke occurs, and what the consequences of that stroke are to the brain itself and actually more widely, and actually what we are most importantly trying to do is try and find ways to reduce the impact of stroke.

Bill Gasiamis 4:46
I'm going to ask a question. I want to interrupt it and some of my questions are just me thinking out loud, and these are the things I'm curious about and maybe you can or can't answer them because your work may not have led you down that path. What comes first inflammation or the stroke?

Professor Stuart Allan 5:03

Very good question. So we think another evidence suggests that actually inflammation probably is a potential contributor stroke happening. So if you look at the reasons, there are different reasons, people have a stroke, of course, and there's different subjects that store, some are genetic. So there's some rare causes that are genetic, and in the case of Natalie Kate Moss, you mentioned.

Professor Stuart Allan 5:29
She had a particular feature in her blood vessels in the brain that might well have been here since birth, that caused a rupture of the blood vessels. But many types of stroke are caused by risk factors. So for example, if somebody has a hypertension, so high blood pressure, if somebody has a atherosclerosis, where they've got buildup of fat in the vessels in the body, and these are all inflammatory, so these are inflammatory conditions, and actually, probably the best evidence that inflammation might cause stroke is infection.

Professor Stuart Allan 5:29
So if somebody has an infection, you're about three times more likely to have a stroke. And actually COVID has confirmed that data. So if you look in COVID, there's this increased risk of basically a clotting and clots forming and COVID. So we think inflammation may be partly contributing towards stroke, it's not the total cause.

Professor Stuart Allan 6:26
But what's not in question, I think, is that once you have a stroke, so once there's a bleed, or a clot forms in the brain, and then there's processes that take place in the brain and around the body that you would call inflammatory. And some of these are good, to be honest, inflammation is a good thing, and some of these are probably good responses, but some are bad responses.

Bill Gasiamis 6:49
Inflammation, which is good for example is when you cut your hand, it gets inflamed, and then it heals, and it hurts and it's hot, and it's all weird, but then it gets better, right. So that's good inflammation, absolutely. Inflammation that happens in the brain, so inflammation before stroke might be happening in a different location, and then the brain gets impacted and then you have inflammation in a nother location where the infarct is or where the hemorrhage was.

Professor Stuart Allan 7:23
Spot on Bill the inflammation, pre stroke is probably peripheral, you know, in the body and could be in a blood vessel, and then the stroke happens in the brain. And then there's local inflammation, we call it local so around, where the brain damage is, you get inflammation.

Professor Stuart Allan 7:39
But also more widely again, you know, the body, which sort of makes sense, if something happens in the brain, the body responds to that. So that so the immune, immune cells are produced in the bone marrow, and they will then travel to the brain, because they obviously think something's gone wrong.

Professor Stuart Allan 7:54
And they will move to the brain to do something in the same way they would move to kill a bug, to kill an infection that you have. And we still don't really know fully how the inflammation, what different, I suppose we could talk about benefits and downfalls of inflammation.

Bill Gasiamis 8:19
Yeah, so I feel like inflammation at the acute phase in the brain is really good. It's kind of trying to support healing and recovery, similar to what's happening in the finger. But then it seems to be that inflammation with regards to stroke, especially ischemic and hemorrhagic scenarios tends to long-term ongoing inflammation seems to be then negatively impacting the brain over and above what the stroke already did. What already the initial incident did.

Professor Stuart Allan 8:54
Yeah, that's what we think. So you've got a great analogy, if you cut your finger, it's a bit painful, it's sore, it goes red. But then it's okay. You know, within a day or two, it's fine, it's all healed. That doesn't tend to happen in the brain. So you don't get this resolution. So that's called resolution of inflammation, it don't doesn't seem to be that same resolution.

Professor Stuart Allan 9:19
Or the response is prolonged. So it's prolonged and it causes a continued problems, basically. And I think most importantly, it doesn't allow recovery. And you know, why the brain tissue doesn't recover in the way that peripheral tissue does is obviously, some evolutionary reason you know, the brain is sort of

protected from the rest of the body. So it might just be this fundamental differences.

Bill Gasiamis 9:47
Yeah. When I was experiencing the first first hemorrhage as a result of a faulty blood vessel an arteriovenous malformation that burst in 2012. One of the first things they did is they prescribed me with dexamethasone, a seriously serious steroid medication that has 60 side effects, and I experienced probably 20 of them. However, what it was designed to do was decrease the inflammation in the brain that was occurring as a result of the blood that had leaked from the blood vessel into the brain.

Bill Gasiamis 10:29
So before I knew anything else about anything, I knew that they were actually trying to decrease the inflammation in my brain. And it made complete sense to me. But that's kind of all I got from it. Like, that's as much as I understood about it. And of course, I didn't know that other people were working in the background, you know, in the universities of the world to find ways to support stroke survivors.

Bill Gasiamis 10:58
So once I discovered the Florey Institute, in in Melbourne, in Victoria here, I got really excited that there was a whole bunch of people working to support us overcome these issues and find new ways to do that. Tell me about some of the research that you're currently involved in, and what it's aiming to do, and how far down the rabbit hole you guys have gone?

Professor Stuart Allan 11:25
Yeah, absolutely. So what I talk about now, very much soon, and you'll be able to I'm sure relate to this as other stroke survivors will, is about that patient journey, because people, you know, obviously stroke happens in an instant. So it's an instant event that happens to somebody whether it be in your case on an AVM the ruptured or a clot. And so the journey begins before stroke obviously, if you've got a risk, if you've got an AVM, that's identified on a scan.

Professor Stuart Allan 11:57
Somebody, a neurosurgeon do something to try and remove that AVM to prevent the blood. So that's prevention, and of course, prevention, in many ways, is what

we really want to achieve. We personally our own research, we don't do a lot on prevention. And that's not because it's not important. It's just it's a different ballpark.

Professor Stuart Allan 12:19
So where we are focused now is really, when immediately after the stroke happens, so whether you get bleeding in the brain or you have a clot, we've spent many years trying to understand what's happening in that first few hours after the stroke happens, because we know that basically brain cells die.

Professor Stuart Allan 12:39
So the consequence of stroke, whether it be hemorrhagic or ischemic stroke, which is a clot is a brain cells die. Unlike many people around the world, we were trying to understand why the cells die. And most importantly, can we stop the cells dying, but at least reduce the number of brain cells that die because the problem is if brain cells die, then you'll lose function of that part of the brain.

Professor Stuart Allan 13:02
And that work has been successful in that we, you know, we've identified, and we use different approaches, you know, we use cell culture where we culture cells, in a dish, we can expose them to different things that might be floating about in the brain after stroke to damage cells.

Professor Stuart Allan 13:20
We also use a mouse and rat models where we can mimic what happens in a stroke. And we've identified as I mentioned, that inflammation is important. So we've got two approaches to that. One is to give an anti-inflammatory drug exactly you mentioned not dexamethasone, because dexamethasone, as you rightly say, has multiple different effects.

Professor Stuart Allan 13:41
And actually was not successful in trials when you looked at dexamethasone. And that's largely because it's a steroid that has multiple other actions. We've identified an anti-inflammatory drug, which only works much more focused than dexamethasone and it acts to block or stop the actions of a protein in the body that's produced after stroke called interleukin 1.

Professor Stuart Allan 14:08
So interleukin one is a cytokine, it's a protein that's produced by immune cells to

fight infection. It's also a protein that's produced in the brain when you have a fever, anyone who's had a high temperature will be experiencing the effects of this protein in the brain because it causes your temperature to rise.

Professor Stuart Allan 14:29
So we've got a drug, we know that there's a drug that's licensed for use in patients for inflammatory disease that we've tried in animals that we show it works in terms of reduced brain damage, it makes animals better. And that's been tested in patients. So it's been tested in hemorrhage patients and patients with a clot and it basically in terms of it reduced inflammation, so that's good because it tells you the drug is doing what it's meant to do.

Professor Stuart Allan 15:02
Of course, the important thing that people want to know is does it improve outcome i.e stroke patients better. And that's been tested now. So the drug is in what we call phase 3 trial. So it's been tested in hundreds of patients with hemorrhage with subarachnoid hemorrhage, which is a bleed around the brain. So we'll know in about two years or 18 months time that tail will finish.

Professor Stuart Allan 15:27
And if people are better, so three months after the stroke, I think or six months outcome, if people are deemed to be better, who've taken the drug versus the placebo, then that drug will have proven to be beneficial. But of course, we don't know. That work's been done in Manchester.

Professor Stuart Allan 15:49
The other work we're doing is much more focused around those who have an ischemic stroke many of them will know that they've given a drug called TPA, a tissue plasminogen activator. So this is a drug with a clot buster. So it's the one treatment we've got for stroke, which is given to people with ischemic stroke not hemorrhagic and it breaks down blood clots.

Professor Stuart Allan 16:15
And it's very good. It can work very well, but it doesn't always work in old people. And there's some reasons why that is one reason we think it doesn't always work is because obviously blood clots are made up of different things, different proteins and different cells come together to form a clot. So therefore, the composition of the clot, what it's made up of will determine how it breaks up in reaction to a

drug.

Professor Stuart Allan 16:42
And so it's believed that TPA doesn't break up some types of clot. For example, platelets are blood borne cells that are particularly present in clots. So we've developed a drug, a new drug here in Manchester, which is this is early stages, we've developed a new drug which will basically break up clots, that TPA doesn't.

Professor Stuart Allan 17:06
So we think it might have benefits, improved efficacy, as we refer to it, compared to TPA. So this is the early days, this has been tested in animals, we the drug has been patented now. Which is important, because obviously you can then try and develop it and get the funding to develop it further. So that's one other bit of work, which is quite exciting. And then related to that is work on hemorrhage.

Professor Stuart Allan 17:34
So hemorrhage is devastating, you know, the statistics for hemorrhage are quite startling, actually. So the number of people who die from hemorrhage has not really changed in about 30 years, or 40 years, which is really quite disturbing, actually.

Professor Stuart Allan 17:53
If you consider the improvements in medicine across most areas, and yet, in this particular type of stroke, there's no improvement in mortality for many decades, it's a very high mortality, about 40% of people will die within one month. And that's a few reasons why, you know, it's obviously you get bleeding in the brain, it causes quite a lot of damage, it causes increases in pressure.

Professor Stuart Allan 18:18
And there's no treatment, there's really no treatment. So we're really trying now. And actually the Natalie Kate Moss trust really got us started on working on hemorrhage, we didn't do much work on hemorrhage before, but they really opened our eyes to the fact that hemorrhage was under researched, and there was a real desperate need for treatment.

Professor Stuart Allan 18:36
So we're doing a lot of work now in the group trying to find ways to help the outcome in hemorrhage. And that can be given in what's definitely known now is that obviously, when you have a hemorrhage, the big difference between

hemorrhage and ischemic stroke is you get bleeding in the brain, so the blood leaks into the brain.

Professor Stuart Allan 18:57
Blood is not a good thing to have in your brain, okay, the brain, it breaks down. So the blood cells break down and release iron, for example, that's toxic, that kills neurons, and it causes damage. So one of the strategies that people think may be important to do is to basically remove that blood as quickly as possible.

Professor Stuart Allan 19:20
And that's been done in surgery, so surgeons can go in and take the blood out. That's not that has yet been shown to be successful. But there might be other ways to do that. And we think, you know, some of my colleagues are working on research where they think they can, for example, change or make the immune cells in the body or the brain it basically eat up the blood, basically swallow up the blood and remove it. And that happens already that happens anyway. But if we can speed that process up, then it might remove the blood quicker and make the outcome better.

Bill Gasiamis 19:59
That happen to me, the first bleed was quite small, about the size of my thumbnail. And the second bleed was about the size of a golf ball. And it started to decrease in size, but it took around about I want to say about 18 months before it got to a point where it was starting to get out of the way and allowing the radiographers to take MRIs and actually see beyond the bleed, beyond the clot.

Bill Gasiamis 20:39
And as it started to decrease in size, more and more of my function came on, and came back on and came upon, I started to feel a lot better. But for a good eight or nine months, I was really on another planet, my brain had completely turned off. And I wasn't operating the same way that I was before that second bleed. At one point, I didn't know my wife's name, I couldn't remember who came to visit me. There was so I couldn't drive, I couldn't work, there were so many I had fatigue,

Bill Gasiamis 21:16
I'd start a sentence and not be able to finish it. All sorts of issues along that and they kind of started to subside, each one of those issues subsided as the blood clot got smaller. And we're able to track the size of it by doing multiple scans once a

month, to see how much it was decreasing and whether it was still bleeding and getting bigger.

Bill Gasiamis 21:37
But the third bleed that happened, which was in November 2014. So almost two and a half years after the original bleed, that bleed ended up me requiring brain surgery. And that was when my surgeon, my neurosurgeon said, look, we've got to go in now because this thing is continuing to bleed, it's going to be risky, it may cause you more harm.

Bill Gasiamis 22:06
And it might put you in a situation where you're driving, and it's dangerous, and you kill yourself or somebody else and all that stuff. And I was very motivated by now nearly three years in to just have this resolved. And the challenge is that after the brain surgery, that's when I woke up with deficits that have not gone away.

Intro 22:25
If you've had a stroke, and you're in recovery, you'll know what a scary and confusing time it can be, you're likely to have a lot of questions going through your mind. Like how long will it take to recover? Will I actually recover? What things should I avoid in case I make matters worse? Doctors will explain things that obviously, you've never had a stroke before, you probably don't know what questions to ask.

Intro 22:50
If this is you, you may be missing out on doing things that could help speed up your recovery. If you're finding yourself in that situation. Stop worrying, and head to recoveryafterstroke.com where you can download a guide that will help you it's called seven questions to ask your doctor about your stroke.

Intro 23:09
These seven questions are the ones Bill wished he'd asked when he was recovering from a stroke, they'll not only help you better understand your condition, they'll help you take a more active role in your recovery, head to the website. Now, recoveryafterstroke.com and download the guide. It's free.

Bill Gasiamis 23:25
So I had brain surgery in 2014. And now I live with left side numbness constantly

tired and some spasticity that's not visible, in my function, but muscle tightness and all that type of thing, temperature difference on my left side compared to my right side, hypersensitivity on my left side compared to my right side, my left side gets more tired, much more quicker than my right side and when I have a drink, which is very rare, but if I have one drink, my left side pretty much is already drunk and gone. My right side still wants to have a party.

Bill Gasiamis 24:07
So what you're saying about the surgery option, it seems to be a good resolution and a full stop to this faulty blood vessel that wants to continue to bleed. But it was the thing that made me unwell more unwell than all the bleeds even though the second bleed was very serious. If it got out of hand it would have been far worse.

Bill Gasiamis 24:35
But I get excited when I hear about things like research into hemorrhagic strokes now. Again, prevention doesn't seem to be on the radar of too many people. I know in Australia, the National Stroke Foundation does preventative work. So as a stroke safe ambassador that I am, I'll go around and talk to people about how to prevent stroke, whether it's usually around they're talking about ischemic stroke, but there's a lot of talk around about going and getting your head scanned, for example, so that you can see whether there's an AVM in there.

Bill Gasiamis 25:21
And then even if you do find an AVM or a cavernous angioma, and there's like, what do I do with it? You know, do I go in and take it out? When it hasn't done anything to me for all these decades? Or do I go in and risk brain surgery and get it removed? There the challenge challenges that I find that's one of the things that it'd be really difficult for me to get behind. I kind of want people to be aware as to whether or not they've got a AVM or cavernous angioma in their head.

Bill Gasiamis 25:53
But then, I don't want to be the person who says yeah, go have brain surgery, because I don't know what that's going to end up doing to you. So it's a very interesting situation. But to find out that perhaps we can remove clots in the brain quicker somehow, that's really exciting. And that would have been amazing for me, because that would have given me back nine months of being in la la land.

Professor Stuart Allan 26:33
Yeah, absolutely. And your point about, you know, everyone, because you could argue that everyone has a brain scan and you know, early on and identify an AVM but as you exactly say, the problem is there's no treatment there. As such, you know, the quandary then is for the neurosurgeon, you know, and the patient is do you operate to remove, but potentially cause a bleed.

Professor Stuart Allan 26:56
So that is a quandary in terms of, you know, removing blood. So I think what's exciting, I think is it's definitely been recognized that doing surgery, major surgery, so major invasive surgery, where you might remove some of the bone, and I suspect this may have happened for you, we did it quite major surgery, that definitely doesn't work. And that's probably due to the complications and the impact of the surgery itself, because it's not great, opening up the bone in the head.

Professor Stuart Allan 27:24
And if you're gonna dig in and get the blood out, it's causing damage anyway. But what the neurosurgeons are doing now is actually what they call minimally invasive surgery. So they're basically trying to be, you know, as carefully as possible to disrupt, to cause as least disruption as possible to the normal tissue. So they'll drill a very small hole, a very, very small hole and put a very, very fine needle into the bleed, and then try and remove it either by injecting TPA, which I talked about earlier on, which will break down the blood and suck it out basically.

Professor Stuart Allan 27:59
Or, and there's a trial now in Holland just started actually, where they basically I think the device they put in this long needle has a little blade that cuts up the blood, and again, sucks it out, basically. So that definitely holds promise, I think that definitely holds promise.

Professor Stuart Allan 28:20
And for me most excitingly as a basic scientist, because one of the challenges in treating stroke is if you need to get the drug, to where the damage is on the brain. That's not always easy, because obviously, the brain is protected. So, you know, the brain has what we call the blood brain barrier. The brain doesn't let drugs to get in very easily in other substances.

Professor Stuart Allan 28:43
So that's a challenge. And that's one of the reasons why so many brain diseases are very hard to treat, because actually, it's difficult to get drugs designed that will get into the brain. But actually, if a surgeon is going into the brain anyway, to remove a clot, then actually you can go you've got to route into the brain directly. So what I think most excitingly for me is that if they do the minimally invasive surgery removes the clot, which I think undoubtedly is a good thing.

Professor Stuart Allan 29:12
And at the same time, inject a drug directly into the tissue, then that will promote repair, then you've got a double win, basically. And I think that, to me, is the exciting thing, which could be the future treatment, you know, could be the way forward to try and impact hemorrhage. Of course, what we don't know is what drug we put into the brain to repair a brain damage. I think that definitely has opportunity to do that.

Bill Gasiamis 29:44
Are you able to give some kind of a description or explanation about what the blood-brain barrier is? I've heard about it I understand what it does. Basically, from my understanding what it does, it stops toxic foreign substances from getting through the blood and into the brain. But is it a physical barrier? Is it inside the blood vessels? Like where is it?

Professor Stuart Allan 30:14
Yeah, so it's so basically it's the blood vessels themselves. So you know, blood vessels are made up of what we call endothelial cells. So the endothelial cells are the cells that make up your blood vessels throughout the whole body, along with other cells that form alongside them and muscle cells. But basically, the endothelial cells are the main cells. And then if you can imagine the cells joining end on end, so these cells link up end on end.

Professor Stuart Allan 30:41
And the big difference is, the key difference is, the cells and other organs in the body that join up but not that tightly. So the join between the two cells is actually quite loose. Which allows movement of substances in and out a bit easier. The brain cells have what we call tight junctions, so it's simply their referred to as tight junction. So basically, the cell, the contact between two adjacent cells, is very tight.

Professor Stuart Allan 31:12
And that's because it has special proteins and special complexes that formed between the two cells. And that's what makes it tight, that's what makes the brain barrier what it is. So it isn't special, it's just the endothelial cells are different. And they form this tight barrier. So nothing can move between the sails. So if you imagine trying to squeeze through a gap, you know, if you've got a door that's slightly ajar, then you can get squeezed through that gap.

Professor Stuart Allan 31:43
If it gets a bit bigger, you can get more things through it. Basically brain barrier is a door that's really tightly shot, and you can't get very much through it. And what's thought to happen is actually Bill one of the most exciting areas of research, I think that what now seems to be the case is that that barrier is not as good in age, certainly when you age, that barrier becomes less strong.

Professor Stuart Allan 32:13
And in many diseases, so it definitely breaks down. So when we say it breaks down, these junctions open up, or even you can believe it or not, you can move things across the cells themselves, basically, you get small, vesicles, or you get little cargos that can get carried across the cell.

Professor Stuart Allan 32:37
And that increases. And in stroke that definitely happens, in Alzheimer's disease, there's some evidence now that blood-brain barrier is disrupted as well. So it's quite an exciting area of research. So it's there, you know, the blood-brain barrier was designed to protect the brain, but it definitely breaks down in disease it might therefore be a contributor towards certain conditions and certain behaviors.

Bill Gasiamis 33:08
Are they measuring the blood brain barrier, do people physically able to move that?

Professor Stuart Allan 33:13
We can't do that, and that's, that's why we're beginning to understand more about this, you know, one of the challenges in medicine and science is obviously trying to understand what's happening in a living organism, particularly in humans. The brain is obviously not easy to study, because it's trapped in a in a in

the skull. Imaging, you know, things like many people listening will have had a scan, a brain scan, and you mentioned brain scans.

Professor Stuart Allan 33:40
So if you have an MRI scan, for example. And these, these techniques, increasingly, scientists are improving and come up with new techniques to be able to visualize or see what's happening in the brain. And one way to do that is to do you can image the blood-brain barrier so what you can do and it's actually quite simple, when you think about the concept is to inject something into the blood that you can see using an MRI scanner

Professor Stuart Allan 34:10
Basically it will cause a change in the picture looks like on an MRI scanner. And if the blood-brain barrier is leaky, that substance will leak into the brain so you'll be able to see a change in the brain in terms of leakage of substance and that's what's now being done.

Bill Gasiamis 34:31
Similar to an angiograph.

Professor Stuart Allan 34:33
Exactly so if you think of an angiogram you know obviously if there's leakage of the contrast into the brain then that tells you your blood brain barrier is leaky so people are doing that a lot more to try and understand when there's blood-brain barrier leakage and where about is that importantly, you know which part of the brain for example might be affected.

Bill Gasiamis 34:57
Wow, absolutely fascinating so I have a question that came up in my mind about general anesthetic. How does that put people to sleep? Does that impact the brain? Does it go through the blood brain barrier? I know that again, it might not be an area that you've studied or researched any idea simply how anesthetic works? Does it go through a different mechanism to actually put people into a state of sleep?

Professor Stuart Allan 35:33
Anesthetics, you know, whatever your local anesthetic or general anesthetics basically or drug what it does is that it binds you so the brain, the whole body is controlled by neurotransmitters. So everything we do is controlled by these

proteins, these substances, chemicals that move around the body, and these chemicals must have an act and these chemicals need to interact or bind to a protein on the surface of a cell.

Professor Stuart Allan 36:03
So they'll bind to a protein on the surface of a cell. And then they'll cause some effect. So for example, when we can be able to speak and produce sounds or to hear is all caused by transmitters and causing changes. So anesthetics basically, block they block signaling in the important parts.

Professor Stuart Allan 36:29
A local anesthetic, we'll do that locally. So it'll stop the movement. And what happens is when a neurotransmitter binds to its receptor, or it's putting on cell surface, what typically happens is it causes a change in the membrane of the cell and allows ions to flow in and out. So that will change the cell property, the cell will then change and that will cause a change something that doesn't seem to happen.

Professor Stuart Allan 36:58
Anesthetic stop that happening. They block it, they stop it happening, basically. So local anesthetic will do it in a local a localized way. And a general anesthetic will act in such a way to put you to sleep. And similar to an epidural, if you think if an epidural is where people get, obviously block, a awful lot typically is used obviously in pregnancy, or for lower body surgery.

Professor Stuart Allan 37:27
And that's because you can inject basically the the anesthetic directly into somebody's spinal cord, and it acts to stop signals, it binds to these receptors and stop signals traveling. It stops a pain basically any pain signals coming up to the brain.

Bill Gasiamis 37:46
Right? Okay, it's it's a completely different mechanism, it doesn't require access via the blood brain barrier, it is a very different thing. All right, that answers that. So your research into this, "new version" or new different type of TPA drug? Is work being done in just Manchester University with that stuff? Or is there work being done in multiple places around the world?

Bill Gasiamis 38:19

And when you get to the end of your studies of your research of your current program, which is about 18 months away, you mentioned how quickly does that knowledge, that understanding, that new data, enable the next phase to occur? How long does it take to get to be used and adopted by hospitals and doctors around the world?

Professor Stuart Allan 38:48
My honest answer Bill is too long. So you know, one of the challenges in research is actually moving things more quickly along the pipeline, as we call it, we call it a translational pipeline. So basically, from the first discovery, to take it into, you know, early studies, and patients, and then trial, in that, and there'll be no surprise for people to hear that that depends on several things, not least funding, because you've got to fund you have to do more research and to do more work needs money.

Professor Stuart Allan 39:19
The bottom line is you need money to pay the salaries of the scientists that do the work etc, to buy the drug or to do whatever you need to do. In that process. That process to secure money takes time. It takes a lot of time, because there's not enough money. Basically, there's not enough money out there to fund all the research that people want to do. So the process of getting money itself takes time.

Professor Stuart Allan 39:44
So you have to write an application to apply for money that can take sometimes a year, it can take a year to apply and get a decision on whether that project will be funded. So that's a delay and then obviously then you've got to do the work. And you've got to then convince people that it's, you know, it's real, that you've actually got good evidence that this is a new drug, for example.

Professor Stuart Allan 40:09
And then you've got to take it along the pipeline of testing if it's a brand new drug, it needs to go through very complex safety tests to show it's not going to cause harm. And you mentioned dexamethasone, and some of the side effects, so you've got to be sure your drug is not going to cause harm, that counteracts any benefit, basically. So it takes a long time it can take many years, decades, to get a drug.

Professor Stuart Allan 40:38

But I think my hope is, the drug I talked about, they're the one that's a new clot buster could be quicker, because we think it's another form of this drug has been tested in humans before so that suggests it's safe to use. So it could be quicker, but it does depend on further research, of course, we need to prove we need to do more experiments to prove it works and it's better than TPA.

Professor Stuart Allan 41:12
So it's hard to predict it really is dependent on a bit of luck in terms of things happening, funding, and having the right people to do research. And that's where the fantastic support the Natalie Kate Moss trust who kindly you know, have gone on as a legacy to Natalie, they've gone on to raise money to fund our hemorrhage research.

Professor Stuart Allan 41:36
And that's been a really fantastic bonus to us. And it's been really driven our research much faster, because they're raising money for us basically to do research directly. So it cuts out the bit in the middle where you've got to write applications and wait for a year to get decisions. And you're competing against all sorts of other applications to get funding.

Bill Gasiamis 42:01
It seems like a blinding flash of the obvious now when you say it when we can't penetrate the blood brain barrier, but then we've got somebody's head open. So while we've got it open, why don't we access the area that we need to why don't we put this particular drug in there?

Bill Gasiamis 42:19
And kill two birds with one stone so to speak. Well hopefully kill no one but, is that a gutsy move? Is that something that takes a long time for somebody to say, hey, why don't we just put it in the hole you've already created? And see what happens? How they get to the point where they do that? Or has there been research on rodent populations, and then as a result, they get to this idea?

Professor Stuart Allan 42:49
The interesting thing is there's been a lot of research in rodent models of stroke, where where drugs have been given directly to the brain, because obviously, you know you can do that or use more easily. But you can do it more easily in a rodent in a rat or a mouse than a human because, of course, you know, you've got to

think about the cost benefit in a human and we've talked about that aspect in neurosurgery.

Professor Stuart Allan 43:16
And actually, we know these works and actually one of the problems people think because a lot of drugs have been shown to work in terms of stroke in animals, but they don't work in humans. And the question is why? The reality is in the positions particularly the case maybe 20 years ago in the 90s is that the drugs often were tested in animals by giving it directly into the brain.

Professor Stuart Allan 43:39
And then they went into the trial where the drug was given into the blood in the patient and so of course there was no evidence to say that that drug in the blood then got into the brain. So the concept if you give it directly into the brain is going to have benefit is definitely true. So the question just is in humans how do you get that and how do you get drugs into the brain?

Professor Stuart Allan 44:03
And one way is through surgery that's happening anyway. And people have thought about this obviously before not just me. And also there's a lot of effort being done by research groups around the world to try and find clever ways to get things to try and move things better into the brain.

Professor Stuart Allan 44:26
And we've got some research we're doing that same thing so you know, we've got some research, so liposomes are basically small packets, they're basically carriers of drug and one of the Coronavirus COVID 19 vaccines uses the liposome to deliver it.

Professor Stuart Allan 44:46
So it basically is a little package that you can put drugs inside it or move around the body. And these are using cancer and actually we've got some evidence now that in stroke these liposomes get into the brain better they seem to access the brain after somebody has a stroke selectively.

Professor Stuart Allan 45:07
So that gives us the opportunity, we think to give to either attach a drug to the surface of that liposome or to put it inside so a little bag that carries the drug to the brain. So there's lots of work to get done to try and do that.

Bill Gasiamis 45:29
That's fascinating. So in the in the situation with the inflammatory response, right, so interleukin 1, there seems to be a benefit of interleukin 1. Is it beneficial? There seems to be a benefit to having the response where interleukin 1 is released into the area that's been injured right?

Bill Gasiamis 45:58
And is it possible that when delivering this new drug to decrease the amount of interleukin 1 that you're causing harm elsewhere? Is it possible that it's doing too much of the reversal of interleukin 1 and therefore interfering with some other part of the healing response? Or the recovery response?

Professor Stuart Allan 46:27
That's a really good question. Because obviously, interleukin 1 is what we call one of the main inflammatory cytokines. So it's used to fight infection, for example, it definitely is. So one of the one of the questions we always get asked is if you stop this, if you give the drug interleukin 1 receptor antagonist, to stop a one action and do you cause more infections?

Professor Stuart Allan 46:49
Because you know, as a foreign example, there's many trials being done in terms of use in COVID, it's been used COVID and shown to be effective and COVID. The trial has been done, show that there's a very slight, a very slight increased risk of infection, but it's very low. And these are not common infections.

Professor Stuart Allan 47:13
And we've done some research here, Manchester, where we think that's because actually, although interleukin 1 is important in infection, there are other mechanisms, the body has other ways to fight infection they don't only need interleukin 1, so therefore, by blocking it to prevent damage, you're not causing an increase in infection.

Professor Stuart Allan 47:36
Of course, you know, what we don't know is, and this is, again, research we need to do is how long do you stop it working for? And that's a question which is true of any pathway because inflammation, certainly what we know is in the stroke to brain if somebody has a stroke, because there's definitely ongoing inflammation in the broadest sense, you know, there are what we would call inflammatory

processes happening over many weeks and months, if not years.

Professor Stuart Allan 48:07
In somebody's brain. And of course, the key question is, are these inflammatory processes actually trying to do some good? Are they trying to, you know, help the brain to repair to allow new connections to form to make the blood-brain body or better, and until you do the test of course, you don't know that. So that that's important.

Professor Stuart Allan 48:33
So the time you treat for is important. And that's why we need more research to try and understand that situation. Of course, the advantage, we think of giving a an inhibitor. So at the moment, all we propose is if you stop interleukin 1 acting very early on in the first day, then that should be at least enough to cause a reduction in damage. So the question is you were only giving the drug for a short period of time.

Professor Stuart Allan 48:55
In the acute very acute phase.

Professor Stuart Allan 49:08
In the acute phase, and that has advantages in the prevents, it stops any potential side effects. It's actually relatively cheap. So in terms of the health economics, because of course, any treatment that's given to patients needs to be paid for and one of the challenges in health services across the world health providers is the cost of drugs can be very expensive.

Professor Stuart Allan 49:32
So actually, if you're giving a drug only once or twice and it's not an expensive drug, then of course that's from a health economics point of view. That's, good because it's doable. But we are interested in ongoing inflammation in the brain. We're also very interested in whether some of the things that happen early after stroke.

Professor Stuart Allan 49:58
So one of the things we definitely know what happens is when you have a stroke in the brain, the immune cells in the blood change, you know, so if you can imagine the immune system can tell there's been a damage to the brain, and the immune cells become different they change the properties. We don't really know

why they change their properties. And what that means longer term.

Professor Stuart Allan 50:23
And we have funding now across several centers in Europe and North America, to try and understand that more, particularly in relation to and you talk to yourself, Bill about some of the problems you had thinking and just doing things that you normally did before your stroke, that you weren't as good as doing it as you previously were.

Professor Stuart Allan 50:44
And that's basically called, that's what we call cognitive decline. You're there's there's a cognitive change that people's ability to process to do things, whether it be speaking, whether it be reacting to something, whether it be remembering becomes changed, only 30% of people who have a stroke will get cognitive decline. Some will get dementia, about 30% get dementia, and we don't understand, we don't know why to be honest, we really don't know why.

Professor Stuart Allan 51:14
But we think, one hypothesis is that actually, some of these changes that happen very early to immune cells have a longer term consequence on the brain to cause changes in brain function. And the exciting thing is, of course, if you prove that, or you can demonstrate that's true, then you can very early after the stroke you can intervene, and try and reverse these changes to then prevent the consequences of stroke happening.

Bill Gasiamis 51:48
I like that idea of early on having the intervention so that you can decrease the damage early on, because it's early on, when all the damage happens really the first few hours of stroke. And as it remained untreated it's getting worse and worse but that initial phase that sounds extremely promising, because then we are saving physically the brain in different parts, and we're restoring function sooner, and that person's getting back to health quicker back to society quicker back to work quicker back to the family, everything is impacted in a positive way, if we can intervene at the very early phase.

Professor Stuart Allan 52:35
We know I think this is a beautiful thing. Although stroke it does have devastating consequences on people. But the good news is there's been real success in the

last 20 years, you know, TPA does work, I think, you know, although we're trying to find out a better drug that might help more people TPA does work.

Professor Stuart Allan 52:55
So TPA has really transformed outcomes in ischemic stroke. And people may be aware over the last three or four years, one of the biggest one of the biggest interventions that works is actually physically pulling clots out. So what's happening now in many stroke centers across the world is they actually clots that are quite big, and maybe don't get broken down by TPA, they can pull them out, they can actually physically retrieve them. A and that is whether that works, it's highly successful, highly successful outcomes are incredible, you know, somebody can go from being really completely, you know, major defects to basically walk out the hospital.

Bill Gasiamis 53:39
Here with some certain I've interviewed stroke survivors who have had TPA and had interventions like that. And they they tell you, they've had a stroke, and it doesn't look are you know, I'm going to use really terrible words, because I don't like that. The thing I'm about to say, they don't look like they've had a strike that an act like they've had a stroke they don't tell you that I have deficits, like someone who's had a stroke, like there's nothing about them that suggests stroke yet.

Bill Gasiamis 54:06
They have actually had a stroke and some of the things that they're left with some of those people might have some fatigue, or a little bit of, you know, memory issues or something minor that you would say, you know what, that is a great outcome for you, for any person who has an outcome like that, because we know what stroke can do. Everything goes right for that person, you know, they notice some symptoms, they get help they get seen immediately they get given the correct intervention immediately.

Bill Gasiamis 54:36
And you know, within a couple of hours, they are back to a level of health that they were very close to before the stroke instead of having nine months of rehabilitation, a lifetime of walking with left side or right side deficits and so on. So I love the idea that this is real the exciting to interview somebody who's in your role, who does the kind of work that you do, because that's the kind of hope

that we stroke survivors are a waiting for.

Bill Gasiamis 55:11
We're waiting for something to turn up. Because we know how devastating it is we actually a lot of the people who come on this podcast do to raise awareness. So that somehow, what's happened to us, something good comes out of it, we can potentially help other people have had a stroke, recover quicker, have less impact from it, and so on.

Bill Gasiamis 55:37
So even though some of these drugs might not be beneficial to me, I love the idea of the fact that they're going to be beneficial to other people, because we know that I think the World Trade Organization now has revised the number of people that will have a stroke in their lifetime to one in four from one in six.

Bill Gasiamis 55:59
It's way too many people that are due to have a stroke in the future, it's just something that I can't even I don't even want to think about. So knowing that, that there's going to be more that we can do for those people, and hopefully, decrease the amount of negative impact. That's really, really amazing, that's really exciting and promising.

Professor Stuart Allan 56:25
I think it's fantastic that people like yourself Bill, another stroke survivor, you do so much to raise awareness, because, you know, many of the things we talk about and are being researched, or, you know, it's terrible to say are too late for people who have had a stroke, because many of these things are about early treatment. But, and I think that's why we need to research to do that we still need research that's going to bring better treatments.

Professor Stuart Allan 56:52
But we also need to do more research on trying to improve those things that are affecting people's lives, quality of life. And you mentioned yourself. And actually you mentioned you know, what's becoming pretty evident now, actually is more people survive, you know, survival rates now are much better for ischemic stroke. So though the major a changes that people will typically relate to so movement problems or speech problems, they're being lessened because of the treatment.

Professor Stuart Allan 57:26

Actually, things like fatigue, and memory problems aren't. So that in some ways, as scientists, we need to understand we need to turn this on why that is, you know, why is? Okay, so you're getting blood back into the brain quicker, which is basically what TPA does and thrombectomy. So you're getting a blood back into the brain.

Professor Stuart Allan 57:44
And that's obviously helping to measure physical deficits. But actually, some of these more subtle, but yet really, really, you know, have major impact on somebody's quality of life are happening. So the question for scientists is why that is, and fatigue is really one of these ones that stroke survivors often report is being one of the most debilitating things that happen, and we really have no understanding as to what fatigue is in terms of the brain function.

Bill Gasiamis 58:15
Yeah, I'm not sure if I'd be able to have a conversation with you about what fatigue is. And I love the nuance in that question, what is fatigue, but there seems to be a lot of work also being done by researchers around the world about the fact that fatigue might be linked to, a gut issue. So there's an article that I'm reading right now it's available on neuroscience news and research, I think, the website is technologyworks.com.

Bill Gasiamis 58:56
Anyway, there's a group of American researchers who are looking at the possibility that stroke impacts the gut in a negative way. And restoring gut health could help save brain function. Or it could help minimize the amount of fatigue for example that somebody might experience now in my own personal experience, one of the things that I needed to do as soon as I realized that doctors were trying to decrease inflammation in my brain and they were doing it with dexamethasone, which was horrible.

Bill Gasiamis 59:33
I was on dexamethasone for about three weeks, and then had to be weaned off it. When I realized how horrible it wasn't that I put eight kilos on in about two and a half weeks, that I wasn't sleeping that I was having hallucinations, that my skin was crawling. I was eating about 4000 calories a day double what I would normally eat because it just made me ridiculously hungry.

Bill Gasiamis 1:00:02
I think it was dropped by my blood sugar did all these things. And when I realized that I wanted to not be on dexamethasone anymore, although I didn't stop taking it, I did whatever doctors told me to do. I thought I'd look into ways that I think I did a Google search that was something like how to decrease inflammation in the brain. And one of the first things that came up was an anti inflammatory diet.

Bill Gasiamis 1:00:30
And what I thought was that the anti inflammatory diet was impacting my head. But what I know now, from, you know, what we spoke about with regards to the blood-brain barrier, the anti inflammatory diet wasn't specifically doing anything to the head, what it was doing was decreasing inflammation in the gut. And as a result of that, I was having positive experiences on the neurological front.

Bill Gasiamis 1:00:55
And of course, I'm early on in this whole process, I don't know what it means. I just know that when I'm not eating sugar, and when I'm not eating certain carbohydrates, like glutinous bread, like white rice, like, we call them soft drinks, you guys might call them sodas, when I wasn't consuming food like that I was having the less fatigue episodes. And the more and more I got that out of my diet.

Bill Gasiamis 1:01:26
And the less I was spiking my insulin, the less I was having fatigue episodes, or they were less dramatic in the way that they impacted me in a negative way. So there is some weird well, it's not weird. I mean, everything in our body is connected right, in some way, shape, or form. So there's some amazing connection between how we can treat the gut, how we look after our gut.

Bill Gasiamis 1:01:58
And how that impacts our experience after a stroke, a neurological experience. And that is one of the only things that I found comfort from initially was because how do I take control of my situation a little bit? How do I control one part of this crazy thing that's happened to me, the only thing I can do is control what I want to consume. And of course, the more I look into it, you know, there's books by Dr. David Perlmutter who's a neurologist.

Bill Gasiamis 1:02:31
There's a whole bunch of other amazing people there's this Grain Brain by

another guy, like there's this, there's all these books, who that talk about how we can positively impact the the brain. But even though I know that it still doesn't make sense to me after what we've just discussed, after the fact that nothing penetrates the blood brain barrier.

Professor Stuart Allan 1:03:06
I'm glad you've made this Bill, because I don't want the listeners to get the wrong idea. So the blood brain barrier is a barrier, but it's not a complete barrier. So things do get in. So things that the brain needs get in. So for example, you have to get glucose into the brain to get energy, and you've got to have oxygen to get into the brain, obviously, through red blood cells, and you need other nutrients.

Professor Stuart Allan 1:03:31
So you need other busy needs other nutrients to get into the brain to help the brain cells to work. So sorry, I made it sound like it's a complete barrier. There are special mechanisms by which things get into the brain. So for example, any substance that is lipid soluble, so innocent it can be go into lipids into fat will get across the brain, into the brain very easily.

Professor Stuart Allan 1:03:57
And of course, it's no surprise therefore, that certain dietary products, certain dietary things are absolutely essential to get into the brain to make the neurotransmitters I've talked about. So actually, the blood-brain barrier keeps out toxins and bad things. But it definitely lets in good things. And, I think the point you actually have nailed on the head, you know, the gut brain that acts is fascinating, because definitely got reacts to damage in the brain.

Professor Stuart Allan 1:04:26
And the gut barrier will break down, you know, obviously basically any lining of the body that is exposed to the outside world is a barrier because of course you need to keep things out. And what we know is the gut has, obviously a very important barrier. If that barrier breaks down, then it will change what gets into the body. So bugs will get into for example, you'll get microbes come in, but also the ability to extract nutrients from foods becomes changed.

Professor Stuart Allan 1:04:56
So the blood-brain barrier is definitely basically a key gateway. So it is a gateway, it's not a complete blocked off seal. And I think the argument you make is right,

and there's good evidence actually if you eat a diet that's high, for example, in certain fatty acids, so they will get into the brain and they then help the brain probably to repair, you know, because you need, for example, if you, you know, the brain, most brain cells have myelin wrapped around the brain's axons to make them work better.

Professor Stuart Allan 1:05:35
So, if you need to repair myelin, you need to get things into the brain to help to do that and make the cells work. So the key thing, I think, and think of it more simply is the blood-brain barrier, we need to promote the entry of things that are going to benefit brain function and keep out bad things.

Bill Gasiamis 1:05:56
Yeah, lovely. I love it. It makes sense. It's a great conversation. It's one that fascinates me. And that's why I love having people like you on the program, a neuroscientist, who knows this stuff inside and out. It's just one of my favorite topics, it's just become one of my favorite topics. And you can understand why.

Bill Gasiamis 1:06:21
But as we come to the end of the episode, I know you're a busy person, you've got a lot of things to do. And I want you to get back to your research. I am wondering if you can talk at all about the work that you might be doing or that you are going to be doing with the Melbourne University. So I'm very pleased to hear that you guys have some kind of a relationship, all the way from Manchester University, to Melbourne University. Can you tell me a little bit about that work?

Professor Stuart Allan 1:06:53
Yeah, absolutely. And it's, you know, it's quite exciting work. So it relates to inflammation. Again, you know, we've got a long interest in inflammation. And I mentioned before that one of the challenges in brain research is getting a window into the brain.

Professor Stuart Allan 1:07:06
So how can we tell what's going on over time in the brain, in terms of different processes that might be good or bad after stroke. So what's fascinating is if you look at the eye, okay, if you look in the eye, the eye is basically part of the central nervous system in terms of development. It's part of the central nervous system, the retina, in the cornea.

Professor Stuart Allan 1:07:32
So with researchers in Melbourne, so some researchers in Melbourne, a Holly Chinnery and Laura Downey they work in the eye, they they're their researchers who study the eye in terms of a disease. But actually, what they've also noticed is that if you, you can use the eye, and it's a bit of a corny cliche, is a window to the brain. And they've got some evidence now that actually things that are happening in the eye, whether that be in the retina, or whether it be in the cornea, actually might reflect what's happening in the brain.

Professor Stuart Allan 1:08:08
So you can use it as if you'd like as a measure of brain inflammation. And particularly they see some certain types of immune cell change in the eye and have shown that this is relevant to some Parkinson's disease they've shown in people who get some cognitive impairment, there's changes in the eye.

Professor Stuart Allan 1:08:30
So we basically are going to combine with a team in Melbourne to study and compare changes that are happening in the eye to changes are happening in the whole body, the changes are happening in the brain in terms of inflammation, and try and understand more about these responses across the whole organism over time.

Professor Stuart Allan 1:08:52
And it comes back to that time thing, that sort of temporal window of a stroke as an immediate event. And then there's consequences that will go on for years, actually. And so that's it. So it's exciting. It's very exciting research for us to use expertise in Melbourne to link it with our expertise in stroke.

Bill Gasiamis 1:09:13
It's totally amazing. I'm blown away. I could go on and on but I won't. Thank you so much for doing the work that you do. Firstly, you guys are the unsung unknown heroes in the background, your whole team, everybody who's involved and all the other people involved in helping people who you don't know who haven't yet had a stroke in case they have a stroke.

Bill Gasiamis 1:09:48
I think that's just fascinating thing to be doing in your life's work. Like I think that's just amazing. I just love that there are human beings doing that for other

human beings they've never met before, in case they get sick. I love it. So thanks for that. Thanks for being on the podcast. I really appreciate your time. And yeah, just giving us an insight into that I think it's going to be a really fascinating topic and something that the stroke survivors and their caregivers who are listening will take some comfort from.

Professor Stuart Allan 1:10:24
Thanks Bill for getting the chance to speak about research which I care so passionate about, and making a difference.

Bill Gasiamis 1:10:31
Thank you for joining us on today's episode, I hope you learned something valuable and important. I certainly did. I absolutely love talking to the people who are behind the scenes doing work for people they've never met. And that they don't know, in the hopes of giving them a better result in case they have a hemorrhagic or an ischemic stroke. I mean, it's just fascinating and amazing that people choose to do that and I'm grateful for them.

Bill Gasiamis 1:10:59
And I probably have, and many of you listening have already benefited from people that have devoted their lives to making our recovery, and the seriousness of the condition that we had to deal with less impactful, it's just unbelievable. So I hope you got a lot out of it, and you can tell how much I got out of it. To learn more about my guests, including links to their social media and other pages.

Bill Gasiamis 1:11:32
And to download a full transcript of the entire interview. Please go to recoveryafterstroke.com/episodes. Sharing the show with family and friends on social media will make it possible for people who may need this type of content to find it easier. And that may make a massive difference to someone that is on the road to recovery after their own experience with stroke.

Bill Gasiamis 1:11:53
If you're a stroke survivor with a story to share about your experience come and join me on the show that interviews are not scripted, you do not have to plan for them. All you need to do is be a stroke survivor, or care for someone who is a stroke survivor or be one of the fabulous people who help other stroke survivors.

Bill Gasiamis 1:12:12

Go to recoveryafterstroke.com/contact fill out the form and as soon as I receive it, I will respond with more details on how you can choose a time that works for me and you to meet over zoom. Thanks again for being here and listening. I really appreciate you see you on the next episode.

Intro 1:12:31
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Intro 1:12:48
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