Macular Chats

TRANSCRIPT

Can Retinal Implants Restore Vision?

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Featuring: Frank Brodie, MD

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Please note: This Chat has been edited for clarity and brevity.

DR. JIMMY LIU: Hello, and welcome. My name is Dr. Jimmy Liu, and I'm the Director of Vision Science Programs at BrightFocus Foundation. I am pleased to be your host for today's Macular Chat, "Can Retinal Implants Restore Vision?" Macular Chats are a monthly program—supported in part by sponsorship from Science Corporation, Genentech, and Regeneron—designed to provide people living with macular degeneration and the family and friends who support them with the information straight from the experts.

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BrightFocus Foundation's Macular Degeneration Research Program has supported over $56 million in scientific grants exploring the root causes and potential prevention, treatment, and cure of macular degeneration and is currently investing in 44 active projects across the globe.

Now, I would like to introduce today's guest speaker. Dr. Frank Bodie is a Retinal Specialist and Vitreoretinal Surgeon at the University of California, San Francisco, and the Medical Director of Vision Programs at Science Corporation. He completed his MD and MBA at the University of Pennsylvania before taking a residency in ophthalmology at the University of California, San Francisco, and a surgical fellowship at Duke University. Additionally, he did a postdoctoral research year at Stanford University in collaboration with Daniel Palanker, the inventor of the PRIMA implant.

DR. FRANK BRODIE: Thank you so much, Jimmy. It's really a pleasure to be here. Thank

you for having me on the podcast.

DR. JIMMY LIU: Of course. Thanks so much, Dr. Brodie, for taking time out of your busy schedule to talk about retinal implants today. The first question that I have for you is: Can you explain what a retinal prosthesis is and how it works to restore vision, as well as who might benefit most from retinal prostheses?

DR. FRANK BRODIE: Sure. I think it's important that we think about how the retina works. And fundamentally, the retina's job is to take focused light and turn that into electrical signals that then get transmitted to your brain so you can have images. If we think about the retina and each component part of it, there are photoreceptors that do that first step of transducing light into electricity. There is a middle layer—the bipolar cells and some other cell types—that then process that information, distill it down. And then, it's the ganglion cells, the very top layer, that actually transmit that down the optic nerve to the brain. So, a retinal prosthesis is an implant we can put in or around the retina, and one that artificially stimulates a layer of cells in the retina—and we can talk about all the different kinds of retinal implants—but stimulates those cells directly with electricity to provide an image for the brain.

And if we think about who benefits the most from these retinal prostheses, right now it's people that have very severe vision loss. It is people with diseases like geographic atrophy or retinitis pigmentosa, Stargardt disease, and advanced forms of those. But we hope that as the quality of the retinal prostheses continue to improve and as the technologies develop, we can help more and more kinds of vision loss. I've been part of the PRIMA project, as you mentioned, and it has been remarkable to see the evolution of implants prior to PRIMA and now with the PRIMA implant, some of the work we saw done in our clinical trial. We had recently published in The New England Journal of Medicine the results from our PRIMAvera trial, which was conducted in Europe among 17 surgeons in five countries. And we found that patients were able to regain the ability to read—not fast, not quickly—but they really could start to read again using a retinal prosthesis, which was a first-of-its-kind breakthrough and very, very exciting for us to see as clinicians. I remember one patient told me when I visited her in France that this was the first time she'd been able to read to her granddaughter in over 10 years. And she said this with tears in her eyes. It was such an important, emotional thing for her to give her back that ability in her life. And that's the kind of impact retinal prostheses can have, and it's been so exciting to see it up close.

DR. JIMMY LIU: Perfect. Thanks so much, Dr. Brodie, for that explanation about retinal prostheses. Kind of backing up a little bit, you described previously that there's different types of retinal prostheses currently in development. Can you describe some of those

that are the different types of retinal prostheses and some of the advantages and challenges associated with each different type?

DR. FRANK BRODIE: Absolutely. As I mentioned, they each sit in a unique anatomical location. And if we think about the categories of retinal prostheses broadly, there is an epiretinal prosthesis, a subretinal prosthesis, or a suprachoroidal prosthesis. This refers to different locations. Epiretinal means above the retina, it sits on top of the retina; subretinal is below the retina; and suprachoroidal means you've inserted the prosthesis in the suprachoroidal space. Now, this is on one of the outer layers of the eye, and it will stimulate the retina and the retinal nerve cells from there from kind of a little bit further away.

The advantages and disadvantages between these then are driven by a couple of things. One is the resolution of the implant themselves, how many pixels they have, how fine is the stimulation of the different cell types, how well it can discriminate between them. The other is where in the visual cascade you're stimulating. As we talked about, there's the photoreceptors, which change light into electrical signals; the bipolar cells, which process those signals; and then the ganglion cells, which send those signals to the brain. If we think about the epiretinal prosthesis, this is one that sits on top of those ganglion cells, so it allows direct stimulation of the ganglion cells, which is nice because if your other layers are disrupted and you just have the ganglion cells, you can get a signal to the brain. The downside is you've lost all that processing power.

Probably the most famous epiretinal prosthesis was the Argus II implant, which is no longer on the market. This was for retinitis pigmentosa—it gave patients primarily what's called phosphenes, or flashes of light that correspond to things in the vision. The Argus II uses external glasses, which communicate with the implant to then stimulate that ganglion cell layer. Patients were able to tell is there something moving in the room, they were able to broadly discern some big shapes, but it didn't give what's called formed vision or the ability to read, discriminate numbers, things like that, follow directions. And in a large part, that was due to the loss of that bipolar cell layer processing that information. Also, it had a coarser resolution. It didn't have probably enough pixels to give you sufficient resolution to do those tasks.

The other implant I mentioned is a suprachoroidal implant. The main one there that comes to mind is the Bionic eye project, and that is out of Australia. Those are implants that were implanted in the suprachoroidal space, or a couple of tissue layers away from the retina, and used electrical signals, kind of diffusing through those layers to then stimulate the retina. Again, it wasn't a very precise stimulation, unfortunately, so you got a very coarse kind of vision. You would get phosphenes, senses of motion in

the room, patients own some ability to navigate the world a little bit better—again, indicated for retinitis pigmentosa.

Now, the third type, and what I've been most involved with, is called a subretinal implant, the PRIMA implant. This is an implant for patients who've really just lost that photoreceptor layer, right, just that ability to transduce light into electrical signals. And with a subretinal implant, you're sitting right where those photoreceptors are, abutting that bipolar layer, that second layer of processing cells. And so, the PRIMA implant, for example, has a very fine resolution, with 100 micron pixels. And you can think of this almost like a TV, right? The better our resolution gets on the TV is more and more pixels per inch, or our computer monitor. Same with these implants is now you're at 100 micron resolution, and that can only get better as these cells get smaller. But one major advantage of the PRIMA implant is because it's directly stimulating those bipolar cells, you keep all that processing power, and then it goes to the ganglion cells and onto the brain. A downside, though, is if you have diseases that affect other layers of the retina, this won't help you. This is really for those diseases that just affect those outer retinal cells, the photoreceptor cells, and can replace those. It's almost like prosthetic photoreceptors.

DR. JIMMY LIU: Perfect. Thanks so much, Dr. Brodie, for that explanation about the different retinal prostheses out in the market thus far. You described a little bit previously about the PRIMA implant. Can you describe to our listeners what the PRIMA implant is, starting from the beginning and discussing basically the details of how it works?

DR. FRANK BRODIE: For sure. So, you know, as I mentioned, the PRIMA is like artificial photoreceptors. Its job is to transmit light into electrical signals for the brain. And if you think about what can do that, it's very similar to the solar cells that some of us have on our roofs to give us solar electricity. And so, it's a grid of 378 tiny, miniature 100-micron solar cells. It's implanted below the retina. It is stimulated by infrared light, which is a really interesting design choice because it means that the rest of the retina in these patients—and these are patients with macular degeneration who have good peripheral vision still and have just lost their central vision—when they wear these glasses that provide the infrared light to the implant, it doesn't disturb their peripheral vision. They still have great peripheral vision. It's not disturbed by wearing the glasses. And what the brain does is it can incorporate the natural peripheral vision with the prosthetic central vision to create one whole image. And we had published on that previously, and it was a real testament to neuroplasticity in these patients, their ability to adapt.

So, patients would wear these glasses with infrared light shining in. It shines on the

implant. The glasses capture what is in front of the patient. That image is then projected with the infrared. The PRIMA implant will then stimulate the overlying bipolar cells directly above it, much like the photoreceptors would do. Those bipolar cells process the information, send it to the ganglion cells, and the ganglion cells send it to the brain. As we saw in our PRIMAvera trial, it made a dramatic difference to patients' vision. We saw an average of five lines of visual acuity improvement in patients in the PRIMAvera trial. And of course, there was a spread. Some patients saw a lot more. We had a patient that improved by 12 lines of vision, and then we had some patients who didn't find as much of a benefit, but the average was five lines of improvement. And this was driven, of course, in part by the fact that because we're using digital vision, in a sense, because it's digitally captured by the glasses, we're able to process that, increase the contrast, increase the magnification, do all sorts of things to try and give patients the best experience, the best vision possible. Does that make good sense, Jimmy? Are you with me? I know I talk a lot, and I apologize to our listeners. I can kind of babble on about this for a long time.

DR. JIMMY LIU: No worries, Dr. Brodie. No, that was a great explanation. I appreciate the detailed explanation. I think a follow-up question to describing how the PRIMA implant works is: What is it used for, for particular eye diseases? And so, I think you talked about that a little bit before, but can you describe again what type of macular degeneration PRIMA is designed for?

DR. FRANK BRODIE: PRIMA, in a sense, is disease agnostic. It is really designed to replace those photoreceptors and can treat any patient with the correct anatomy, and that is loss of photoreceptors. We completed the clinical trial in advanced age-related macular degeneration, geographic atrophy. So, this is advanced dry AMD. Because we know in those patients, generally, they have very healthy inner retinas, and it's just the first layer that is lost, so it is a perfect candidate for the PRIMA implant. There are other inherited retinal diseases that also would be very amenable to this. In particular, we're looking at Stargardt disease. I think there are other inherited diseases, as well, and other types of non-inherited diseases, but those are the main ones we're thinking about right now, although we have a lot of plans to study a broad range of diseases in the future and are excited about this kind of disease-agnostic therapy that really is just driven by the anatomy.

What we see is that these patients really have the ability to adapt to this device, and that is something I want to stress, because even though generally patients with age-related macular degeneration are older, their ability to neuro-adapt and functionally use this device, it is hard to overstate it. I was at a clinical trial meeting a couple of weeks ago, and one of our clinical trial experts brought in a book, a novel, and he said,

"A PRIMA patient read this book." And this was a patient that was legally blind, 20/300 vision, hadn't read in years and years and years, and had now completed an entire novel with the PRIMA device alone. Again, not reading fast, bit by bit, but she completed the entire novel, and it was just remarkable. So, it's exciting to have that kind of impact on these vision loss states. And as you well know, in geographic atrophy right now, we don't have much in our clinical armamentarium. You know, we're fortunate to have the complement inhibitors for earlier stages of macular degeneration, which can slow the disease. And we're all very grateful for that in the field, but we don't have anything that can stop the progression of geographic atrophy, and we certainly don't have anything else that can actually restore vision. So in that sense, PRIMA is very unique.

DR. JIMMY LIU: That's awesome, Dr. Brodie. Yeah, it's exciting to see all the results from the clinical trial that you had in Europe and that patients were able to improve their vision by, on average, five lines. That's really exciting. And that the implant is disease-agnostic, so it can work with many different eye diseases. Another question that we have frequently got from listeners is: Are there any plans to study or use the PRIMA implant for those with wet AMD?

DR. FRANK BRODIE: I think it's a great question. We picked GA initially because we know that the overlying cells are not disturbed. And as I mentioned, you know, we really need those bipolar cells and ganglion cells to be in great shape to get your best vision out of PRIMA, and that is obviously what you look for in a clinical trial. In wet AMD, it's a little bit more heterogeneous. Some patients absolutely will have great overlying cells, but some patients, unfortunately, that have had a lot of bleeding and exudation from the wet AMD will have a little bit less function in those cells. Certainly, we would plan to study it in the future, and we would just have to think hard about making sure that we could pick patients that would benefit the most from PRIMA. We want to make sure that everyone gets a tremendous benefit from this device.

DR. JIMMY LIU: Perfect. Thanks so much for that explanation, Dr. Brodie. So, again, you talked about what the PRIMA implant is and how it works from a detailed, mechanistic standpoint. Can you then describe to us how the PRIMA implant is surgically done, procedurally, and about the adaptations or rehabilitations needed after surgery, after the implant is implanted?

DR. FRANK BRODIE: That's a great point, Jimmy. The PRIMA implant, unlike the current drugs for GA, it requires surgery, right? It's not just an injection, it's surgery. It uses a lot of the things we do routinely in retinal surgery, which is called vitrectomy, where we remove the vitreous from the back of the eye so we can access the retina. And that's pretty much how every retina surgery starts. That's kind of step number one for

everything I do. After we do the vitrectomy, we use a little bit of fluid to elevate the retina nearby the area of geographic atrophy. We then make a small incision there and can slide the implant underneath the area of geographic atrophy. We then flatten the retina back up, and we'll put in either a gas or oil bubble for short term just to help the retina heal as the patient recovers from surgery. On average, in a clinical trial, it took less than 2 hours, and these were kind of the first procedures anyone had ever done. And we expect that time to go down, but it's still retina surgery, and it is worth talking to your physician at length about it.

DR. JIMMY LIU: Perfect. Thanks so much for that explanation, Dr. Brodie. Another question that I have is: At what stage of development or clinical trials is PRIMA currently in? I know you briefly discussed a little bit about the clinical trial in Europe, but maybe discuss a little bit about maybe potential future in the U.S. or other places. We have a number of listeners who have expressed interest in participating in a clinical trial for this device.

DR. FRANK BRODIE: Oh, that's wonderful to hear. I guess I'll lead off with that, is that we are planning clinical trials in the U.S., in Europe, in Australia. And the best way for listeners to get involved in those trials is to go to our website and sign up for the patient registry. And I'm going to give you that address. It is www.Science.xyz. And we have a special page for the patients listening to this podcast, so it's http://science.xyz/brightfocus. And that's specially designed for the folks listening today, help them get involved with the registry, learn more about the device. You can hear everything that we've been talking about today by going to the registry.

So as far as clinical trials, just like you mentioned, Jimmy, we finished a pivotal trial in Europe, and we're so pleased with the results there. As I mentioned, it got written up in The New England Journal of Medicine and actually was covered in a lot of the popular media. And I think that really speaks to what a need there is for vision restoration. We had stories in The New York Times, the BBC, we were in Time Magazine. And it was really gratifying just to know that this meant something to the public, that restoring vision in these patients was really a meaningful achievement. And we are planning studies now in the United States, in Australia, follow-on studies in Europe—both for the current generation of device and new indications.

And already, we've begun a lot of work on the next generation of PRIMA implant, with higher resolution, making things easier to read, and new technology in the glasses, making them easier to use. So, we're very excited about all those things. You did touch on rehab, and like prior retinal prostheses and other vision restoring therapies, there is a rehabilitation period to teach a patient to use the technology and also help with some

of that neuroadaptation that we're talking about and teaching the brain to see again after it hasn't seen in so long and helping the patients focus and sort through those signals to make sure they can read at their best level.

DR. JIMMY LIU: Perfect. Thanks so much, Dr. Brodie, for that explanation. And so, another question that I had: We talked a little bit about rehabilitation, adaptation. What have you learned so far, in terms of those clinical trials, about the safety of this device?

DR. FRANK BRODIE: Yeah, that was something we were really pleased with. When we looked at all our safety data from the PRIMAvera trial—and this was 38 patients, with 32 making it to the 12-month endpoint—we saw there was really no concerning safety signals about the device itself. What we saw was that you had the kind of side effects you'd expect from retina surgery, from doing vitrectomy. These are things like high eye pressure the day after surgery that you get eye drops for, bleeding around the site of incisions, things like that. There was nothing that really jumped out. And what we did is we looked at how much patients use the device and wanted to make sure that use wasn't associated with any problems in the long run. And we didn't see that, either. We found that patients could safely use the device as much or as little as they wanted without any changes in the safety profile, and so that was very reassuring to us.

DR. JIMMY LIU: Thanks, Dr. Brodie, for that explanation. Before I go on to the next question, you gave so much amazing information for our listeners on the call. And so, I kind of just wanted to summarize everything that you've said in the past 10 to 15 minutes to make sure that everyone is on the same page. And so, you talked about this PRIMA implant, which is a subretinal implant that is placed in the back of the eye. And essentially what it does is it is kind of like a solar panel that basically helps replace those photoreceptors that help amplify the light signal and convert it to an electrical signal that helps rewire that signal into your brain for those people to see a projection or for them to see something. And then in terms of the clinical trials, there has been a clinical trial done in Europe, and future clinical trials will be done in the U.S., Australia, and maybe one other country that I am forgetting at this moment.

DR. FRANK BRODIE: That's okay. We're going to do some more in Europe, as well.

DR. JIMMY LIU: Oh, perfect. And then in terms of the safety and just the adaptation and rehabilitation after the surgery, everything that you've seen from the clinical trial was really great and patients seem to have no safety and efficacy issues for that portion for the most part. And so, does that sound like a good summary, relatively, of what the PRIMA implant is?

DR. FRANK BRODIE: Yeah, I think that was a great summary. I think maybe two finer

points I'd put on something. One is when I think about how the PRIMA is functioning, I use the term "restoring the visual cascade," because what's happening in these patients is without the photoreceptors, no information is even starting to be transmitted, right? They can never get that light into electrical signal. And that's what PRIMA replaces. It restores that ability that turns light into electrical signal, which then can get processed and sent to the brain. And that signal then is amplified by the bipolar cells, but there wasn't anything to start with, you know? So, I think of it as a real restoration therapy, which differentiates it from some things that maybe just magnify things or vision that's already coming in, like readers or things like that. And the other thing I would say is that, certainly, I was thrilled with the safety and efficacy—it's still a surgical procedure, and I don't want listeners going away thinking they're going to get this thing at Walgreens or anything like that. This is a real surgery, and it has to be taken seriously. But we were very happy with the results we got and that patients did incredibly well after this procedure.

DR. JIMMY LIU: Perfect. Thanks so much for that summary, Dr. Brodie. Moving on to the future steps for this implant, what are the next steps in research and development for not only the PRIMA implant, but for retinal prostheses in general? And specifically, what about the approvals of bringing PRIMA to the market? A lot of our listeners have asked, "When can I get this implant?" So, do you have any comments about that?

DR. FRANK BRODIE: Absolutely. We're working very hard on that. We want to get this technology to patients as fast as possible. It's been submitted for approval in Europe to be able to bring it to patients in Europe. They have an organization similar to the FDA called the Notified Body, and we've submitted to the Notified Body there and hope to have it this year to patients in Europe. Similarly, we're working very, very hard with the FDA here in the United States to show them our data from the trial and bring it to patients in the United States as fast as possible. So, one thing we always get asked is, "What can I do in my patients, in my clinic, and things like that?" And I think your listeners are doing the best thing they can do, which is being involved in organizations like BrightFocus, being involved in patient advocacy organizations, learning more, getting educated. Certainly, they're welcome to go to our website to learn more about the patient registry. I'll just plug the website again. It's http://science.xyz/brightfocus for your listeners. And there are times when the FDA asks for public comment, as well. And certainly, if people are motivated, that's a great way to get involved and let these regulatory bodies know how much vision means to your listeners and the kind of impact they can have on bringing these things to market.

DR. JIMMY LIU: Perfect. Thanks so much for that, Dr. Brodie. Yeah, we had one listener ask, "What can I do to help bring technology like PRIMA to market sooner?" so thanks

so much for providing all that information for our listeners today. Another question that we had was: Beyond retinal prostheses, what other approaches are being explored to restore vision in general? And how do you see the field of vision restoration evolving over the next 5 to 10 years?

DR. FRANK BRODIE: I'll tell you, Jimmy, it's an incredibly exciting time to be an ophthalmologist. And I feel so fortunate to practice right now because there are so many ways that people are trying to restore vision. Obviously, we've talked a lot about retinal prosthesis. Other technologies that are being developed are optogenetics—that's where you can make cells that are not necessarily light-sensitive naturally, you can turn them into light-sensitive cells so then they can restore the visual cascade. And there are several companies working on that, and it is very exciting. Other things that are being done are cell-based therapies, where you inject stem cells or differentiated cells into or around the retina to restore the function. And that is tremendously exciting. There are folks looking at ways of just directly stimulating the brain as opposed to doing anything with the eyeball, just getting around it all and stimulating the brain.

And of course, whole-eye transplant is really actively being investigated. ARPA-H has given out huge grants. It's kind of like the NIH; it's a parallel organization and has given out huge grants for many groups to study whole-eye transplantation. And that's very exciting. So, like I said, it's a great time to be an ophthalmologist and you know, you never want to have an eye disease, and I have a huge amount of sympathy for my patients going through all the challenges they do with eye disease, but in a sense, we're very fortunate to be living in this time where there's so many exciting developments happening at a very, very rapid pace.

DR. JIMMY LIU: Thanks, Dr. Brodie. Yeah, I totally agree. This technology really has been advancing in the eye field. And I think the listeners on this call can be very optimistic about new technologies that can help restore vision for them and for their families and loved ones who are affected with either AMD or other eye diseases. And so, I think we have some time for some listener questions, and so these are going to be a little bit rapid fire. The first question that I have from our listeners is, "Is there an age limit for getting the PRIMA implant?"

DR. FRANK BRODIE: Nope, no age limit at all. We had patients as young as in their 60s and as old as in their 90s get it in the trial. And there's no age limit.

DR. JIMMY LIU: Perfect. Okay, another question we have is, "If a person had cataract surgery, can this impact results of the implant procedure?"

DR. FRANK BRODIE: Actually, the PRIMA implant is designed to only work with folks that have had cataract surgery. And so, if you haven't had cataract surgery and are otherwise interested in a PRIMA implant, your retina specialist would work with your cataract doctor in helping you get cataract surgery prior to getting the PRIMA implant. So, it's designed to work with patients that are what we call pseudophakic, or have already had their lens replaced.

DR. JIMMY LIU: Perfect. Another question that we had is, I know you talked about how you met a patient who was able to read a novel from beginning to end, and that's so incredible. A listener asked, "Are you able to drive again after this implant?"

DR. FRANK BRODIE: You know, with the current generation of implant, you probably could not drive. And one of the reasons is the field of vision is not wide enough for driving. You know, in driving, you require both acuity, but you also have to have a wide field of vision to see the whole road, to see pedestrians, all those sort of things. If you go on our website, you'll see the size of the implant. It's a small implant, so it can fit underneath the retina. But the current generation doesn't give you a wide enough field to be able to drive. We're working on larger implants. I'm not sure that the stuff we're working on in our lab will get you all the way to driving, but it certainly will help more with doing more and more tasks. And we hope someday soon that we can get you to tasks like driving and those things, but not today, unfortunately.

DR. JIMMY LIU: Another listener question that we also had is, "Is this implant only implanted in one eye or both eyes?"

DR. FRANK BRODIE: It's a great question. We get that one a lot. Right now, we just do it in one eye. What we found is people generally just use their better eye. Most tasks you can accomplish with one eye using the better eye. Two eyes really comes into play if you need 3D vision. And that's called stereopsis, where a slightly different image from both retinas lines up just so and your brain can then interpret that in 3D. Right now, the PRIMA isn't designed to provide stereopsis, even when implanted in both eyes. I think that would be something we would definitely look at in the future. But you see a lot of the functional gains just by improving vision in one eye, and so that's what we're really focused on now, is just getting to as many patients as we can with at least helping the one eye.

DR. JIMMY LIU: Perfect. Thanks so much, Dr. Brodie, for that explanation. The last listener question that we have is, we had a lot of questions about how much this will cost and if we can expect this PRIMA implant to be covered by Medicare. You may not have the answers for this yet, but can you comment on this at all?

DR. FRANK BRODIE: You know, I'm not involved in the business side, and so I don't have any pricing. But what I would say is that the expectation is that we will work diligently with insurance. We don't expect patients to pay out of pocket for this device. We want to make this device available to all patients that need it. And Medicare has shown a dedication to patients. They covered the Argus device, they've covered other vision restoration therapies, gene therapies. And so, I think Medicare has a great track record of supporting vision restoration, and so we're very hopeful that they will continue to support it in the way they have, and we're committed to making sure patients who need it get it.

DR. JIMMY LIU: Perfect. Thanks so much for that explanation, Dr. Brodie. So, that's all the time we have for questions today. Thank you again, Dr. Brodie, for answering so many of our questions and all the information you shared with us today. To our listeners, thank you so much for joining our Macular Chat. I sincerely hope you found it helpful. Dr. Brodie talked about this earlier, so to sign up for Science Corporation's patient registry to receive updates about the PRIMA visual prosthesis and the latest research, please visit http://science.xyz/brightfocus. I would also like to mention that our website, www.BrightFocus.org has a wealth of information about macular degeneration.

So, Dr. Brodie, before we close, do you have any final comments for our audience?

DR. FRANK BRODIE: So, Jimmy, I really think we covered it all. Thank you so much. This has really been an honor to be on the show, and I appreciate it. And so much gratitude to all the folks that tune into these BrightFocus Macular Chats. I think it's a wonderful source of information for the patients I take care of and so many patients around the world.

DR. JIMMY LIU: Perfect. Thank you again, Dr. Brodie, so much for taking time out of your busy day to share so much information with us. Our next Macular Chat will be on Wednesday, February 25. Thanks again for joining us, and that concludes today's Macular Chat.

To our listeners, thank you so much for joining our Glaucoma Chat. I sincerely hope you found it helpful. Dr. Nagarsheth, before we close, what advice would you give to patients who feel overwhelmed after receiving a glaucoma diagnosis?

Useful Resources and Key Terms

BrightFocus Foundation: (800) 437-2423 or visit us at www.BrightFocus.org. Available resources include—

- Macular Chats Archive
- Research funded by Macular Degeneration Research
- Overview of Macular Degeneration
- Treatments for Macular Degeneration
- Resources for Macular Degeneration

Helpful low vision tools or resources mentioned during the Chat include—

- Science Corporation
- Science Corporation's webpage for Macular Chat listeners: https://science.xyz/brightfocus
- PRIMA visual prosthesis
- PRIMAvera clinical study
- PRIMA research article in *The New England Journal of Medicine*
- Argus II implant
- Bionic Vision Technologies Second-Generation Suprachoroidal Retinal Prosthesis