

KENDALL LEE: Well, thank you very much for joining us today. My name is Dr. Kendall Lee. I'm a neurosurgeon and the director of Mayo on Neural Engineering Laboratories. Today, I have with us Professor Kevin Bennet, who is also the chair of division of engineering as well as the co-director of the Neural Engineering Laboratories. Professor Bennet, can you please tell us a little bit about the Division of Engineering?

KEVIN BENNET: Certainly, I'd be delighted to. Thank you for speaking with me today. The Division of Engineering has been around since about 1950, and so we're an embedded engineering group within the Mayo Clinic. And that's very unusual to have a group of engineers that are able to be a part of the research, be a part of medical care within the Mayo Clinic.

KENDALL LEE: And you've been working with us now in the Neural Engineering Laboratories. What work have you been doing in neural engineering?

KEVIN BENNET: It's been a very large variety of work, which has been very gratifying, in that we have been working in terms of developing new electronic circuits for deep brain stimulation. We've been developing new software and integrated circuits for the development of measurement of neurotransmitters and specialized electrodes that would be used in patient care for the measurement of neurotransmitters long term.

KENDALL LEE: So the specialized electrodes, can you explain about that a little bit?

KEVIN BENNET: Certainly, I'd be delighted to. The electrode is one which would be implanted into the brain with a neurostimulation electrode that keeps track of the neurotransmitters that are being released. The interesting thing about it is that we hadn't anticipated that we would use an older technology that was well-known. But what we discovered is actually the technology didn't last long enough, and so we did an analysis of the situation and came up with the idea that we needed to use diamond as the sensors. And so we are now growing diamonds in the basement of the Medical Sciences building for uses as neurotransmitter detection.

KENDALL LEE: I'm sure our listeners are sort of wondering. Diamonds in health care, how or why did you even think about diamonds?

KEVIN BENNET: Well, it's basically back from the engineering principles and that we understood what needed to be done. And in terms of looking at the materials to be used, it became very apparent that all other materials were not going to work. And so diamond was the best hope. And so in terms of developing and doing the measurements, we discovered that by creating an electrically conductive diamond, we could effectively make the electrodes function.

KENDALL LEE: Now, you know the National Institute of Health is also very interested about this diamond. Can you tell our audience about the recent grant that you have obtained, the BRAIN Initiative grant, the U01 grant?

KEVIN BENNET: The U01 grant is a delightful opportunity to extend the technology. And this is a grant that we developed in conjunction with the researchers, the scientists, the MDs, the PhDs, because it really is a collaborative effort that makes these opportunities possible. And so quite a number of the members of the Division of Engineering and the Neural Engineering Laboratory are working very closely together to make these sensing systems a success.

KENDALL LEE: So you talked about team, team works. Can you tell us who else is involved in the BRAIN Initiative grant, as well as how have you been able to organize such a large team?

KEVIN BENNET: It's been an interesting process in that, actually, when we first started our collaboration a number of years ago, it was really the development of that future plan, what sort of people that we needed, what sort of outcome did we want to create. And by developing that and growing that over the years, we have elected and selected the right team to work together. And that team is actually really quite large, and approximately probably 50 people or so have been involved in that development.

KENDALL LEE: And in fact, that goes outside of Mayo, including Dr. Dong Pyu Jang at Hanyang University in South Korea, as well as Dr. Felicia Manciu at University of Texas at El Paso.

KEVIN BENNET: Exactly. And so what we're doing is that as we identify needs, we look for experts, anyplace in the world, that would be necessary to work with us to develop this application for patients.

KENDALL LEE: Professor Bennet, that's very exciting about diamonds. But I know that you are also working on spinal cord stimulation and limb reanimation. Could you talk about that a little bit?

KEVIN BENNET: Yes, well, this is an ideal example of how the development of technology in one aspect of health care can be used in other aspects. And basically, the same techniques, the same basic understanding of neural circuits, extend to the spinal cord, because in effect, the spinal cord is an extension of brain. And so by using the devices for stimulation, the devices for measurement of neurotransmitters, we're able to utilize this for the research and development for, as we're calling it, the limb reanimation, reinserting the information for movement back into the spinal cord.

KENDALL LEE: OK. Again, my name is Dr. Kendall Lee. I'm with Professor Kevin Bennet. Thank you very much for joining us today.