OPTIMIZATION OF MICROELECTRONIC METHODS TO PRODUCE AN IMPLANTABLE RETINAL PROSTHESIS TO TREAT BLINDNESS

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MASSACHUSETTS EYE AND EAR INFIRMARY

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Public Abstract

The leading causes of blindness among our U.S. military Service veterans are currently not treatable. Our proposal is designed to optimize the design of our retinal prosthesis to make it suitable for human use. We hope that our upgraded prosthesis will restore vision to some severely blind patients.

The goal of developing an implantable prosthesis that is small enough to fit into the eye, electronically sophisticated enough to deliver intricate patterns of stimulation to the retina, and which would not require wire connections or batteries is challenging. Our multi-disciplinary research group has been focused on this goal for nearly two decades. After having accumulated a wide range of experiences and after having already performed FDA-approved human trials, we are now ready to undertake a significant optimization of our current prosthesis.

We will utilize state-of-the-art microtechnology to design and build new integrated circuits that will operate with exceptionally low power. Our low power specifications will provide the advantage of safer usage over the many years that we intend the device to survive in human eyes. We will use our experience of microfabricating into thin films to create flexible electronic circuits, which is a particular strength of our group. We will modify some techniques and develop new methods to protect our implanted electronics from contact with the salty fluids of the body, which would destroy the function of our electronic devices.

We anticipate that we will complete the optimizations for our human-grade retinal prosthesis at the end of this two year-funding request. We have already contacted the FDA to begin the process of obtaining approval for long-term human implants. We anticipate that we will be able to perform long-term human implants 3 - 4 years from now. Dr. Rizzo, the Principal Investigator of this proposal, serves as the Director of the Center for Innovative Visual Rehabilitation at the Boston VA hospital. Dr. Rizzo's research program is just entering its second, five-year cycle of VA research support. Our commitment is to provide our disabled and veteran U.S. military personnel with access to our advanced-therapy for forms of blindness that are currently not treatable, like laser (i.e., range finder)-induced retinal injury, ocular blast injuries, and age-related macular degeneration.

There is no guarantee that a retinal prosthesis will restore useful vision to blind patients, but the evidence continues to accumulate that patients who have been legally blind for decades can see almost immediately in response to retinal stimulation. With our upgraded device in hand, our future research will be geared toward learning how to use the electronically sophisticated prosthesis to obtain higher quality visual images than has been obtained so far. The remarkable success of the cochlear implant in restoring hearing to completely deaf patients provides our research family with optimism that we may be able to achieve a similar level of success for blind patients.

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