

“System-Integration: Examples of Innovative Health Products”

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This tutorial will review medical devices and technology that have resulted from research at the Biomimetic Microelectronic Systems Engineering Research Center. One of the major projects of this center was a retinal prosthesis for the blind. Several components of the retinal prosthesis have been spun-off into medical devices or platform technologies. Retinal prostheses have been demonstrated to improve vision in select blind populations. In a normal eye, retinal photoreceptors initiate a neural signal in response to light. In a retina with photoreceptor degeneration, electrical stimulation of the remaining cells in the retina can produce the sensation of light. An electronic retinal prosthesis uses a camera to sense light, digital and analog circuitry to convert image data to stimulus pulses, and a multi-electrode array to stimulate the retina with a pattern. Retinal prosthesis patients can distinguish basic shapes, detect motion, navigate towards a target, and recognize letters. Based on these encouraging results, the current focus is being shifted to the development of a high-resolution retinal prosthesis which will be capable of stimulating the retina at thousands of individual points. This development has required innovation in materials and systems that have utility in other medical devices. These include implantable drug pumps, adhesive materials, protective coatings for implantable electronics, and highly electroactive metal oxides for stimulation and sensing.



James Weiland received his B.S. from the University of Michigan in 1988. After 4 years in industry with Pratt & Whitney Aircraft Engines, he returned to Michigan for graduate school, earning degrees in Biomedical Engineering (M.S. 1993, Ph.D. 1997) and Electrical Engineering (M.S. 1995). He joined the Wilmer Ophthalmological Institute at Johns Hopkins University in 1997 as a postdoctoral fellow and, in 1999, was appointed an assistant professor of ophthalmology at Johns Hopkins. Dr. Weiland was appointed assistant professor at the Doheny Eye Institute-University of Southern California in 2001. Currently, Dr. Weiland is a Professor of Ophthalmology and Biomedical Engineering, University of Southern California. He is Deputy Director of the Biomimetic Microelectronic Systems

Engineering Research Center. Dr. Weiland’s research interests include retinal prostheses, neural prostheses, electrode technology, visual evoked responses, implantable electrical systems, and wearable visual aids for the blind. He is a Senior Member of the IEEE EMBS, the Biomedical Engineering Society, Sigma Xi, and the Association for Research in Vision and Ophthalmology.