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Facial Nerve Injury and Repair: Development of Treatment Strategies for Clinical Application

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Our neuroregeneration laboratory investigates underlying mechanisms of neural injury and repair, in the context of both trauma and disease. One major area of study lies in the exploration of the neurotherapeutic potential of gonadal steroid hormones in facial nerve injury and in spinal cord injury. We have recently initiated a translation study with Dr. Sam Marzo, who is an Assistant Professor in the Division of Otology, Neurotology, and Skull Base Surgery, Department of Otolaryngology – Head and Neck Surgery Loyola University Health System. The purpose of the project is to determine if the combination of electrical stimulation and gonadal steroid treatment can accelerate functional recovery from unilateral facial paralysis. Positive results will lead directly to clinical application, as both gonadal steroids and electrical stimulation are treatment modalities currently in clinical use for a variety of different problems. Work from this project has been presented already at local and national conferences, received awards, and been submitted for publication in Otolaryngology-Head and Neck Surgery. As a new translational venture initiated in 2006, the relatively rapid success of this project can be attributed to four main factors: the question, funding, the personnel, and cross-collegiality among those basic scientists and clinicians involved in the project.

The “question”, of course, is the fundamental component of any successful collaboration. It is essential to identify relevant questions that both basic scientists and clinicians have in common. In their practice, Dr. Marzo and his colleagues observe insults to the facial nerve which occur secondary to trauma, idiopathic etiologies, neoplasms, or iatrogenic injuries following surgery of the head and neck. Our laboratory is interested in targeted therapies for facial nerve regeneration. Therefore, the focus of our collaborative project is to explore potential combinatorial treatments for facial nerve repair that may have direct clinical applicability. As an interesting aside, the historic use of facial nerve injury in animal models has been based upon the fact that, because the facial nerve does *not* subserve any vital functions (eating, swallowing, chewing, drinking, etc.) that would compromise animal well-being, it serves as a very simple model for the study of nerve repair. In contrast, however, prolonged unilateral facial nerve damage in humans results in a disfigurement that is psychologically devastating and of enormous impact upon the well being of the individual. Consequently, we have a serendipitous opportunity to use simple animal models to identify therapeutic strategies for a significant human impairment.

Next, once we outlined our mutual interests and objectives in facial nerve regeneration, a budget was proposed. The head of the Otolaryngology Department, Dr. James Stankiewicz, provided the initial funding necessary to initiate the translational project. This budget included postdoctoral salary, animal costs, and surgical supplies to accomplish a set of pilot studies and maintain ongoing personnel in the lab. Our project has been particularly successful because of the personnel that are collaborating on the experiments. Residents in the Otolaryngology Department are required to have a quarter rotation designated to research. Throughout the first year of this project, we have had four hardworking, independent residents who have participated in the research. The postdoctoral fellow was hired to lead

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the project and help introduce the basic research techniques to the residents as well as provide cohesiveness between the research performed by each of the residents. With stable leadership, previous work can be expanded or built upon and the results of these combined efforts can be pulled together into manuscripts. Our team is also fortunate to have a MD/PhD student from the Neuroscience Department here at Loyola University to help conduct the research as part of her thesis proposal.

Lastly, we have determined that an important component of success is a result of the mutual respect we have for the other's contributions. We have met together on multiple occasions throughout the year to discuss the data collected, as well as future directions. These meetings have been a forum for understanding the clinically relevant issues, discussion of published basic research, and the expansion of new ideas. Without the presence of respect for other points of view, these meeting would not be as productive and fruitful. As basic scientists, we have been introduced to the clinical scope of the problems associated with human facial nerve injury. In turn, the residents have been able to spend enough quality time in the laboratory using the simple animal models and existing data to formulate experiments that are designed to directly take the results from "bench to bedside". Importantly, the postdoctoral fellow and graduate students also have the opportunity to actually do "translational research". Given the direction that NIH is taking, this provides basic scientists with additional skills for their future as funded investigators. At the present time, outside funding is being sought from NIH, VA and private foundation sources to continue several future directions of the project: development of an intracranial animal model of facial nerve injury to more closely approximate that found in the clinical situation, and application of embryonic stem cells differentiated into motoneurons into replacement tissue for facial motoneurons lost with intracranial nerve damage.

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