Model: Rat and mouse models are generally good in vivo candidates for nerve regeneration since they are relatively small and easy to use in a lab space. Additionally, they mimic humans closely enough that they can give indicative results as to how the human body may react in similar situations. Rats are slightly larger which makes them easier to perform surgical tasks on. For this model, rats will be used to simulate a stab injury to the sciatic nerve to create a peripheral nervous system (PNS) injury. A majority of PNS neural regeneration models are performed using a nerve crush method, for example, the sciatic nerve is commonly used in mice and rats to simulate a nerve crush injury. This nerve is used since it is easily accessible, of reasonable size, and muscle innervation is clearly understood. Additionally spinal cord crush injuries have been performed before along with cortical stab injuries [1], but sciatic nerve stab injuries have not been used as a model. This is performed in the cortex by inserting a sterile needle into the brain in previous methods [1]. In the new method, the mouse would be opened surgically, exposing the sciatic nerve and a sterile needle would be inserted into the nerve. This could be done with various gauges of needle to establish different degrees of severity of injury. There would be some trial and error in this process to establish a consistent model. With the stab wound, it is also expected that the tissue would be more challenging to regenerate than the crush method.

Potential Uses:

- Use of the sciatic stab model could be used to investigate tissue regeneration and systemic response based on positioning of the stab and depth. The wound could be a complete nerve sever, loss of function of one side of the nerve, or just a partial stab wound. This could mimic penetrative like wounds in humans and the effects that these types of wounds have on the tissue since much of this analysis would be too invasive to do in humans. With these models, tissue slides and stains could be prepared to fully understand how the tissue behaves. The muscles could also be harvested and the atrophy of the muscle could be investigated and compared to typical crush models.
- This model could also be used to potentially test new treatments for encouraging nerve regeneration. This could include drugs for improving regeneration, nerve grafts, nerve transfers, and nerve conduits (as discussed in lectures). This would be effective for any treatment in pre-clinical trials in the animal model stages.
- Additionally, if this model is successful, it could be expanded to the central nervous system (CNS). The stab wound method could be used to investigate spinal cord injuries as well as various brain injuries. Tissue regeneration could be investigated in these cases as well.

References

[1] I. P. W. G. K. S. D. E. K. S. S. B. H. E. J. B. J. F. &. K. F. Emad Moeendarbary, "The soft mechanical signature of glial scars in the central nervous system," *Nature Communications,* vol. 8, 2017.