

## See notes from the GM team below the outline!

Article Subject: Scaffolding spinal cord injury for repair

### Intro: “Macro” background on spinal cord injury (SCI)

- Incidence of spinal cord injury
  - Lee, B., Cripps, R., Fitzharris, M. et al. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord* 52, 110–116 (2014). <https://doi.org/10.1038/sc.2012.158>
  - Significant variation of SCI by geographic region
    - Furlan, J., Sakakibara, B., Miller, W., & Krassioukov, A. (2013). Global Incidence and Prevalence of Traumatic Spinal Cord Injury. *Canadian Journal of Neurological Sciences / Journal Canadien Des Sciences Neurologiques*, 40(4), 456-464. doi:10.1017/S0317167100014530
- Current treatments and outcomes
- Brief intro to regenerative medicine
- Topic sentence: Using a combination of biomaterial scaffolds, researchers are studying the central nervous system's regenerative capabilities, which could lead to improved functioning and quality of life after injuries in the future.

### Biology background on SCI

- Composition of spinal cord - introduction to the basic components of the spinal cord and what its function is in the nervous system
- Pathophysiology of SCI
  - Yilmaz T, Turan Y, Keles A. Pathophysiology of the spinal cord injury. *Journal of Clinical and Experimental Investigations*. 2014;5(1):131-136. doi: 10.5799/ahinjs.01.2014.01.0378.

### Biomaterial scaffolds

- Basic types of scaffolds
  - Khaing ZZ, Schmidt CE. Advances in natural biomaterials for nerve tissue repair. *Neuroscience Letters*. 2012;519:103-114. doi: 10.1016/j.neulet.2012.02.027.
  - Teng YD, Lavik EB, Qu X, et al. Functional recovery following traumatic spinal cord injury mediated by a unique polymer scaffold seeded with neural stem cells. *Proceedings of the National Academy of Sciences*. 2002;99(5):3024-3029. doi:10.1073/pnas.052678899.
- Theory of why scaffolds should work
- Why they still need work
  - Khaing ZZ, Ehansipour A, Hofstetter CP, Seidlits SK. Injectable Hydrogels for Spinal Cord Repair: A Focus on Swelling and Intraspinal Pressure. *Cells Tissues Organs*. 2015;202:67-84. doi: 10.1159/000446697.
- Which ones work well (so far)?
  - Combined approach—complex issue needs complex solution

### Materials with promising results

- Biomaterial scaffolds with stem cells have been shown to help axon regrowth
  - Shrestha, B., Coykendall, K., Li, Y. et al. Repair of injured spinal cord using biomaterial scaffolds and stem cells. Stem Cell Res Ther 5, 91 (2014).  
<https://doi.org/10.1186/scrt480>
- *Antheraea pernyi* silk is one possible biomaterial with promising results
  - Varone, A., Knight, D., Lesage, S. et al. The potential of *Antheraea pernyi* silk for spinal cord repair. Sci Rep 7, 13790 (2017).  
<https://doi.org/10.1038/s41598-017-14280-5>
  - Results in minimal immune response
  - Does not lead to microglia reaction, meaning there is no inflammation during spinal cord repair
- Injecting biomaterials into mice in vivo
  - O'Shea, T.M., Wollenberg, A.L., Kim, J.H. et al. Foreign body responses in mouse central nervous system mimic natural wound responses and alter biomaterial functions. Nat Commun 11, 6203 (2020).  
<https://doi.org/10.1038/s41467-020-19906-3>
  - Identifies properties of biomaterials associated with healing.
    - Describe stakes of the article - why is it significant?

### Conclusion: Where is the research going?

- Summary of where the research is right now
- What researchers need to move into clinical trials
- Ethical concerns
- What increased functional recovery could mean for individuals and American healthcare systems—why we need to continue research on this issue

### **Notes from the GM Team:**

What we like about this outline:

- The author has clearly outlined the different sections of their article – this doesn't mean that the author cannot change the sections later in the writing process, but it's helpful to have a solid idea of the scope of the article from the start
- There are at least 5-7 peer reviewed sources (the more, the better!)
- The sources are all fairly recent – since neuroscience is such a rapidly evolving field, it is best to stick to sources from the past 10 years or so, although exceptions can be made for foundational papers, etc.
- All sources are from journals that pass the GM benchmark for impact factor (minimum impact factor of 2, but higher is better!). To find a journal's impact factor, simply google "'journal name' impact factor".
- The author made sure to check the "GM past topics list" on the resources page of the website to ensure no one had written about their topic recently.

What could be improved about this outline:

- The author could list the specific next steps and ethical concerns in the conclusion that they want to talk about (the more detail, the better)
- The author could provide an overview of their existing knowledge and/or include sources regarding current treatment and regenerative medicine in the introduction (the more detail, the better)