Executive Summary

Tissue Engineering Scaffolds

Summary

The project below is a fictional executive summary for Stryker, an innovative science and technology research company. I aimed to provide the Stryker science department with a grant request directed to the company board.

For this reason, I highlighted the information from "A Comparative Study of Oxygen Diffusion in Tissue Engineering Scaffolds" by Fielder et al. intending to promote the science department's belief that further work on Fielder et al.'s research on tissue engineering scaffolds could benefit the company in the future. [1]

Intended Audience

Client:	Stryker Board of Directors
Recipient:	Emily Ferris – Carnegie Mellon University Professional & Technical Writing Course Instructor

Completed Tasks

- Analyzed the provided text by Fielder, et. al.
- Assessed project information
- Created an outline illustrating topic points and vital information
- Drafted the Executive Summary
- Proofread with peers
- Turned in final project

Developed Skills

- Research
- Critical Thinking
- Writing Communication
- Proposal Writing
- Proofreading and Editorial Skills
- Expository Writing
- Technical Research
- Content Adaptation

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Amid significant studies on improved bio-compatibility material enhancements, ideas concerning tissue engineering scaffolds comprised of “third-generation biomaterials” (TGB) are now more vital than ever in the discipline of regenerative medicine. Based on a study of oxygen diffusion by Fielder, et. al. TGB may support tissue engineering scaffolds in regenerative medicine research. Scientists know that oxygen and nutrient transportation, including waste removal, are essential for new tissue growth and sustained function. However, scaffolds illustrate a solid phase or low pore count that act as diffusion barriers and inhibit oxygen diffusion.[1] Sustained tissue growth fails if oxygen is unable to pass through scaffold pores, which results in tissue failure and necrosis.

According to researchers, biomaterial scaffolds are in development, with a variety of scaffold designs offering tissue regeneration research distinct levels of oxygen diffusion. Fielder, et al. continued research on scaffold design and focused on three potential scaffolds– foam replication (FR), robocasting (RC), and sol-gel foaming (SGF). The three materials were analyzed to determine the best materials and practices for oxygen diffusion in tissue regeneration. Based on Fielder, et al., we propose that additional research at Stryker’s science division would help finalize necessary information on regenerative medicine scaffolds.

Regenerative medicine scaffolds are porous, allowing oxygen to rejuvenate new tissue as healing progresses. Furthermore, these scaffolds provide surface area support for growing tissue. Fielder et al. address the effects of scaffold design; particularly on porosity/oxygen diffusion and scaffold strength. Therefore, Fielder et al. determined the efficiency of diffusivity in the three scaffold designs using the Lattice Monte Carlo (LCM) analysis.

For researchers, LCM is an algorithm that simulates mass and thermal diffusion in both composite materials and cell structures resembling scaffold tissue. As porosity and architecture vary by the scaffold, LCM helps calculate percentages for “solid” tissue diffusivity. Thus, Fielder et al. focused on regenerative tissue porosity and illustrated scaffold strength malfunctions that further research and product development could improve.

[1] Solid phase – Newly formed tissue obstructing the pores of the structure.

After Fielder, et al. analyzed the three tissue scaffolds (FR, RC, and SGF), results varied in diffusion simulation. They concluded that FR scaffolds reached 82.9% in diffusivity due to scaffold porosity and pore connection.[1] They also determined FR had the weakest structure strength due to a high number of pores.[2] Furthermore, RC scaffolds structural strength was promising but yielded a low normalized diffusivity due to low porosity.[3] Fielder et al. also concluded that the SGF porosity normalized at a 75.6% diffusivity rate but produced a moderate structural strength of 2.4 MPa.

Therefore, Fielder et al. proposed that future research should focus on scaffold structure degradation as regeneration occurs. Furthermore, they claim that further research should focus on tissue regeneration over time to assess oxygen diffusion effects and structural strength throughout the process. Fielder et al. concluded that high porosity (FR model) was beneficial for diffusion improvement. However, they caution that many factors influence the overall success of tissue scaffolds. Thus, further development of models such as the FR model could explain the importance of scaffold degradation kinetics in oxygen diffusion and tissue regrowth diffusivity.

That is why we, the science division at Stryker, believe that the Fielder et al. findings merit additional research. We thereby request $5,000 to develop research for the best scaffold design in high porosity and strength. We believe that this research would make Stryker the forefront leading company in regenerative medicine research and product development for tissue scaffolds in the medical industry.

1 FR Porosity ranged at 89.7% and 91.2%.

2 FR showed an approx. 0.3 MPa (Mega-pascal Pressure Unit).

3 RC structural strength reached 6.0 MPa, but the lowest porosity at 41.7-46.7%.

[1]Fiedler, T., Belova, I. V., Murch, G. E., Poologasundarampillai, G., Jones, J. R., Roether, J. A., & Boccaccini, A. R. (2014, July 14). A comparative study of oxygen diffusion in tissue engineering scaffolds. Retrieved September 15, 2018, from https://link.springer.com/article/10.1007/s10856-014-5264-7