

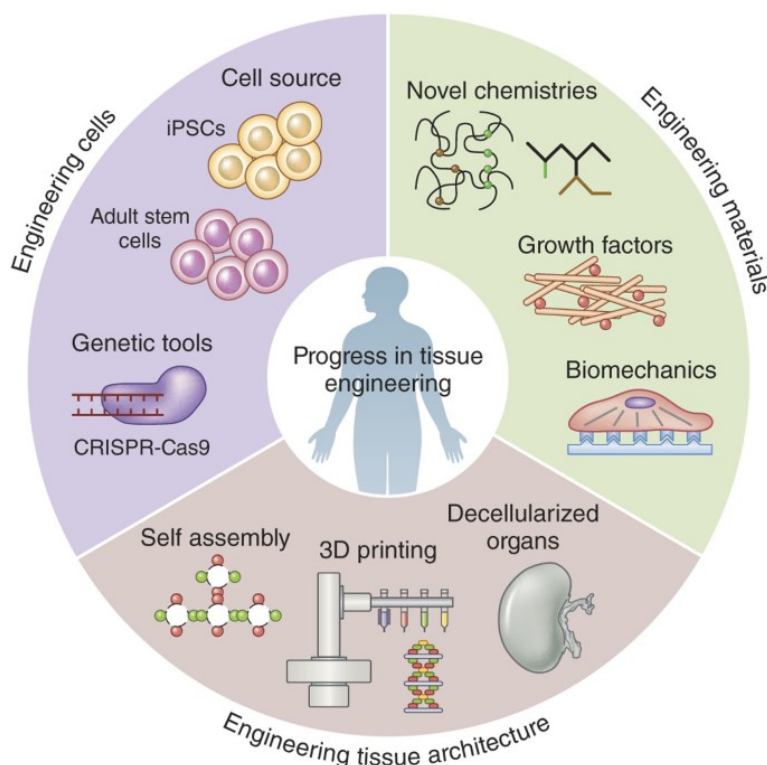
Oxygen and the Biocompatibility of Scaffolds in Tissue Engineering

by Justin Croft

Introduction

Scaffolds are support structures used in tissue engineering that are designed to assist cellular growth and proliferation of certain cells upon implantation onto a specific tissue. A fundamental property of scaffolds is their biocompatibility. In its most general sense, biocompatibility may be characterized as the ability of a biomaterial to perform its desired function with respect to a medical therapy, without eliciting any undesirable local or systemic effects in the recipient or beneficiary of the therapy. As such, these biomaterials are most often developed *in vitro* first and then fully fleshed out within animal models.

As biocompatibility is important, researchers do attempt to make their cellular models and scaffolds work as close to what would be seen in the *in vivo* condition. As oxygen is one of the most important molecules for sustaining life, it is understood that it is also an important variable to consider in tissue engineering and regenerative medicine. It has been shown that the change in oxygen concentration in an artificial or tissue-engineered graft affects cell survival, differentiation, and tissue growth in profound ways. As researchers continue to need to control and identify oxygen levels within scaffolds, Oxford Optronix is in a unique position to help these researchers on both ends of this spectrum.



From "A decade of progress in tissue engineering" by [Khademhosseini & Langer \(2016\)](#).

The image is a summary of the 3 primary tissue engineering areas, namely engineering cells (stem cells and genetic tools), engineering materials (growth factors, chemistries, and biomechanics), and the available tissue architectures (self-assemblies, 3D printing, and decellularized scaffolds).

***In vitro* scaffold research and Oxford Optronix**

For *in vitro* studies, cells grow around and within scaffolds and are heavily dependent on the external and internal oxygen environment. Here, researchers can test scaffolds in media within hypoxia chambers (such as the [Hypoxylab](#)) or within bioreactors that control the flow of physoxic media over a scaffold. Within these closed systems researchers can measure the pO_2 both within their media and their scaffolds, using the small [OxyLite](#) oxygen sensor.

References

Below are some recent publications in this area.

Maury *et. al.* 2021

[Rapid Evaluation of Novel Therapeutic Strategies Using a 3D Collagen-Based Tissue-Like Model](#)

*Used to **Hypoxylab** to set O_2 levels of the 3D to cell collagen-based models. Then used the **OxyLite** monitor to measure the collagen models pO_2 levels in real time.*

Niu *et. al.* 2020

[High Oxygen Preservation Hydrogels to Augment Cell Survival under Hypoxic Conditions](#)

*Oxygen tension in the hydrogels with or without MSC encapsulation was measured using an **OxyLite** fibre-optic oxygen micro-sensor.*

Lee *et. al.* 2017

[Developing a Customized Perfusion Bioreactor Prototype with Controlled Positional Variability in Oxygen Partial Pressure for Bone and Cartilage Tissue Engineering](#)

*Used the **OxyLite** sensors to take pO_2 readings across the tissue cultivation platform within a closed bioreactor.*

Nyga *et. al.* 2013

[A Novel Tissue Engineered Three-Dimensional *in vitro* Colorectal Cancer Model](#)

*Oxygen levels were measured in 3-D constructs comprising the artificial cancer mass using the **OxyLite** tissue oxygenation monitoring system.*