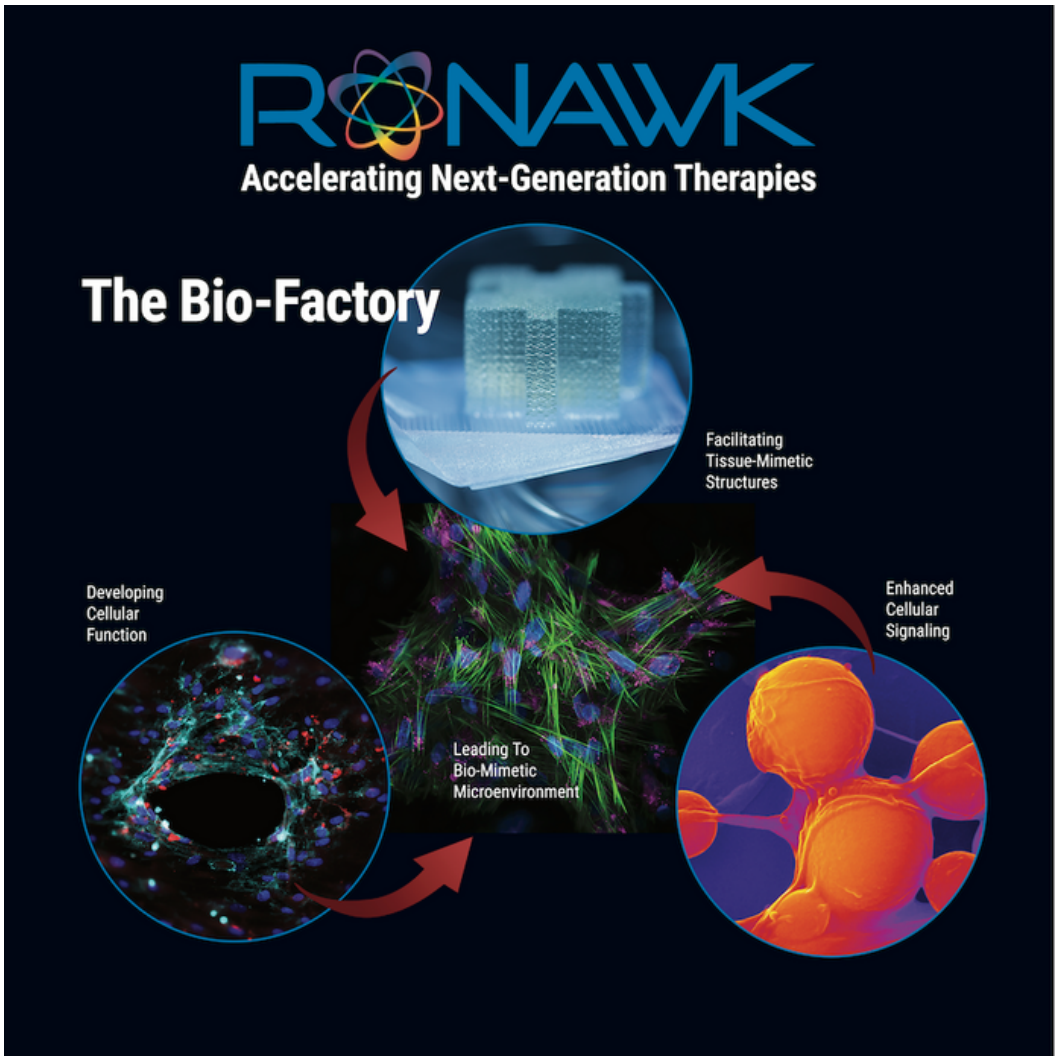
Ronawk, Inc.

Bio-Blocks™:
THE Bio-Factory For Generating Bio-Mimetic Microenvironments



Introduction

When it comes to the culturing of tissue or cells, the traditional "one-size-fits-all" approach using flat and rigid surfaces can limit the growth and development of cells. This is where Tissue-Mimetic Technologies(™) (TMT) come into play. These technologies use substrates or devices that can simulate or induce the properties found in natural tissue, allowing cells to behave more natively.

The newest of such technology is Ronawk's Bio-Blocks™, a new class of Bio-Factory developed using TMTs. Bio-Blocks are tissue-mimetic porous hydrogels that are shaped like jigsaw puzzle piece cubes and contain a series of microchannels running through them. These microchannels enable cells to create their own bio-mimetic microenvironments and regulate themselves naturally, leading to the formation of actual tissue.

But what does "tissue-mimetic" actually mean?

Essentially, it refers to a substrate or device that can simulate or induce the properties found in natural tissue. For example, different tissues have different stiffness and elastic properties based on their function, which can be mimicked in the Bio-Blocks. Additionally, the extracellular matrix composition can aid in influencing the formation of specific tissue types when the appropriate cell types are applied.

Background

For decades, researchers have been using traditional cell and tissue culture methods that involve growing cells on flat and rigid surfaces. However, this approach has limitations, as cells actively respond to their environment and require certain conditions to properly organize and secrete structural proteins needed for mature tissue formation. Unfortunately, cells grown in non-native environments have a limited shelf-life and do not adequately represent the cells or tissues found within the body.

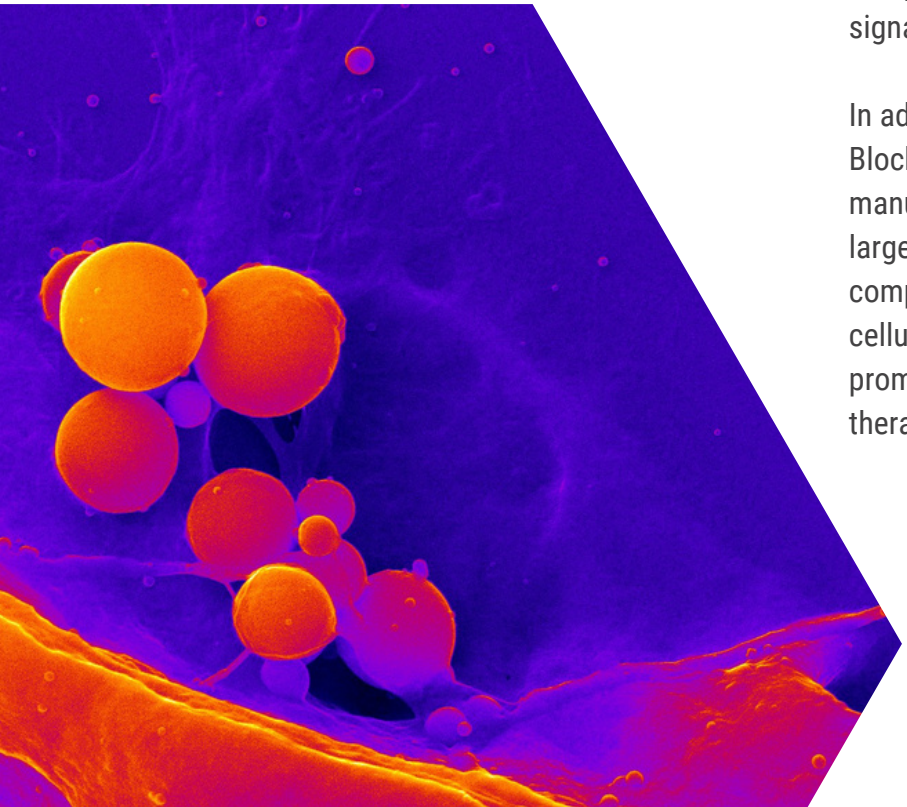
Fortunately, tissue engineers have been working on these challenges for decades and have uncovered some fascinating insights into how cells behave within tissues. The stiffness and elastic properties of a tissue support basic function, while the chemical and biological makeup of tissue contributes to how cells respond during homeostasis or in response to an injury.

This is where TMTs come into play. The physical, mechanical, chemical, and biological properties of tissue-mimetic substrates, like Bio-Blocks, can be modulated to mimic specific tissue environments. These technologies enable cells to behave more natively and can lead to the development of better models for treating diseases, cancers, and injuries.

Bio-Blocks: The Bio-Factory for Generating Bio-Mimetic Microenvironments

Bio-Blocks™ are great vehicles for enabling cells to produce mature microtissues and for introducing novel stimuli to observe how cellular functions change and develop. The microchannels within Bio-Blocks allow for continuous and uninterrupted cell growth, which means that primary cells retain their native characteristics longer and are less likely to senesce or stop dividing. This is in contrast to traditional cell and tissue culture methods where cells must be detached, diluted, and replated to continue propagation.

Additionally, Bio-Blocks can be easily modified to mimic the physical, mechanical, and chemical properties of virtually any tissue by adjusting the formulation of the hydrogel.



For example, the elastic modulus of the hydrogel can be adjusted up or down to mimic virtually any tissue in the body. The topography of the Bio-Block can also be adjusted by coating it with different extracellular matrix proteins, which can influence the formation of specific tissue types when the appropriate cell types are applied.

Bio-Blocks allow researchers to observe tissue formation directly by visualizing cell and extracellular matrix organization, structure, and arrangement in a 3D space.

The Bio-Blocks have also been developed to be processed like tissue, meaning they can be chemically fixed, embedded in paraffin or cryomedia, sectioned, and stained or immunolabeled for characterizing tissue composition. This makes Bio-Blocks great for studying developing tissues and examining the signals communicated between cells.

In addition to their research applications, Bio-Blocks have the potential for use in manufacturing. They can be used to generate large quantities of biologically active compounds, which can include tissues, cells, or cellular secretions. This makes Bio-Blocks a promising tool for the development of novel therapies, diagnostics, and prognostics.

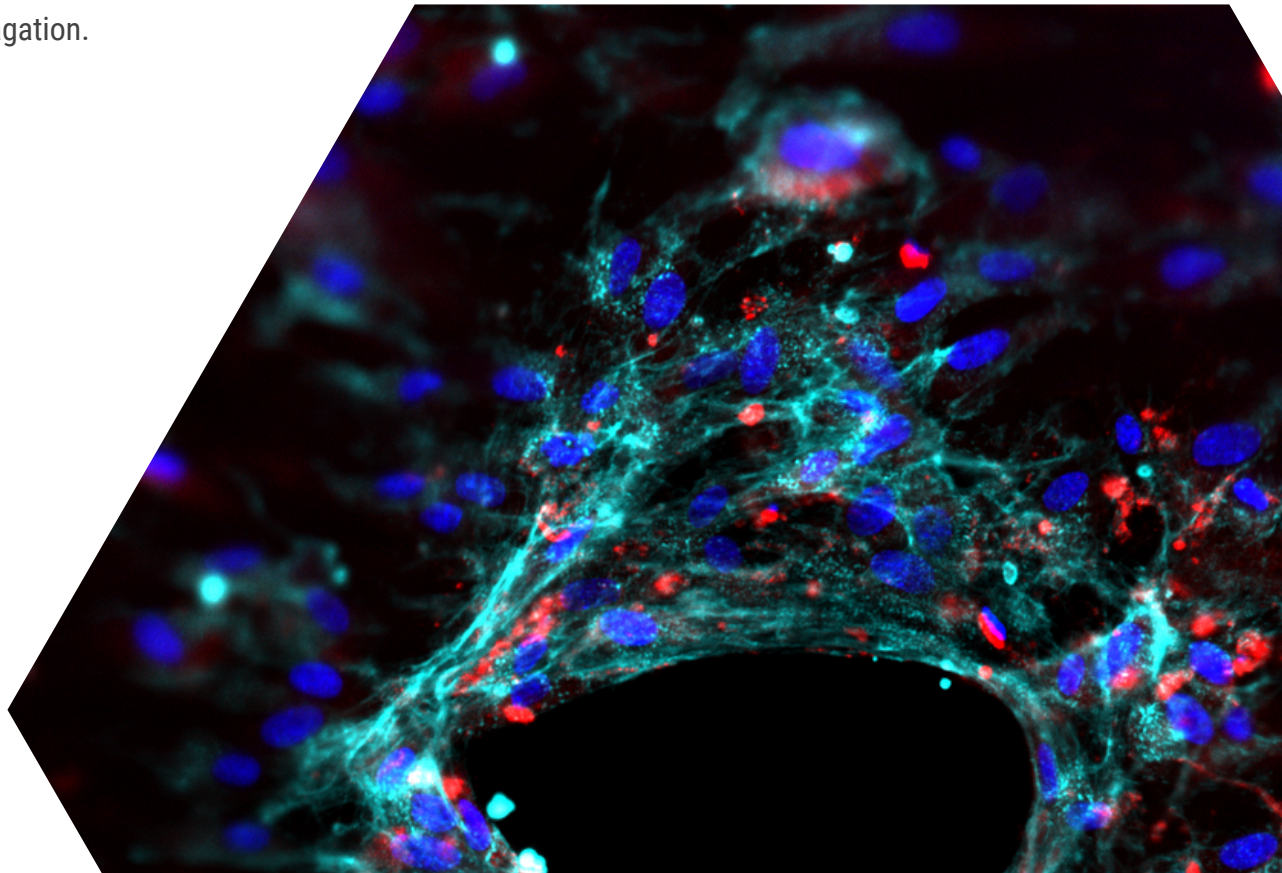
Structure of Bio-Blocks

Bio-Blocks™ are shaped like jigsaw puzzle piece cubes. They are made to create different hydrogel formulations, which can be modified to mimic the physical, mechanical, chemical, and biological properties of virtually any tissue. The Bio-Blocks hold large quantities of water while maintaining a physical structure.

Bio-Blocks contain a series of microchannels that run through the Bio-Block and create a sophisticated network. The microchannels are spaced such that nutrients and biologics can diffuse freely between microchannels, which allows for mature tissues to form within the microchannels. The Bio-Blocks are designed such that when one Bio-Block is connected to a second Bio-Block, the microchannels between the two Bio-Blocks align, creating a larger network of tunnels between the two Bio-Blocks. This allows cells to continue to proliferate and migrate uninterrupted, unlike traditional cell culture where cells must be subcultured to continue propagation.

Cells form sophisticated 3D structures that become microtissues within the Bio-Blocks. The microchannels do not inhibit mass transport, and the microchannels are large enough so mass transport is uninhibited. This is in contrast to traditional cell culture methods where cells are grown on flat and rigid surfaces that do not resemble native tissues and do not allow cells to form proper tissues.

The Bio-Blocks themselves are tissue-mimetic structures that enable cells to form their own organized structures within the microchannels, which contributes to the development of bio-mimetic microenvironments within the microchannels.



The Bio-Blocks allow researchers to observe tissue formation directly by visualizing cell and extracellular matrix organization, structure, and arrangement in a 3D space. Additionally, the Bio-Blocks have been developed to be processed like native tissue, for histological and immunological characterization.

Function of Bio-Blocks

Bio-Blocks™ are great for generating mature microtissues where different stimuli can be applied to alter functional outcomes. Different doses of chemical agents can be added to induce changes or injuries in cells within mature microtissues. The behavior of the cells can be observed in real-time while in the Bio-Block. Cells can also be co-cultured in Bio-Blocks to generate sophisticated bio-mimetic microenvironments. One cell type can be cultured in one Bio-Block and a different cell type can be cultured in a different Bio-Block. When a researcher wants to see how the cells interact and behave when co-cultured, the two Bio-Blocks can simply be joined together.

The generation of the bio-mimetic microenvironment within the microchannels provides end-users an opportunity to study developing cellular functions. This is because cells form their own bio-mimetic microenvironments within the microchannels of the Bio-Blocks, which can be influenced by a variety of parameters and leveraged for different applications as well as manufacturing purposes. The Bio-Blocks allow researchers to examine tissue anatomy directly by visualizing cell and extracellular matrix organization, structure, and arrangement in a 3D space.

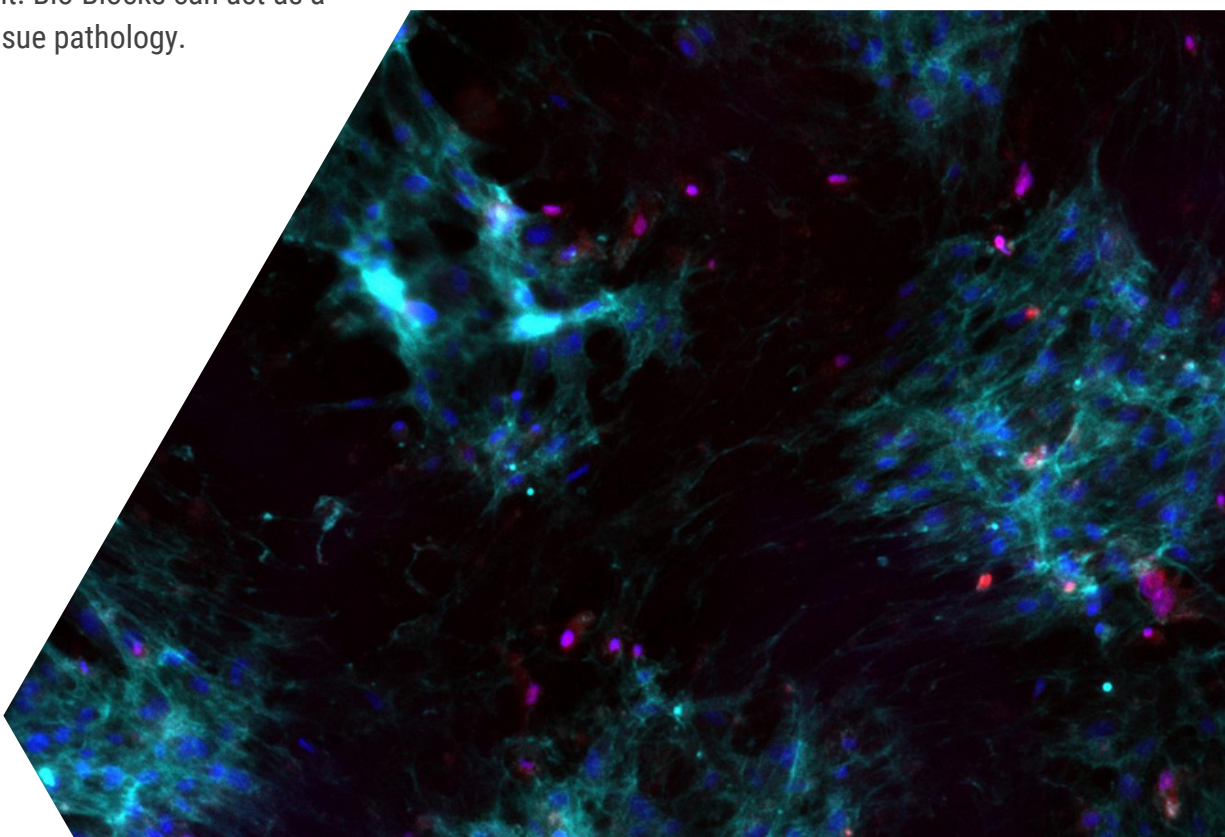
The Bio-Blocks can also be gently degraded to isolated individual cells for cell sorting, genomic analysis, or proteome analysis. This allows researchers to examine the behavior of cells at a cell-to-cell level and understand tissue physiology.

Signaling in Bio-Blocks

One of the unique features of Bio-Blocks™ is that they offer an easy way to examine the signals communicated between cells cultured within the microchannels. Due to the structural nature of the channels, cellular secretions that localize to the luminal space of the microchannel can easily be collected, filtered, isolated, and quantified by collecting the media from each microchannel separately or in bulk. Cellular secretions that localize into the hydrogel pores between microchannels can also be identified through immunolabeling and visually observed if the Bio-Block is fixed, embedded, and sectioned.

The output of the cells can be influenced by changing the stimuli applied to cells within the Bio-Blocks to change the secretory fraction of cellular components, which makes Bio-Blocks highly useful for diagnostic and prognostic purposes. For example, cells from a tumor or cells treated with a therapeutic agent may emit different signals that can be collected from the Bio-Blocks to analyze the progression of a disease or treatment. Bio-Blocks can act as a tool for studying tissue pathology.

Furthermore, Bio-Blocks enable researchers to examine the behaviors between cells at a cell-to-cell level to understand tissue physiology. Different doses of chemical agents can be added to induce changes or injuries in cells within mature microtissues, and the behavior of the cells can be observed in real-time while in the Bio-Block. Cells can also be co-cultured in Bio-Blocks to generate sophisticated bio-mimetic microenvironments, which can provide helpful insights into the behaviors between cells.



Conclusion

Tissue engineering has come a long way over the past few decades, and the development of TMTs has allowed for a more sophisticated approach to cultivating cells in vitro. Bio-Blocks, the Bio-Factory for generating bio-mimetic microenvironments, is an innovative solution that enables researchers to create sophisticated structures that become microtissues within the microchannels of the Bio-Blocks.

Bio-Blocks are tissue-mimetic porous hydrogels that are designed to allow cells to create their own bio-mimetic environments and regulate themselves naturally. The microchannels within the Bio-Blocks enable cells to interact in 3D and form their own bio-mimetic microenvironments, which leads to the formation of actual tissue. The shape and size of the microchannels can be adjusted to better mimic the architecture of target tissues, allowing for greater control over the formation of the bio-mimetic microenvironment.

The bio-mimetic microenvironment created by the Bio-Blocks is highly useful for studying developing cellular functions and understanding tissue pathology. The ability to examine the signals communicated between cells and collect cellular secretions makes Bio-Blocks highly useful for diagnostic and prognostic purposes.

In summary, Bio-Blocks are a revolutionary tool for tissue engineering research that enables the creation of bio-mimetic microenvironments that mimic the physical, mechanical, and chemical properties of virtually any tissue. The ability to grow cells in a more tissue-mimetic environment leads to better models for treating diseases, cancers, and injuries. Bio-Blocks offer researchers a way to examine the signals communicated between cells and study developing cellular functions, which can be highly useful for diagnostic and prognostic purposes. Overall, Bio-Blocks represent an exciting new technology in the field of tissue engineering and have the potential to revolutionize the way we think about growing cells in vitro.

Highlights

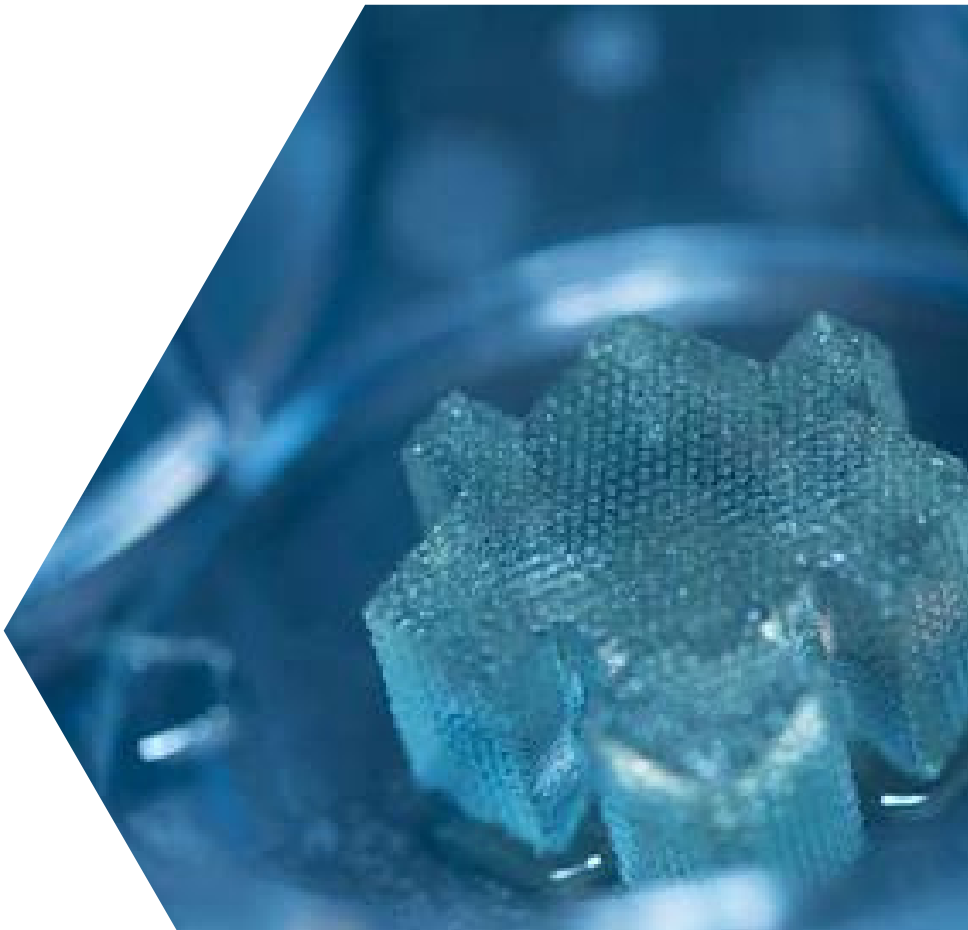
- Bio-Blocks™ are tissue-mimetic porous hydrogels that enable cells to create their own bio-mimetic microenvironments and regulate themselves naturally, leading to the formation of actual tissue.
- The microchannels within Bio-Blocks allow for continuous and uninterrupted cell growth, which means that primary cells retain their native characteristics longer and are less likely to senesce or stop dividing.
- Bio-Blocks can be easily modified to mimic the physical, mechanical, and chemical properties of virtually any tissue by adjusting the formulation of the hydrogel.
- Bio-Blocks offer an easy way to examine the signals communicated between cells cultured within the microchannels, making them a promising tool for diagnostic and prognostic purposes.
- Bio-Blocks are versatile tools for enabling cells to produce mature microtissues and for introducing novel stimuli to observe how cellular functions change and develop.

References

Ronawk, Inc. **Ronawk's Bio-Block Technology.** https://ronawk.com/our-technology/ (accessed February 23, 2023).

Jacob G Hodge, Jennifer L Robinson & Adam J Mellott. **Novel hydrogel system eliminates subculturing and improves retention of nonsenescent mesenchymal stem cell populations.** Regen Med. 2022 Oct;17(7):641-654. doi: 10.2217/rme-2022-0140. https://www.futuremedicine.com/doi/10.2217/rme-2022-0140

Jacob G. Hodge MS, Heather E. Decker BA, Jennifer L. Robinson Ph.D., Adam J. Mellott Ph.D. **Tissue-mimetic culture enhances mesenchymal stem cell secretome capacity to improve regenerative activity of keratinocytes and fibroblasts in vitro.** Wound Repair and Regeneration. 2023 March 3: Funding information: National Institute of General Medical Sciences, Grant/Award Number: R35GM143081 https://onlinelibrary.wiley.com/doi/10.1111/wrr.13076



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About Ronawk

Ronawk's Bio-Block Universe™ is the first expandable Bio-Factory designed to accelerate development of biotechnology applications, processes, and technologies. By leveraging advanced mimetic culture technology, Ronawk's Bio-Block Universe™ streamlines cell and tissue production, ultimately expediting research for next-generation therapies.

The Bio-Block Universe™ simplifies the once-tedious process of mimetic-culture workflows by minimizing labor, consumables, and space. Bio-Block™ technology employs biomimicry of soft tissues to optimize the growth of cells outside the body in a way that closely mirrors their natural growth within the body. This approach not only increases biological opportunities but also ensures cell viability, preservation of key characteristics, and secretion of therapeutic biologics. The process also lowers senescence and risks of contamination by removing subculturing from the process.

Ronawk's Bio-Block™ platform is customizable, offering consistent, repeatable, and scalable bio-mimetic microenvironment production that accelerates research and paves the way for innovative regenerative therapies. By harnessing the power of mimetic culture technology Ronawk is committed to transforming the field of biotechnology and advancing the development of life-changing treatments for patients in need.

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Schedule A Meeting

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