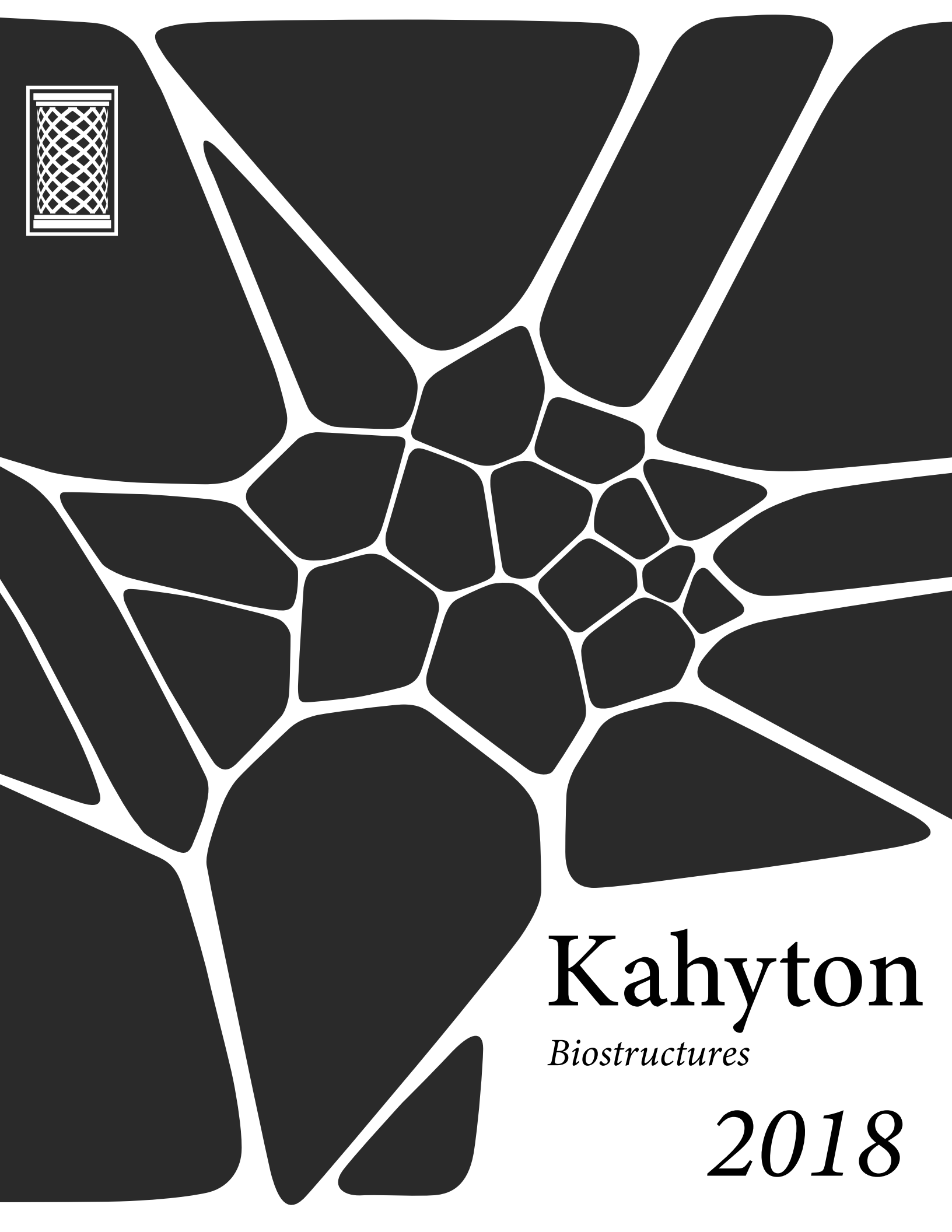


Kahyton

Biostructures

2018

Fellow Tech Enthusiasts,

We have been working on our newest model of Adaptive Braces for two years now and are proud and excited to finally introduce it to you. The purpose of this report is to introduce you to our newest take on a new generation of orthopedic exoskeletons. We believe that this design, which combines 3D printing and our second-generation biomorphic algorithm, will substantially improve the lives of patients and help doctors and therapists provide better care.

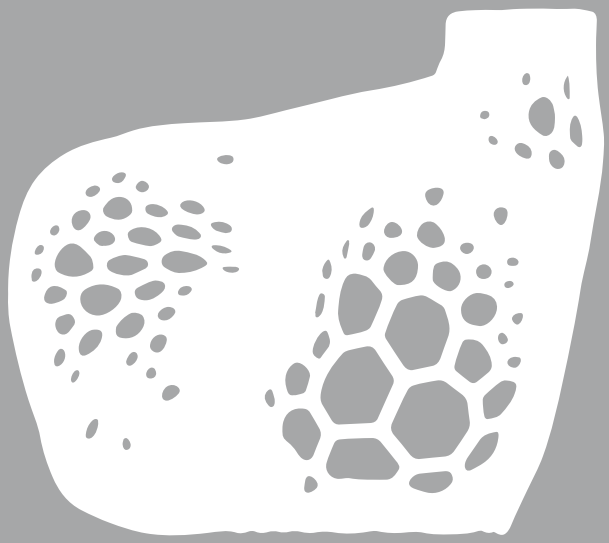
The first sketches of Adaptive Braces came about after I had surgery on my right thumb. The surgery was intensive and involved alterations to the joint. After the surgery, the doctors gave me conflicting instructions. I had to massage the joint as much as possible to break up debilitating scar tissue but had to keep the joint completely immobilized while it healed. I could not do both at the same time. To massage the joint, I had to remove the brace. I created my first prototype to solve this problem after my right hand healed in preparation for surgery on my left hand. After the surgery, my newly designed brace completely changed how I interacted with my injury. I know that Adaptive Braces work because the difference between my left and right thumbs could not be more noticeable. After healing, my right thumb joint is tight and inflexible because I had to choose between massage or stability. However, my left hand is just as flexible and healthy as before the surgery because I could constantly massage and care for the joint without having to destabilize it.

Adaptive Braces are a 3D printed exoskeleton that leverages a robust pattern found in nature called a Voronoi pattern. This pattern is a reoccurring motif throughout nature and can be seen in plant cells, dragonfly wings, leaf venation, and many other natural patterns. I chose the Voronoi pattern for my braces because it is strong and flexible while maximizing breathability and surface area. The Voronoi pattern has been optimized over billions of years of evolution and is surprisingly difficult to recreate.

To map the design onto 3D scans of hands, wrists, knees or elbows, we have developed a series of biomorphic algorithms that build off the Bowyer-Watson algorithm and Delaunay triangulation to create perfectly sized openings over any injury without compromising the stability of the brace. Here at Kahyton, we are very appreciative of all those who support us and we hope that this brochure helps explain some of the unique and useful features of our newest addition to the Kahyton family.

Sincerely,

David Kastner



Adaptive Braces

Nature is the ultimate innovator. Through billions of years of evolution, nature has found solutions to some of the most challenging problems. My invention, Adaptive Braces, is inspired by nature's solution to the stability-flexibility tradeoff.

Our research at Kahyton Biostructures has focused on understanding how nature solved the issue of structure. Structures need to be durable but adaptive, resiliant but flexible. These characteristics are inherently contradictive and difficult to balance. However, both properties are essential for a successful species or a successful invention.

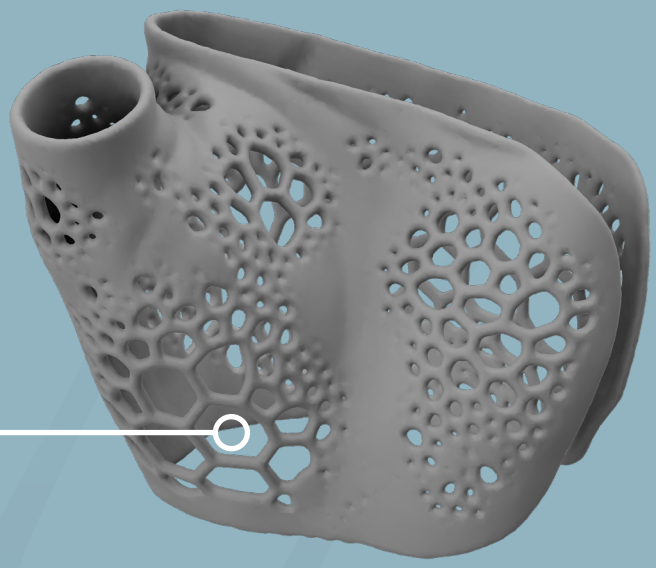
One of the ways that nature has solved the structure paradox is through organic motifs that balance forces and pressures throughout the entire structure.

The voronoi motif has been of particular interest to us because of its consistent reoccurance in nature across unrelated applications such as dragonfly wings, lizard scales, venation in leaves, and even bubbles.

Adaptive Braces take advantage of the adaptability, strength, and flexibilty of the voronoi structure to maximize comfort and durability in medical grade braces. *Adaptive Braces* are light weight, breathable, and can be used anywhere from the soccer field to the pool.

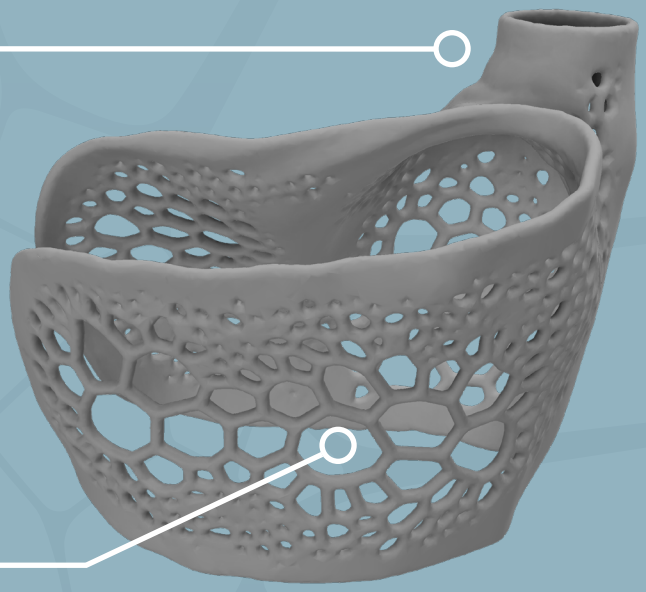
ADAPTIVE BRACES

Generation 2.0



Accesible

Each voronoi pattern has a unique design that accomodates the patient and their situation. Holes are placed over the site of injury to provide easy access during massage, light, or ultra sound therapy.

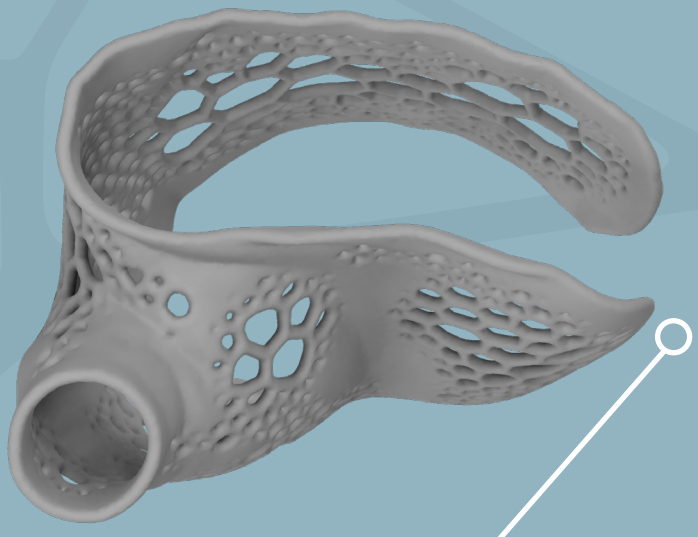


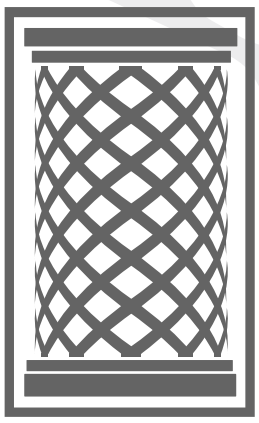
Durable

Areas that are under high stress are reinforced with additional material. The thumbs, palm, and edges are designed to distribute force evenly across the brace during high intensity activities and is perfect for athletes and excercise enthusiasts.

Breathable

The voronoi pattern makes our braces strong, flexible, lightweight, and breathable. All our products are designed with convenience in mind. The waterproof coating allows patients to shower with the protection of their brace.



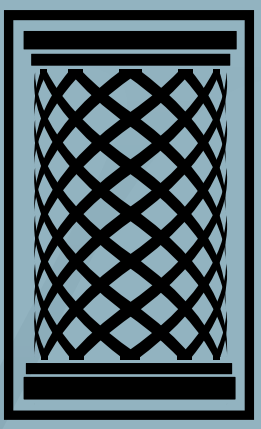


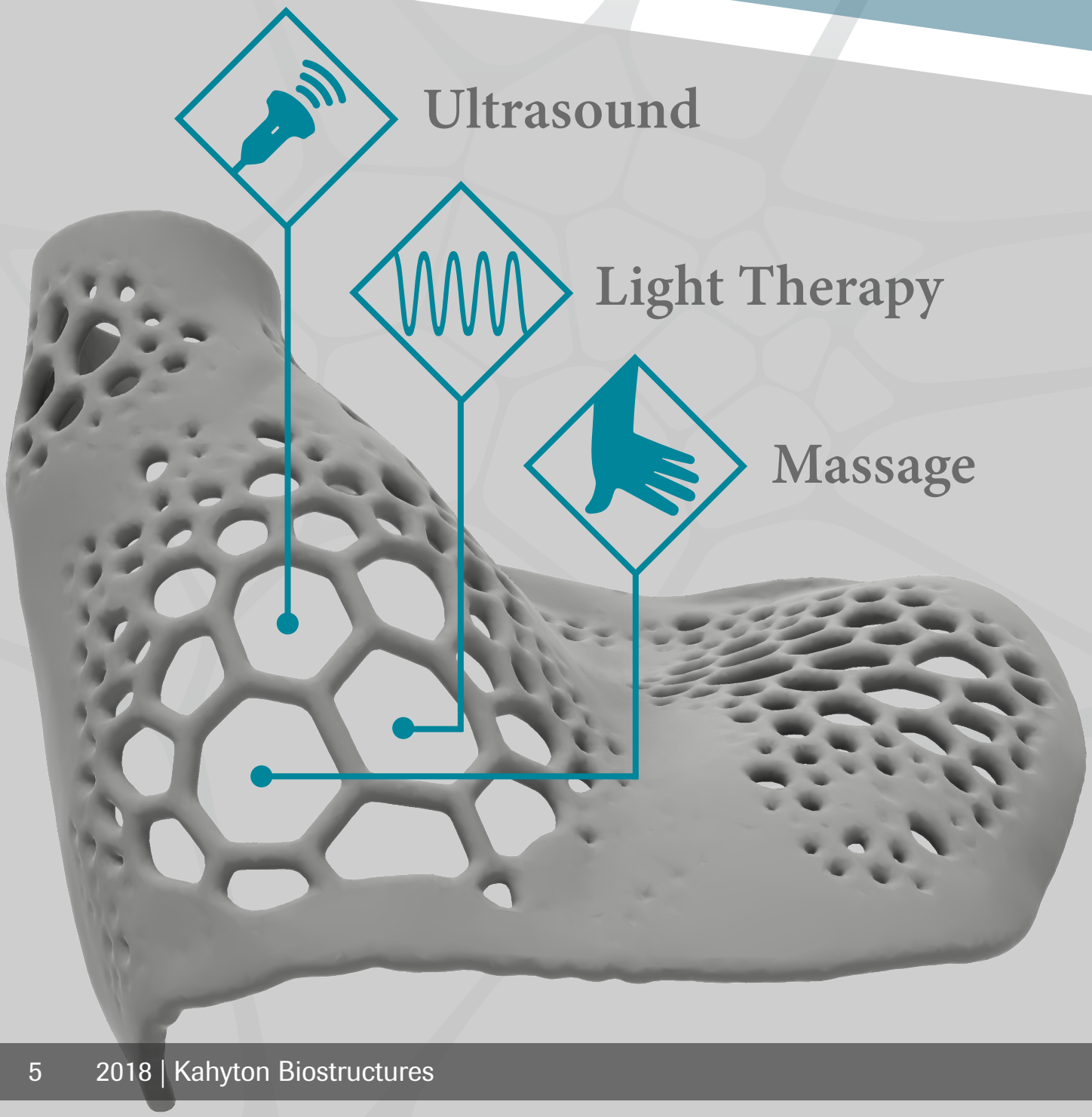
Strapless

A unique feature of our braces is that they are strapless. Each brace is custom made for the patient from a 3D scan and is a guarenteed perfect fit every time. Our braces also benefit from the flexiblity of PLA and are more comfortable than conventional braces.

Novel Medical Applications

Traditionally, braces provided support but prevented patients and health care providers from interacting directly with the injury. Our newest generation of braces will allow patients with conditions such as arthritis, tendonitis, fibromyalgia, and carpal tunnel to recieve treatments such as ultrasound therapy, light therapy, massage, and acupucture without having to remove their support.





“

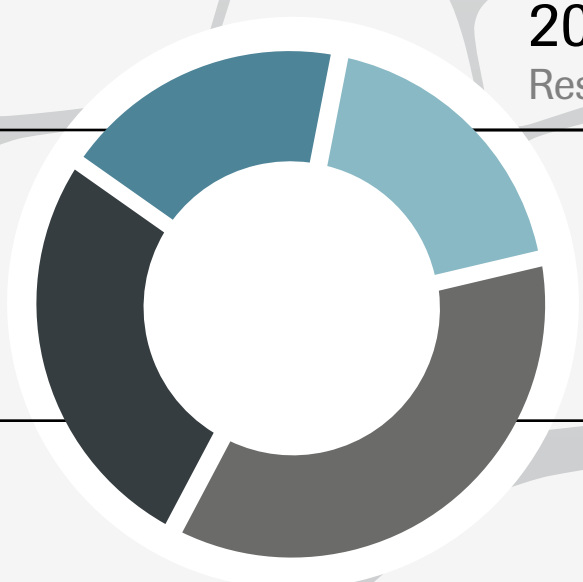
Putting evolution to work for you.

Complementary

Business Divisions

10%
Consulting

20%
Research and Development

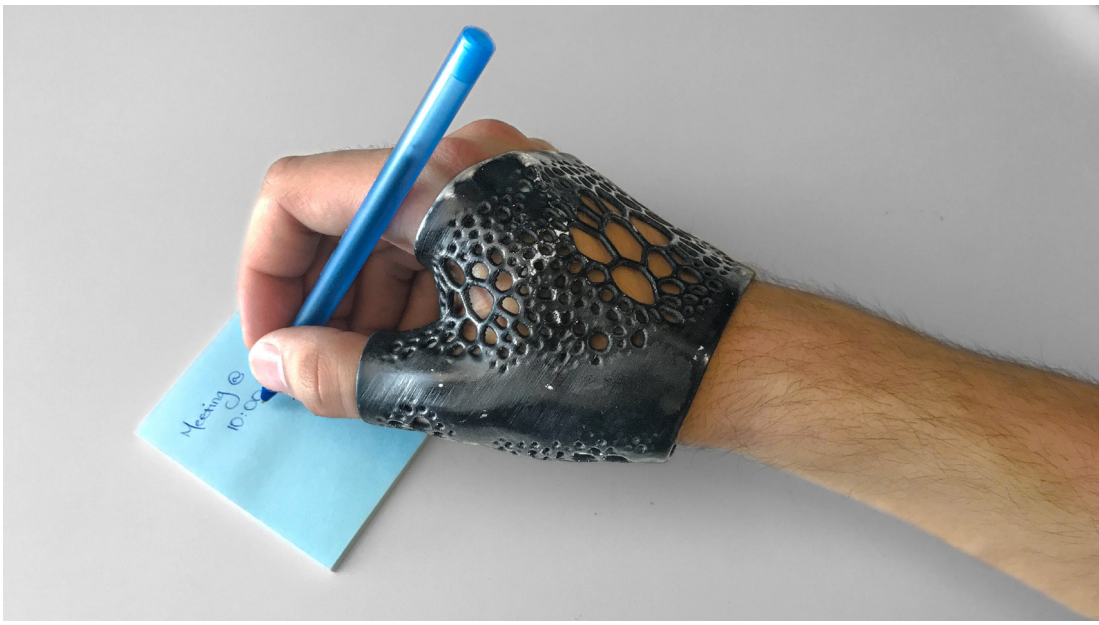


30%
Other Devices

40%
Adaptive Braces

Purpose

My goal for designing Adaptive Braces was to improve the lives of patients. This invention will introduce doctors to new 3D printing technology and complimenting physical therapy, and is reusability will help decrease healthcare expenses.



Complimenting Physical Therapy

Adaptive Braces are unique in that the openings created by the voronoi motif are strategically placed over injuries to increase accessibility during physical therapy. Adaptive Braces allow patients to continue their therapy even when they are in too much pain to remove their brace.

Reducing Costs

Traditionally, braces are made of non-durable fabrics and plasters that are only good for a few months. Adaptive Braces are 3D printed using durable polylactic acid and are waterproofed so that they can be washed and cleaned. Durablitity tests show that the braces can last for up to several years.

New Technology

Braces and casts have not changed since they were first introduced into hosp-itls. In designing my adaptive braces, I tried to use the newest technology and applied many of the principles of biomimetics that I have learned during my biophysics degree.

Science and Technology

At the heart of Adaptive Braces is a desire to better understand the world. Nature has already solved many of the most challenging problems and I believe that it is our job to uncover those solutions to help patients.

Biostructures

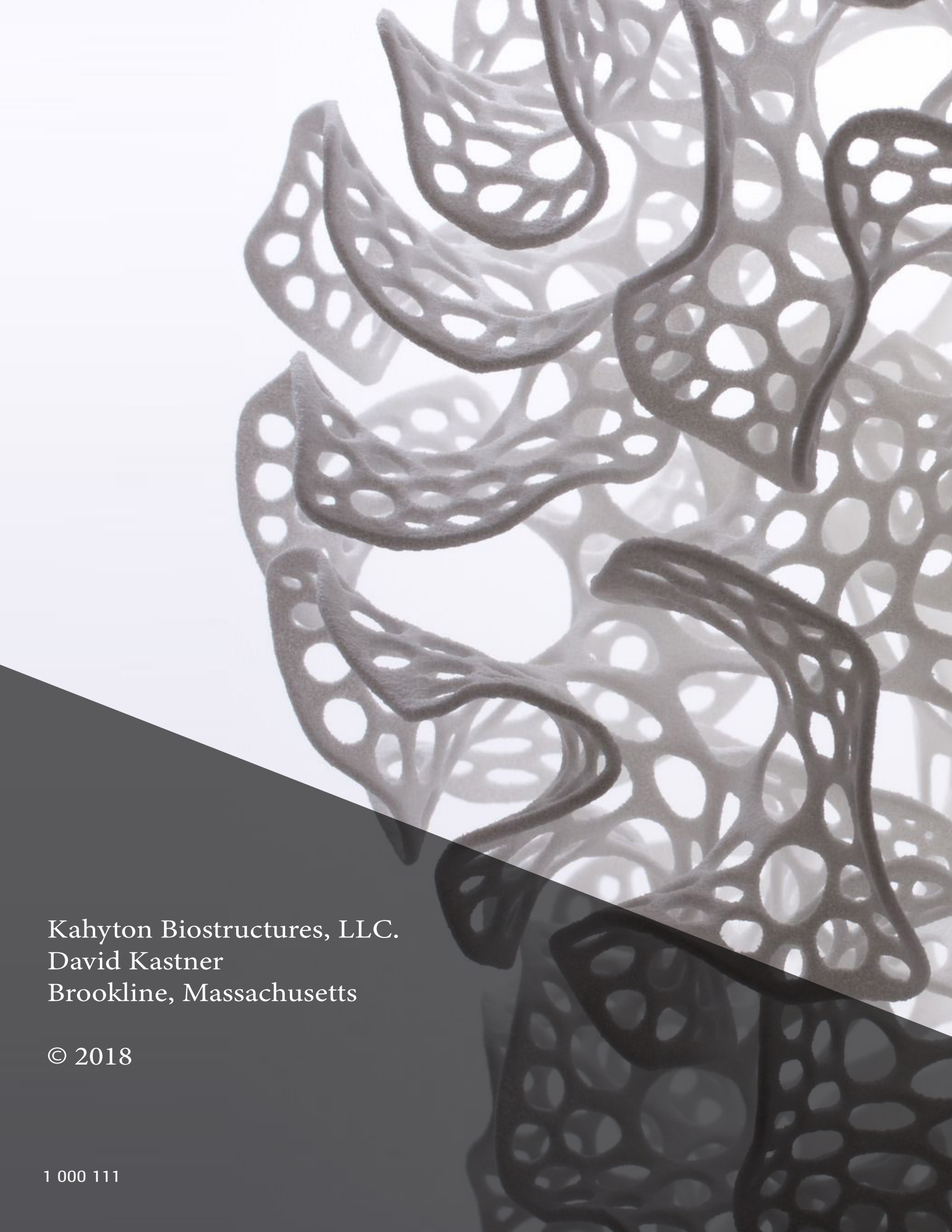
Anyone with a disability that requires the continual use of braces will tell you that braces are ugly. The beauty of the Voronoi pattern is that it is attrative, durable, and breathable. It was designed by nature billions of years ago and can be adapted to human exoskeletons to help patients.

3D Printing

Each Adaptive Brace is 3D printed using the latest in 3D printing technology and is printed using biodegradable polylactic acid (PLA). By using 3D printers, we are able to create personalized medical-grade braces. We strongly believe that it is time that we stop creating cookie-cutter medical devices because every individual is different.

Computational Approaches

The Voronoi motif used in Adaptive Braces are too complex to be designed by hand every time and therefore depend on computational solutions to maximize their effectiveness. Over the years, we have optimized two algorithms that can map organic patterns onto 3D scans of body parts using the Bowyer-Watson algorithm and the Delaunay triangulation methods.



Kahyton Biostructures, LLC.
David Kastner
Brookline, Massachusetts

1 000 111