



FINIS®

HYDROX™

NEXT GENERATION TECHNICAL RACING SUIT



POWERED BY

MEMORY flex™

TECHNOLOGY

BACKGROUND

The purpose of this document is to provide readers with an in-depth analysis and science behind our newest innovation in technical swimwear, the FINIS HydroX™ made with MemoryFlex™ tech fabric developed by FINIS, Inc. and associates. We worked with world-renowned professor [Redha Taiar](#), whose concentration in biomechanics and anatomy has helped us develop the next generation of great technical racing suits. Taiar Ph.D. accomplished this through a series of precise studies focused on the natural expansion and contraction of the muscles, the interaction between the muscles and fabric, and the interaction between the fabric and the water.

CONTENTS

- MUSCLE INTERACTION
- FABRIC SPECIFICATION
- INTERACTION BETWEEN WATER DROP & FABRIC
- MEMORYFLEX™ FABRIC



MUSCLE INTERACTION

When developing a technical racing suit, it is crucial that the athlete has optimal flexibility, compression, muscle contribution, stability, and rigidity. To accomplish this, we must first understand the principles of biomechanics as they relate to swimming and performance.

Biomechanics is defined as the application of engineering related to the movement of living organisms. As the body moves throughout the stroke cycle, various muscle groups work together allowing the swimmer to execute proper technique increasing efficiency. While each swim stroke uses different muscle groups to execute different techniques all swim strokes will develop the following muscle groups.

- **Core abdominal and lower back muscles** keep the body in a steady streamlined position reducing drag in the water.
- **Glutes and hamstring muscles** keep the body in a balanced position and aid in propulsion.
- **Deltoid and shoulder muscles** increase propulsion and help the hands have the proper entry.
- **Upper back muscles** stabilize the shoulders throughout the swimming strokes.

FIGURE I

Heat mapping images display the muscle contribution of the upper body after 100m of each stroke.

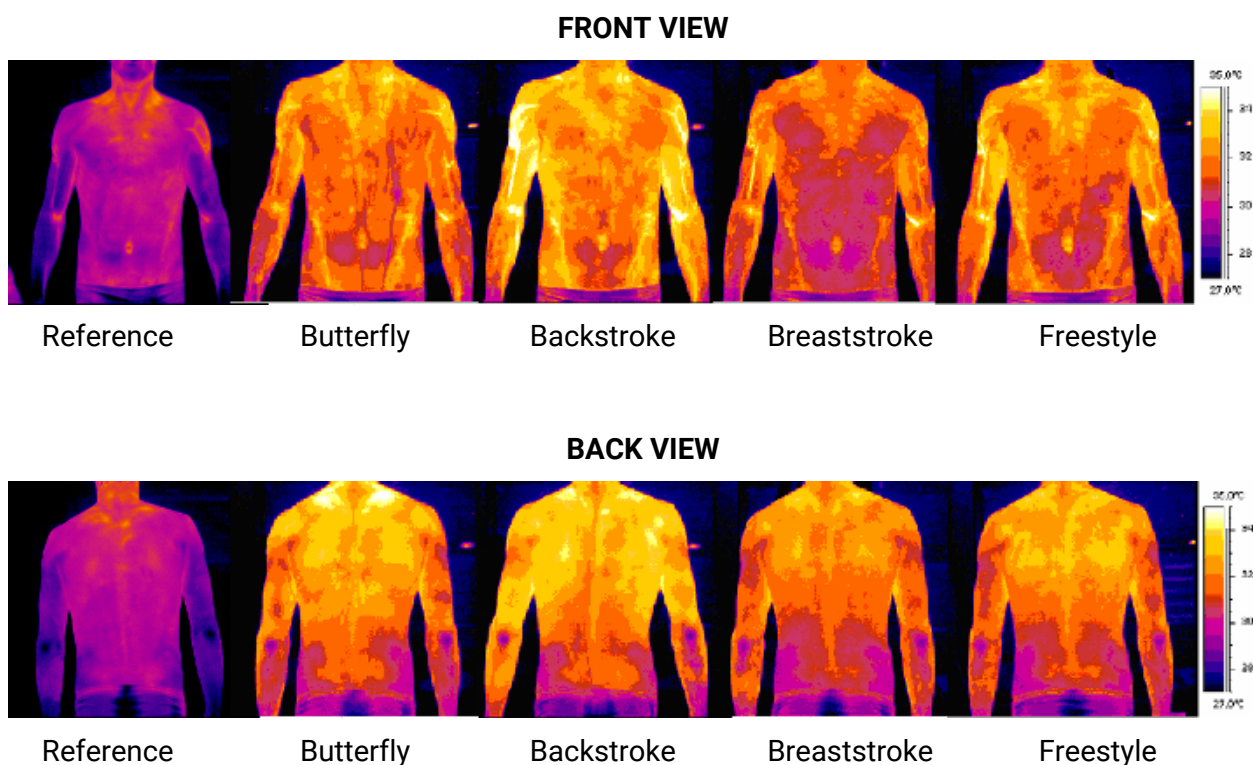
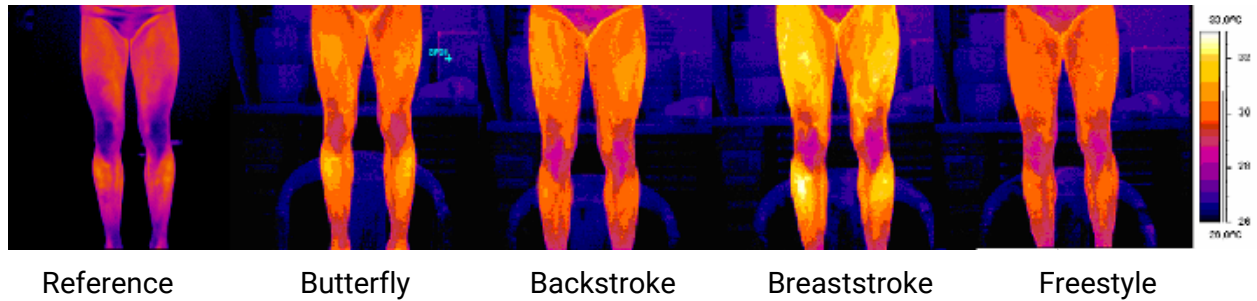


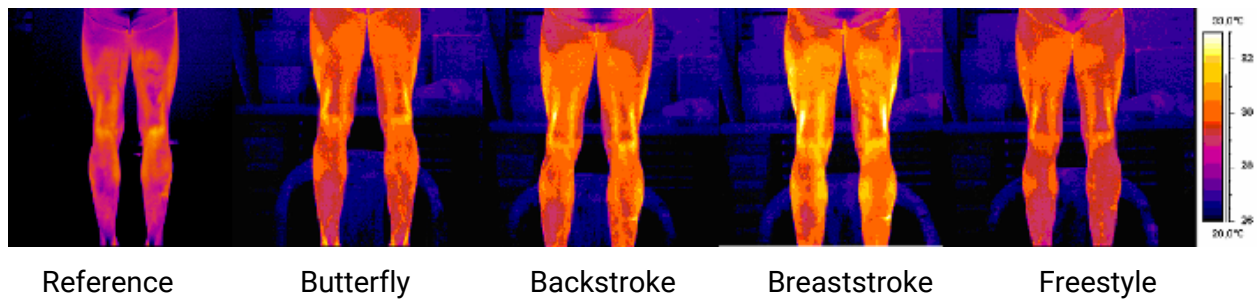
FIGURE II

Heat mapping images display the muscle contribution of the lower body after 100m of each stroke.

FRONT VIEW



BACK VIEW



Two of the most important factors related to biomechanics in swimming include posture and stability, which can be improved by developing the proper muscle groups.

The HydroX was developed to enhance the natural expansion and contraction of these muscle groups as covered by the suit. To accomplish this, we positioned the fabric in accordance with each muscle group maximizing the natural motion and allowing for superior performance.



FABRIC SPECIFICATION

The complex nature of fabric requires special attention when it comes to the material used in technical racing suits as it must provide support, enable flexibility, and contention. With careful consideration as to how the muscles behave, we've developed a proprietary fabric, called MemoryFlex™, that mimics the natural expansion and contraction of the muscles, enhancing flexibility and reinforcing contention.

Most fabrics found today are woven in a two-dimensional plane. This simply means that fabrics are connected through an X and Y plane and this is true for 99% of the apparel and athletic wear on the market today. This is one of the reasons why fabric will often become stretched out over time. Then combine a tight-fitting fabric such as a tech suit with explosive athletic movements and you are sure to stretch the material. As time goes on, the performance of the suit deteriorates as there is less support and contention after each use.

Our proprietary fabric called MemoryFlex™ was developed to provide consistent support and contention throughout its useful life. Rather than using a standard fabric that was woven in a two-dimensional plane, we have created one that enables flexibility in the third dimension. We accomplish this by weaving the additional threads around those that exist on the X and Y plane, mimicking the natural structure of our muscles.

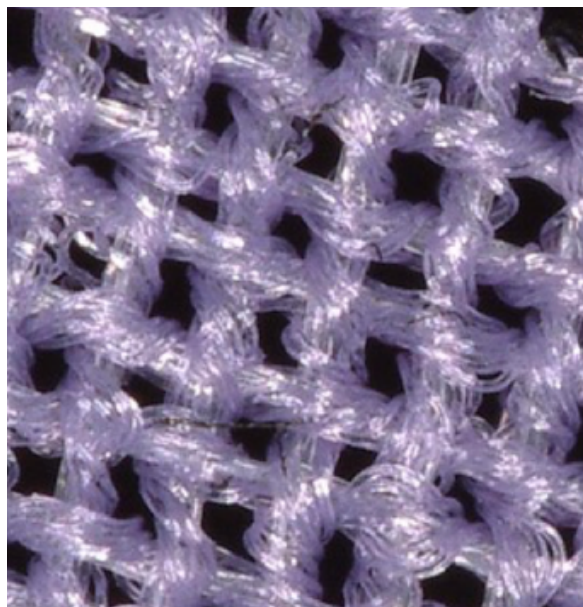


FIGURE III

Image on the right displays Memory Flex™ fabric woven in three dimensions.

Fabric that mimics the muscles is beneficial for many reasons. The first is that your muscles are no longer constrained by the two-dimensional fabric. Not only does this allow the muscles to function in the way they were designed, but it provides consistent contention. The contention is important because it provides tension, flexibility, and force. When a swimmer is at the neutral or zero position there is little to no contention, however, during a race, the swimmer exerts levels of contention greater than zero. Where traditional fabric woven in two dimensions provides little contention, our MemoryFlex™ material will provide consistent contention-enhancing the swimmers' performance.

For this reason, we have named the material MemoryFlex™. MemoryFlex™ is a smart material that behaves as the muscles do in a three-dimensional plane. Each time the swimmer performs a movement that exerts tension on the fabric it will always want to return to its initial position

in terms of flexibility, tension, and force exerted between the fibers. This ability to return will provide swimmers' muscles with greater efficiency, allowing them to retain greater levels of contention throughout a race.

INTERACTION BETWEEN WATER DROP & FABRIC

To further optimize the performance of the suit, the material must be hydrophobic. This prevents the swimmer from carrying any additional weight caused by water retention.

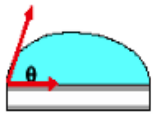
When water comes in contact with standard fabric, water molecules attach themselves, leaving the material saturated, and in turn increase drag. MemoryFlex™ fabric is a proprietary material that's interaction with water is hydrophobic. This simply means the water molecules will not attach themselves to the fabric. As the swimmer comes into contact with the water, the water molecules will become unhooked and decrease the frictional resistance caused by swimming.

FIGURE IV

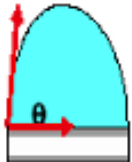
Displays the difference between hydrophilic and hydrophobic.



Hydrophilic drop behavior (absorbs water directly)



Hydrophilic drop behavior (absorbs water with time)



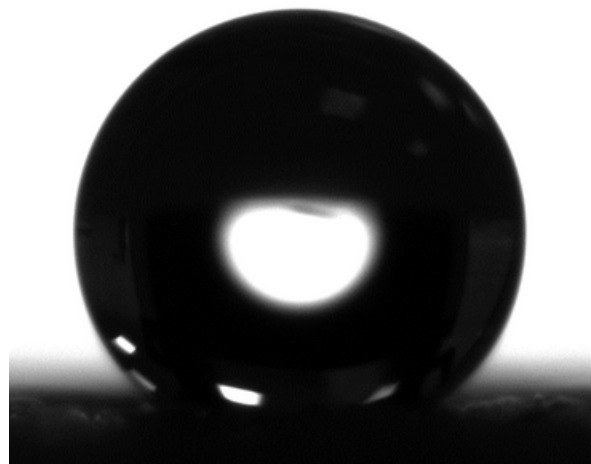
Hydrophobic drop behavior (does not absorb water)

MEMORYFLEX™ FABRIC

MemoryFlex™ fabric is uniquely constructed as a deep water repellent applied to each thread prior to the construction of the fabric. Once the fabric is constructed a second coating is applied increasing the water repellency of the HydroX™ by more than twice that of competitor suits.

FIGURE V

Image on the right displays the interaction between water drop and MemoryFlex™ fabric.





Although other tech suits on the market today may appear to repel water, they in fact end up taking on more water after each use. Our proprietary MemoryFlex™ technology and dual coating ensure the integrity of the fabric remains consistent after each use.

MemoryFlex™ fabric is inherently thin, which allows for an increased range of motion and less opportunity for water absorption. In addition, while the HydroX™ may appear wet after a race, the suit will actually retain very little water. Compliant with FINA permeability standards the HydroX™ allows water to penetrate through the fabric without absorption, decreasing drag and resistance caused by the intake of water.

FIGURE VI

Displays the decrease in resistance through the placement of the fabric.

