# Biofunctional Approach to Promote Wound Healing

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In preparation for human exploration, NASA is conducting research in a variety of areas to keep future astronauts safe and healthy. In particular, some studies indicate that astronauts may be immune-compromised and have wound-healing deficiencies while in space. On Earth, the typical treatment for immune compromised individuals requires medical supplies and equipment that would be difficult to transport into space for long duration missions.

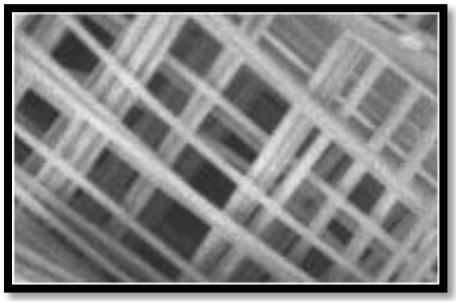
A team at NASA Langley Research Center is investigating a novel solution to address this issue. Knowing electrical activity has been shown to expedite tissue regeneration, Materials Research Engineer, Dr. Lisa Scott Carnell, decided to explore the possibility of using the electroactive fiber technology she had been researching as a means to facilitate the wound healing process.

"The material exhibits what we call piezoelectric and pyroelectric properties. At body temperature, it gives off a very, very slight charge, and the charge helps cells migrate to the wound site to promote the healing process."

For her studies, Scott Carnell is using a commercially available material, Polyvinylidene Fluoride (PVDF) to create a fairly inexpensive material.

"We actually process the powder form into a fiber that we can make into a scaffold, almost like a gauze, using a modified electrospinning method we developed at NASA. During that process, the material actually transforms from its original crystalline state to a piezoelectric state that renders these properties."

The Langley electrospinning process is controlled with an auxiliary electrode in order to obtain the 3D scaffold's highly aligned fibers with controlled porosity. The control over the porosity permits oxygen to pass through the scaffold to assist the wound healing process.



Electrospun PVDF Scaffold

The material holds promise for wound healing in many other application areas, such as field use for the military. In other cases, where people are immune-compromised such as diabetes, patients could actually perform their own treatment at home without a prescription.

H&E stain showing re-epithelialization complete after day 16

To date, Scott Carnell has conducted two in vivo studies with Duke University in North Carolina. In both cases, the results have been very promising. Further work may include a simulated microgravity ground-based study to help determine the expectations for astronaut healing in space.