THE HARTWELL FOUNDATION

2011 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Anjelica L. Gonzalez, Ph.D.**
Assistant Professor
Department of Biomedical Engineering

Institution: **Yale University**

Proposal: **Artificial Amniotic Membrane Scaffolds for Scarless Wound Healing**

By conservative estimates, there are approximately 10,000 extensive pediatric burn injuries annually in the U.S., resulting in over $200 million in hospital inpatient charges. The CDC estimates that 435 children are seen each day in emergency units due to burn injury alone. The damaging disruption to the skin due to accidental burn injury predisposes to infection and commonly leads to permanent disfigurement. Large, dense, and inflexible scar formation on a small child leads to physical contraction of the wound site (burn wound contraction) and ultimately, extensive scar formation. The scarring is not just physically disfiguring but often, debilitating for muscle movement, as well. To prevent physical deformity, the standard of care for treating children who experience burn wound contracture is painful and high-risk surgery. Normally, dermal wound healing is characterized by a robust inflammatory response, resulting in the slow recruitment and proliferation of various new cells, and deposition of misaligned matrix proteins around the cells, which are then responsible for producing dense scar tissue. Remarkably, dermal wound healing in the fetus is so restorative that it is indistinguishable from uninjured skin. Unfortunately, there are currently no therapies that effectively employ the multiple factors involved in preventing fetal scarring and thus, current methods of scar minimization in childhood burn victims are inadequate. To address this unmet need, Angelica seeks to redirect the skin healing process in children to achieve scar-free wound repair similar to the fetus. Her working hypothesis is that the unique extracellular matrix of the amniotic sac protects the fetus from the inflammatory response to injury that ultimately results in scar formation. To modulate the mechanisms by which the cellular processes of wound healing occur, she envisions an artificial membrane (skin) that would overlay the burn and mimic the fetal amniotic membrane. The cellular signals and subsequent responses that need to be controlled in such a system will, by nature, be complex. However, using a robust statistical method (response surface optimization) she expects that the precise composition of the membrane can be tuned to direct the cellular response of the burned tissue to the desired outcome. If her innovation is successful, an artificial therapeutic membrane capable of promoting rapid and scarless wound healing will be available to pediatricians and hospitals, dramatically improving the current therapies for childhood burn victims.

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