Shriners Hospitals for Children®
Boston, Massachusetts

ENGINEERED SKIN REPLACEMENTS

The management of wound healing and subsequent scarring is a significant problem in burn patients. Slow and no healing wounds such as diabetic and venous ulcers, pressure sores and undesirable scars, such as keloids and hypertrophic scars, severely burden the U.S. health care system. Abnormal scars are the main factor limiting long term functional recovery from a serious burn injury. While skin substitutes currently used in clinics provide an adequate solution and improve survival after a burn, they do not address the subsequent problems, such as scarring and lack of appendages in the regenerated skin.

At Shriners Hospital for Children — Boston, we are leading the field of skin engineering by developing cutting edge technologies to address the needs of patients and surgeons. This tradition began more than 30 years ago with the development of the first artificial skin at our hospital. We specialize in creating innovative solutions with the ultimate goal of improving the lives of burn patients. Our efforts currently focus on engineering a new generation of skin substitutes that harness nanoparticle technology for simultaneous delivery of factors to modulate the regeneration of healthy skin. We also established pulsed electric fields as a modality in burn wound treatment with applications in wound disinfection, stimulation of scarless regeneration and treatment of hypertrophic scars.

Recent Publications

1. Quinn KP, Golberg A, Broelsch GF, Khan S, Villiger M, Bouma B, Austen WG, Sheridan RL, Mihm MC, Yarmush ML, Georgakoudi I (2015) An automated image processing method to quantify collagen fibre organization within cutaneous scar tissue. Exp Dermatol 24:78–80.
2. Bohr S, Patel SJ, Vasko R, Shen K, Iracheta-Vellve A, Lee J, Bale SS, Chakraborty N, Brines M, Cerami A, Berthiaume F, Yarmush ML (2015) Modulation of cellular stress response via the erythropoietin/CD131 heteroreceptor complex in mouse mesenchymal-derived cells. J Mol Med 93:199–210.
3. Yarmush ML, Golberg A, Serša G, Kotnik T, Miklavčič D (2014) Electroporation-based technologies for medicine: principles, applications, and challenges. Annu Rev Biomed Eng 16:295–320.
4. Golberg A, Broelsch GF, Vecchio D, Khan S, Hamblin MR, Austen WG Jr., Sheridan RL, Yarmush ML (2014) Eradication of multidrug-resistant A. baumannii in burn wounds by antiseptic pulsed electric field. Technol 02:153–160.
5. Bohr S, Patel SJ, Sarin D, Irimia D, Yarmush ML, Berthiaume F (2013a) Resolvin D2 prevents secondary thrombosis and necrosis in a mouse burn wound model. Wound Repair Regen 21:35–43.
6. Golberg A, Bei M, Sheridan RL, Yarmush ML (2013a) Regeneration and control of human fibroblast cell density by intermittently delivered pulsed electric fields. Biotechnol Bioeng 110:1759–1768.

7. Bohr S, Patel SJ, Shen K, Vitalo AG, Brines M, Cerami A, Berthiaume F, Yarmush ML (2013b) Alternative erythropoietin-mediated signaling prevents secondary microvascular thrombosis and inflammation within cutaneous burns. Proc Natl Acad Sci USA 110:3513–3518.
8. Bohr S, Patel SJ, Vasko R, Shen K, Huang G, Yarmush ML, Berthiaume F (2013c) Highly upregulated Lhx2 in the Foxn1-/- nude mouse phenotype reflects a dysregulated and expanded epidermal stem cell niche. PLoS ONE 8:e64223.
9. Golberg A, Broelsch GF, Bohr S, Mihm MC Jr., Austen WG Jr., Albadawi H, Watkins MT, Yarmush ML (2013b) Non-thermal, pulsed electric field cell ablation: A novel tool for regenerative medicine and scarless skin regeneration. Technol 01:1–7.
10. Koria P, Yagi H, Kitagawa Y, Megeed Z, Nahmias Y, Sheridan R, Yarmush ML (2011) Self-assembling elastin-like peptides growth factor chimeric nanoparticles for the treatment of chronic wounds. Proc Natl Acad Sci USA 108:1034–1039.