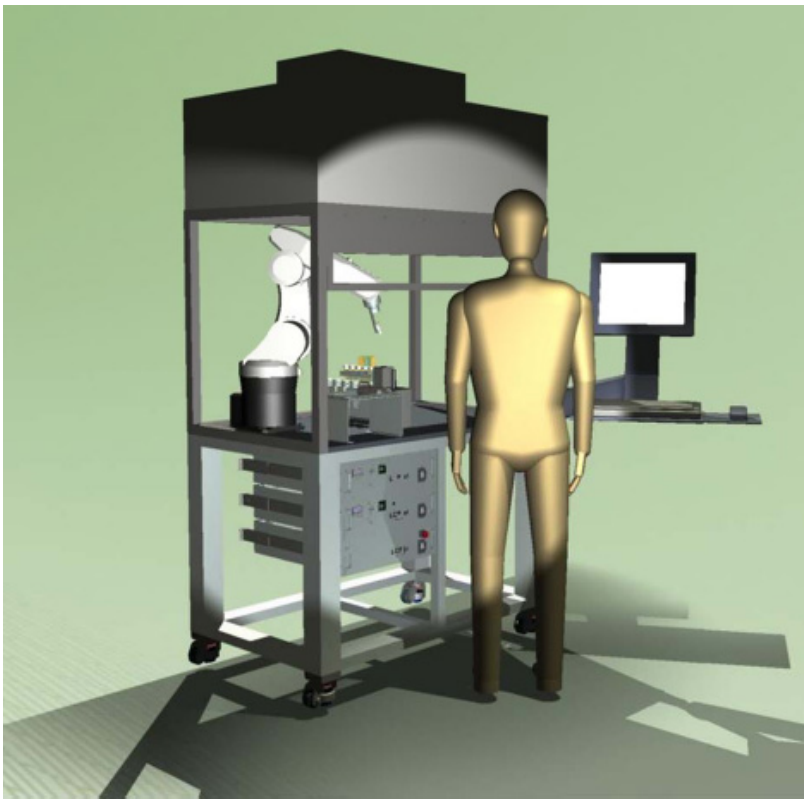

This project will develop a skin engineering bioprinter that significantly advances the fabrication of anatomically and functionally improved skin substitutes. This instrument will fabricate skin substitute repair constructs for treating skin wounds that are a result of thermal injury, mechanical trauma, disease, cancer and genetic disorders. The Dermal Repair Construct Printer (DRCP) can also be used to fabricate functional skin substitutes for cosmetology and pharmaceutical testing and skin research in vitro studies.

The DRCP will be capable of large volume global deposition of construct materials and epidermal / dermal cells for high throughput fabrication combined with low volume high precision inkjet deposition to spatially define patterns of functional cells, growth factors and acellular matrices. This will enable the in situ delivery of skin substitute materials to provide for rapid skin restoration directly on the patient. An important feature is the capacity to deposit subconfluent autologous cells, thus reducing the time required compared to conventional confluent cell methods (from 2-3 weeks to 5-7 days).

The volume and ratio of cells, matrices and growth factors, as well as the thickness of the skin substitute layers can be more precisely controlled via non-contact drop-on-demand inkjet based bioprinting in comparison to conventional bolus application methods.

The approach to be developed will advance the treatment of burn patients by reducing morbidity and mortality rates, while improving the outcome of patient recovery with more rapid healing, improved functionally and less pain and suffering. In addition, the inkjet-based dispensing systems, protocols, and materials developed in this project for dermal repair will have broad applicability to tissue engineering and regenerative medicine in general.