Development of skin replacements to act as autograft substitutes should provide clinical advantages including reduction of:

a) the amount tissue donated for grafting,
b) the number of surgeries needed to complete grafting, and
c) total hospitalization time.

In addition, improved functional and cosmetic results compared to conventional autografting are required to assure that the long-term post clinical course is advantageous to the patient. In a first approximation of undamaged skin, methods for permanent skin replacement must re-establish an epidermal stem cell population and minimize the formation of scar in the healed connective tissue of the skin. Restoration of proper pigmentation, epidermal adnexal structures (hair follicles, sweat glands, sebaceous glands) and nervous sensation are also important considerations for more complete functional replacement of the skin.

To maximize consistency and predictability of outcome, replacement of full-thickness skin loss must provide both dermal and epidermal components of the skin. Tissue culture methods for normal human epidermal keratinocytes (HK) have been developed (Boyce and Ham, 1983, 1985) that allow an approximate 1:600 expansion of area covered by partially stratified sheets of HK in a period of less than three weeks. To replace the dermis, a membrane consisting of bovine collagen and chondroitin-6-sulfate (Boyce et al., 1986a) has been combined with HK cultures to generate a full thickness skin replacement with dermal and epidermal components (Hansbrough and Boyce, 1984, 1986). Grafting of the acellular dermal membrane to excised full thickness burns promotes regeneration of connective tissue from the woundbed and reduces wound contraction compared to ungrafted excised burns and to non-excised burns (Boyce et al., 1986b). Grafting of the dermal membrane alone promoted the regeneration of tissue that resembles healthy skin histologically, but without epidermal adnexal structures. Comparison on athymic (nude) mice of the complete dermal-epidermal skin replacement to murine autograft and human xenograft is in progress.

References: