EPITHELIALIZATION:
EPIDERMAL REGENERATION

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Tissues (epidermis and endothelium) within the same tissue classification (epithelium) behave in similar ways in response to injury and in wound healing.

Even tissues which can regenerate (epithelium) may not do so to fill defects which are too large (greater than the “critical” size).

The principal roles that biomaterials may play in replacing tissues or facilitating regeneration may differ from one tissue to another in the same tissue classification.

In some applications the principal beneficial role of the biomaterial may be to just maintain the physiological environment.
LESSONS

Biomaterials for the fabrication of temporary wound covering materials
Skin Wounds

Figures showing skin wounds at different depths removed due to copyright restrictions.
Effects of Maintaining a Moist Environment at the Wound Site

“Scab”

Diagram of skin cells removed due to copyright restrictions.

Do epithelial cells come only from the edges of the wound?
Source of Epithelial Cells

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Epidermal cells moving through the outer root sheath around a hair shaft.
Hydrogel: Geliperm ©

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Polyacrylamide-Agar Interpenetrating Network; 96% water
Particulate form of the hydrogel

Diagrams removed due to copyright restrictions. “Dry ulcer” and “Exudating ulcer.”
Animal Model: Miniature Pig

- Certain features of skin similar to human

Photo of miniature pig in lab test removed due to copyright restrictions.
EPITHELIALIZATION

Full Thickness Burns
Skin Graft Donor Sites
Meshed Grafts
Heated aluminum block applied to skin for a specified time period.

Immediate Post-Op

Hydrogel

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5 days post-op

Photos of wounds removed due to copyright restrictions.

Dry

Hydrogel

Dry
5 days post-op

Hydrogel

Histology slide photos of healing skin removed due to copyright restrictions.
EPITHELIALIZATION

Full Thickness Burns
Skin Graft Donor Sites
Meshed Grafts
Dermatome

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Donor graft being taken from the miniature pig.

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Two photos (for comparison) removed due to copyright restrictions.
5 Days Post-Op

Hydrogel

Gauze

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Human Trial
5 days post-op

Hydrogel

Gauze

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EPITHELIALIZATION

Full Thickness Burns
Skin Graft Donor Sites
Meshed Grafts
Production of a meshed graft

Miniature Pig Model
5 days post-op

Hydrogel

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Miniature Pig Model
5 days post-op

Hydrogel

Histology slide photos of healing skin removed due to copyright restrictions.
• A collagen-glycosaminoglycan matrix, impregnated with autologous keratinocytes, was applied as island grafts onto full-thickness porcine wounds to determine whether complete epidermal coverage could be achieved in a single grafting procedure.
• Grafts with seeding densities ranging from 0 to 3,000,000 cells/cm2 were used to determine the kinetics of epidermal coverage.
• Autologous keratinocytes proliferated as the collagen-glycosaminoglycan matrix was vascularized to form a confluent epidermis by 2 weeks in matrices seeded with at least 100,000 cells/cm2.
• Irrespective of seeding density at 2 weeks the collagen-glycosaminoglycan matrix was well vascularized, contained a dense cellular infiltrate, and was almost completely degraded. These studies demonstrate that seeded keratinocytes proliferate and differentiate to form a confluent epidermis by 2 weeks in matrices seeded with at least 100,000 cells/cm2.
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