Skin Physiology

The skin both transmits and blocks communication

1. A brief view of the anatomy
2. Sensors in the skin
3. The organ of touch
4. The language of skin
5. Barrier to the world
6. When the barrier fails

A model of the skin

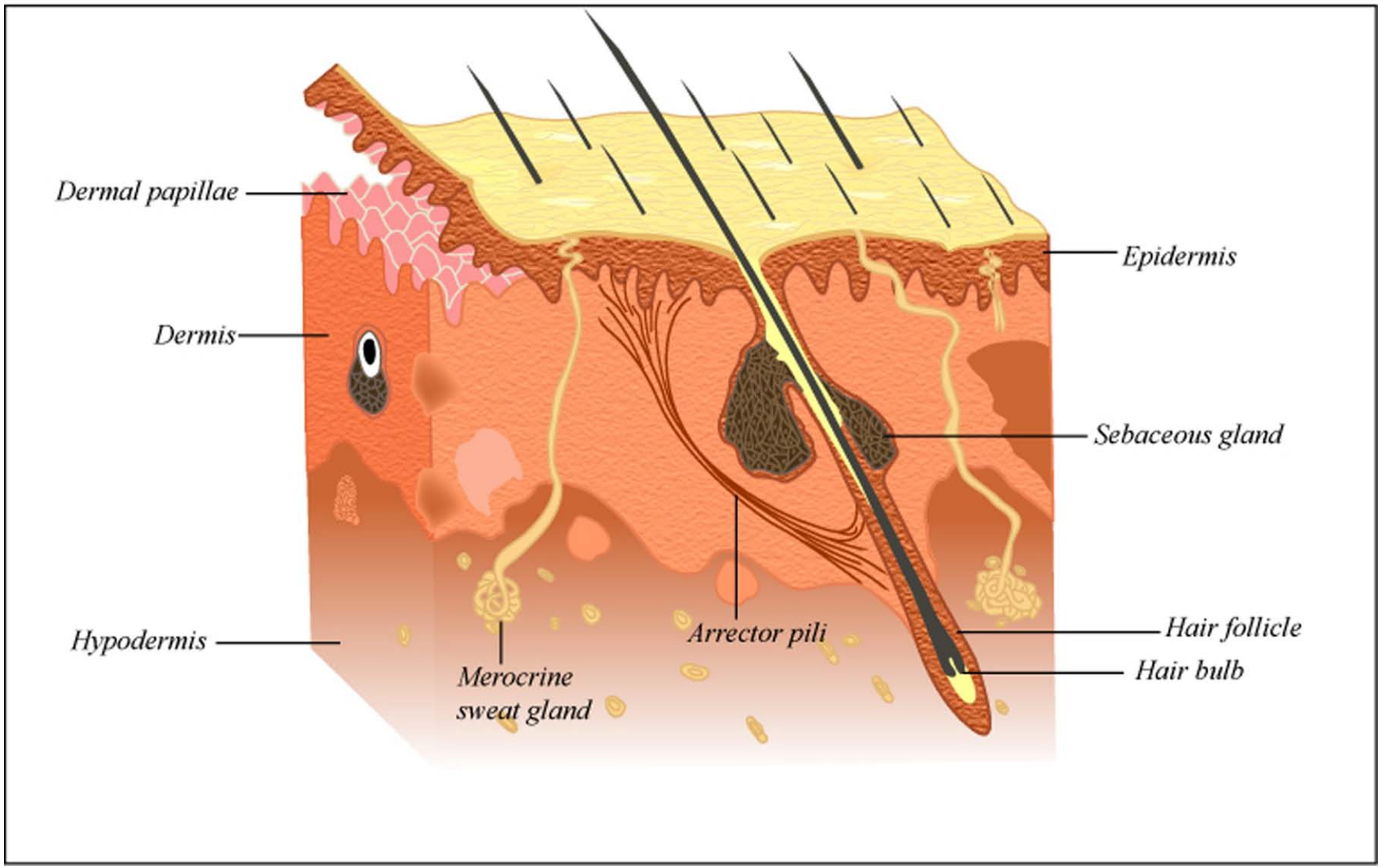

Figure by MIT OpenCourseWare.

Diagram removed due to copyright restrictions.

A hair follicle is a cylinder of epidermal cells that have tunneled inside the dermis

Sensors in the skin

Free nerve endings (and Merkel cells): temperature, touch, pain

Histology photo removed due to copyright restrictions.

Meissner’s corpuscle

- lies between dermis and epidermis
- located in fingertips, palms, lips and tongue, nipples, genitals
- informs body exactly where skin is touched

Histology photo removed
due to copyright restrictions.

Histology photo removed
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Pacinian corpuscle: lies deep inside dermis; located around joints and tendons, tissue lining organs, and blood vessels. Provides instant information about how and where we move

The Organ of Touch

Buddhist monks

Photo removed due to copyright restrictions.
Two monks bowing to each other.

in France

Premature baby being comforted with fleece of lamb's wool at Yale University Hospital to avoid deprivation of touch

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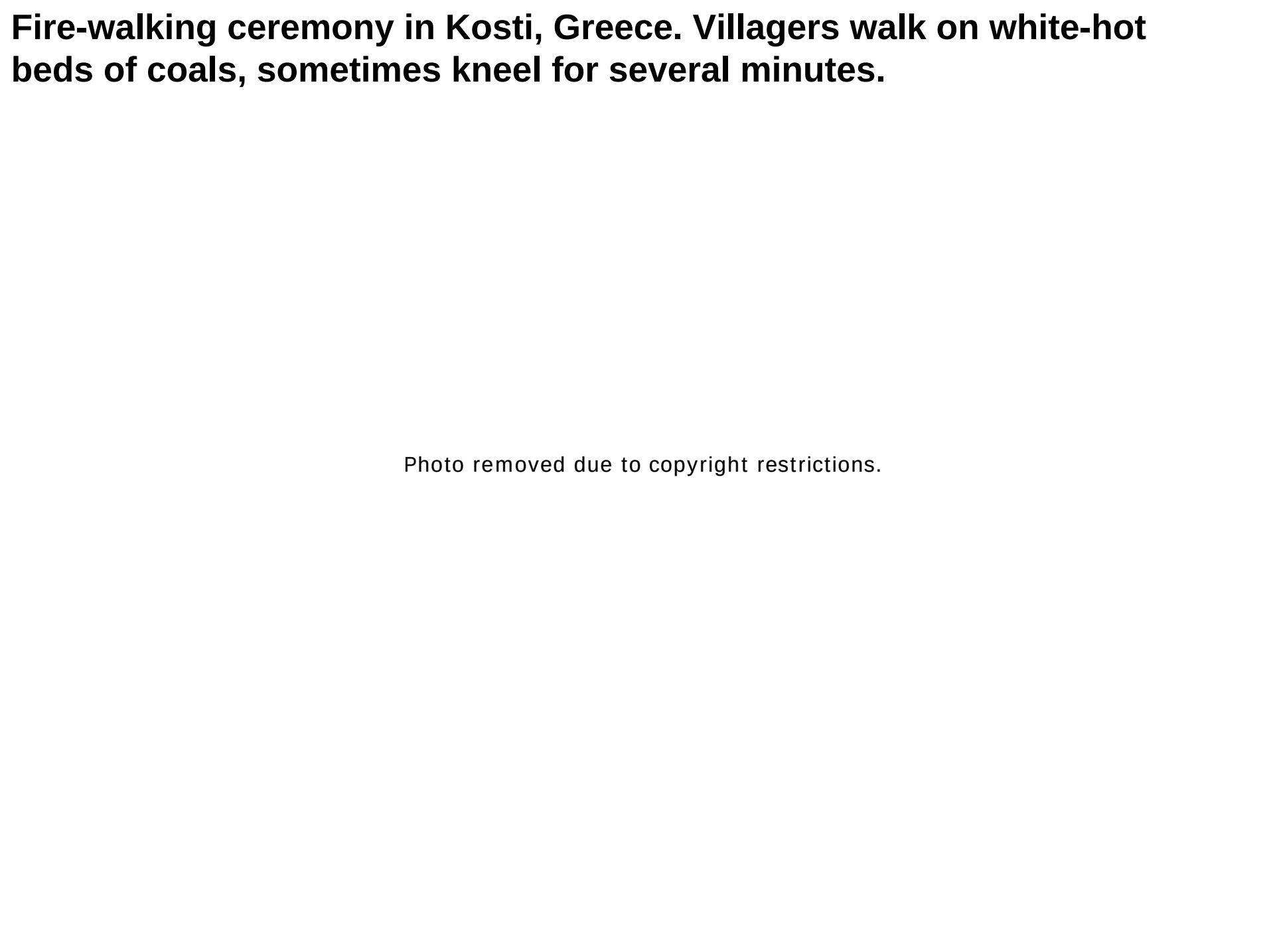
Fire-walking ceremony in Kosti, Greece. Villagers walk on white-hot beds of coals, sometimes kneel for several minutes.



The Language of Skin

skin decoration used in Mt. Hagen, New Guinea

Photo removed due to copyright restrictions.
Human face.

Photo removed due to copyright restrictions.
A woman’s back.

Nuba woman, Sudan used special cutting tools to retard healing and form scars

Meru girl, Kenya

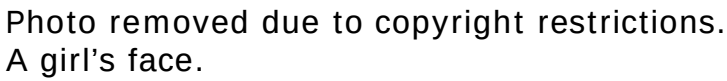


Photo removed due to copyright restrictions.
A girl’s face.

Native of Amazon basin with lip disk

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Player in traditional Chinese opera

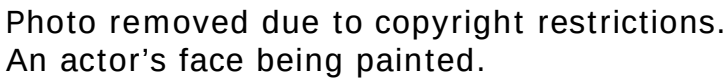
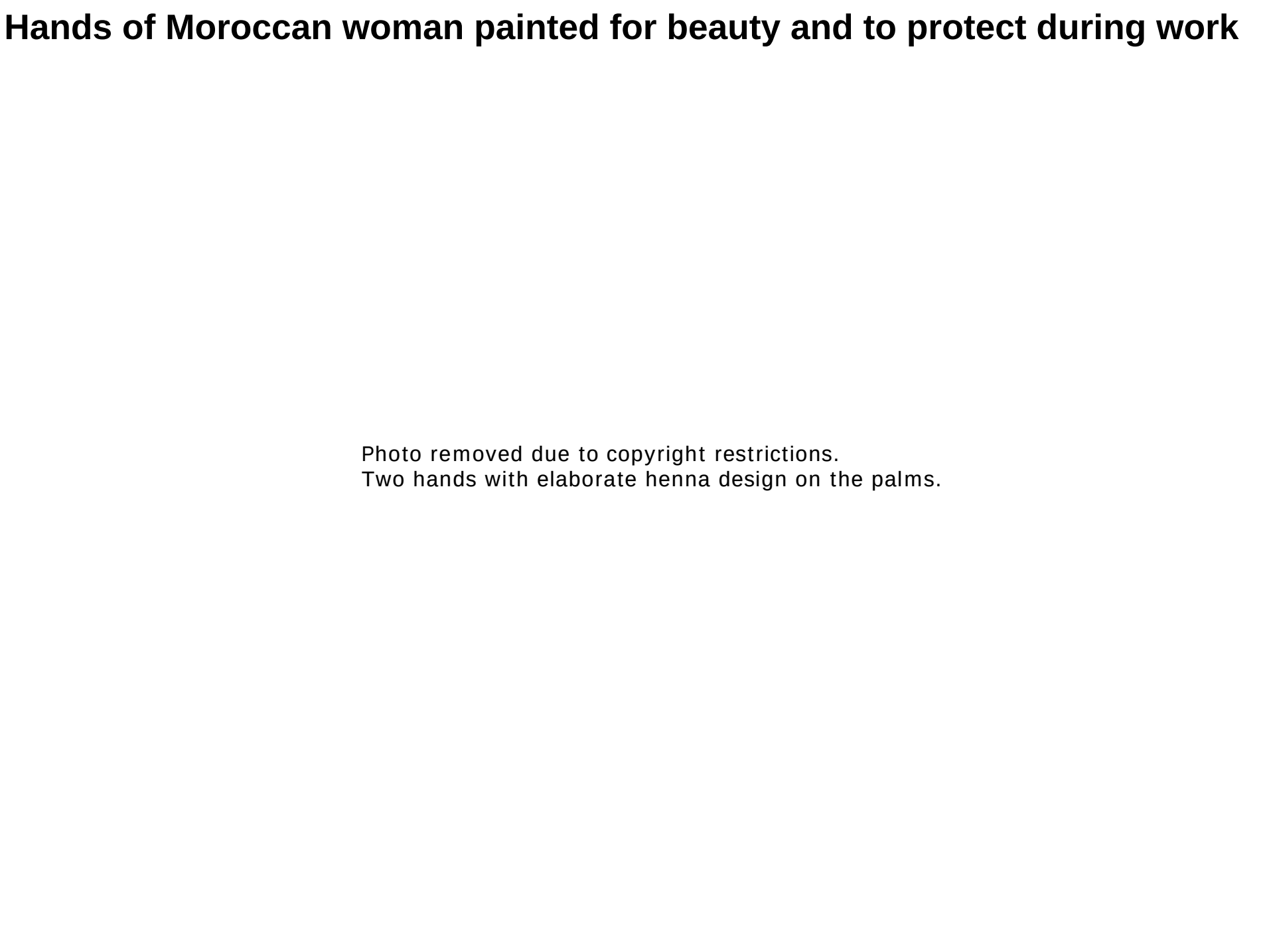


Photo removed due to copyright restrictions.
An actor’s face being painted.

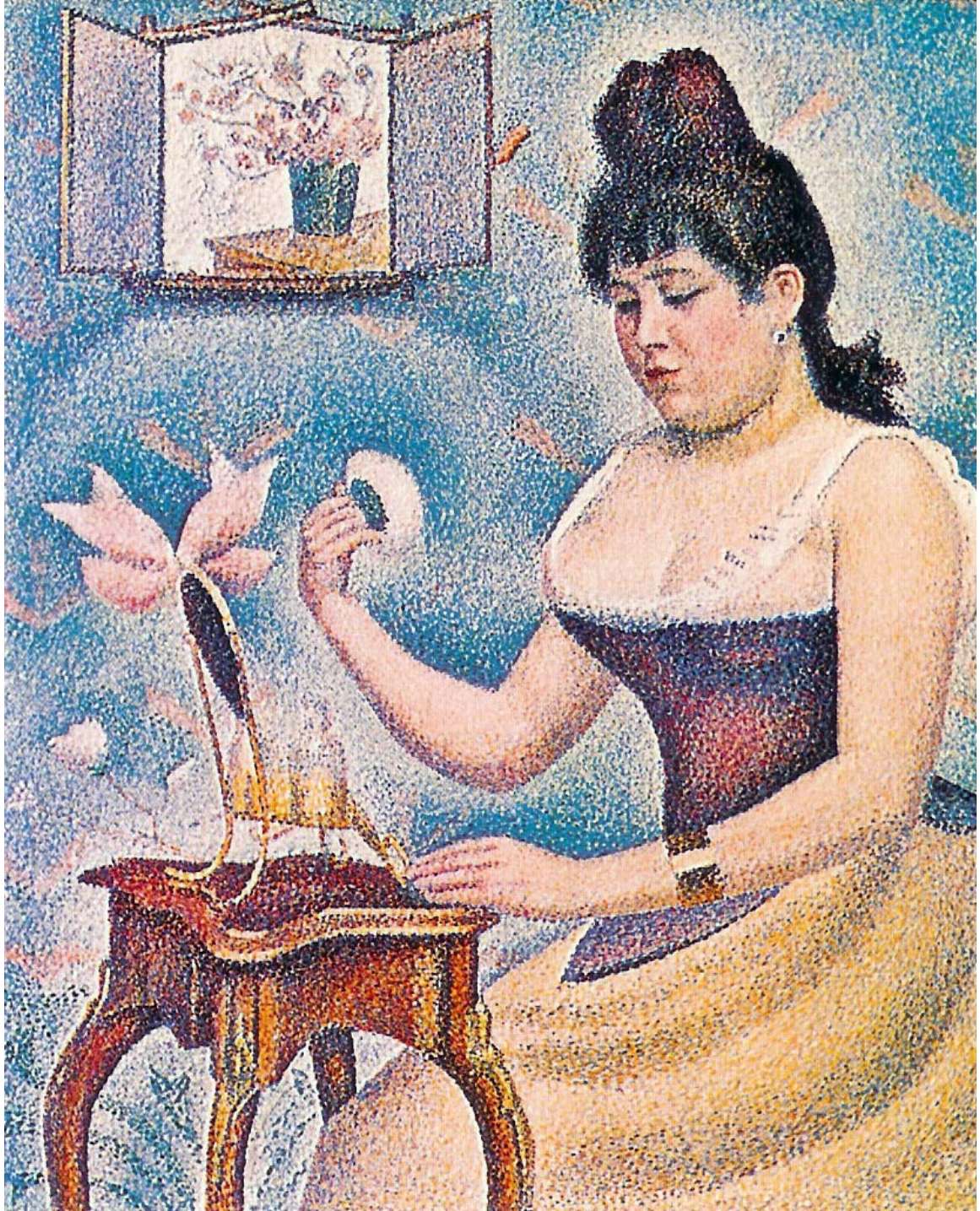
Hands of Moroccan woman painted for beauty and to protect during work



Fourth of July celebration, New York City

Photo removed due to copyright restrictions.
A man’s heavily tatoo’d arm.

“…fresh snow falling on Fuji’s white crown”
Tago no Ura

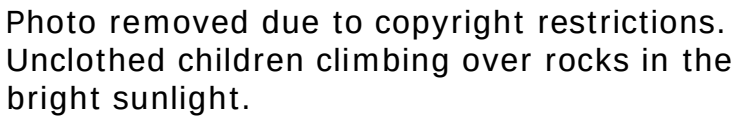


a traveling actress

Georges Seurat

A nervous itching disease possibly forced Napoleon to keep scratching

Natural colors and hues

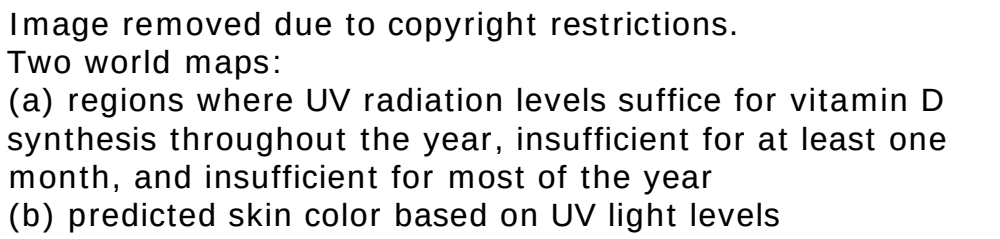


Melanin protects children from UV radiation in Australian outback

Absence of pigment (albinism) causes Hopi girl to squint, standing between her sisters

Photo c. 1900.

UV radiation levels



From Jablonksi, N. G., and G. Chaplin. “Skin Deep.” *Scientific American* 287, no. 4 (Oct. 2002): 74-81

Predicted skin color

Scientific American

Barrier to the World

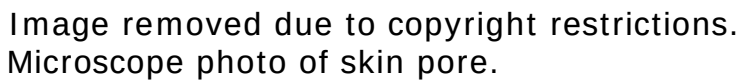
Image removed due to copyright restrictions.
Thermal imaging of a child sitting on floor.

Child sitting on cold floor

Photo courtesy of alextorrenegra on Flickr.

Climbers risk frostbite when too long in contact with freezing surface

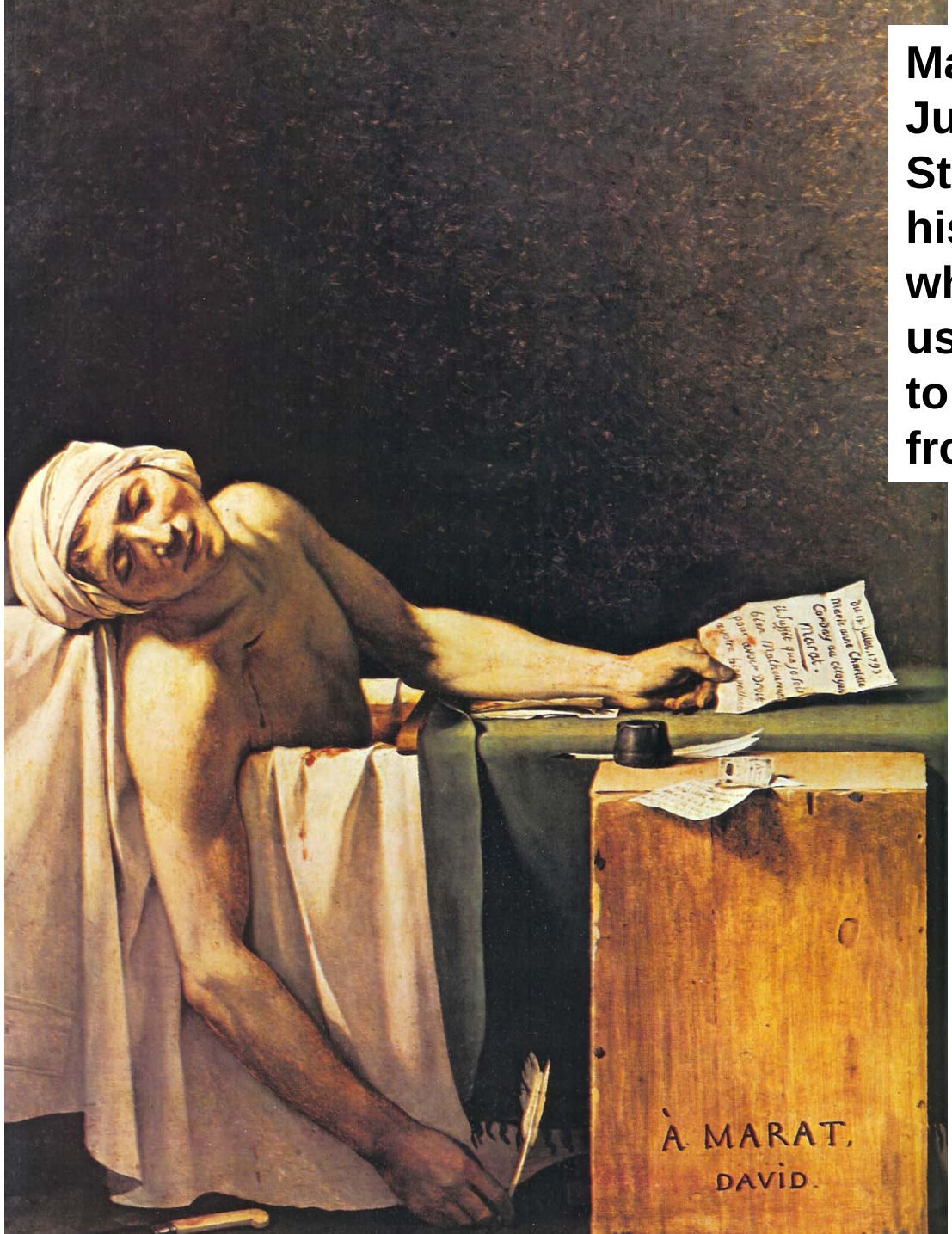
Skin pore, about 100 micron diameter



Sweat droplets on surface of skin. Sweat cools when allowed to evaporate from skin.

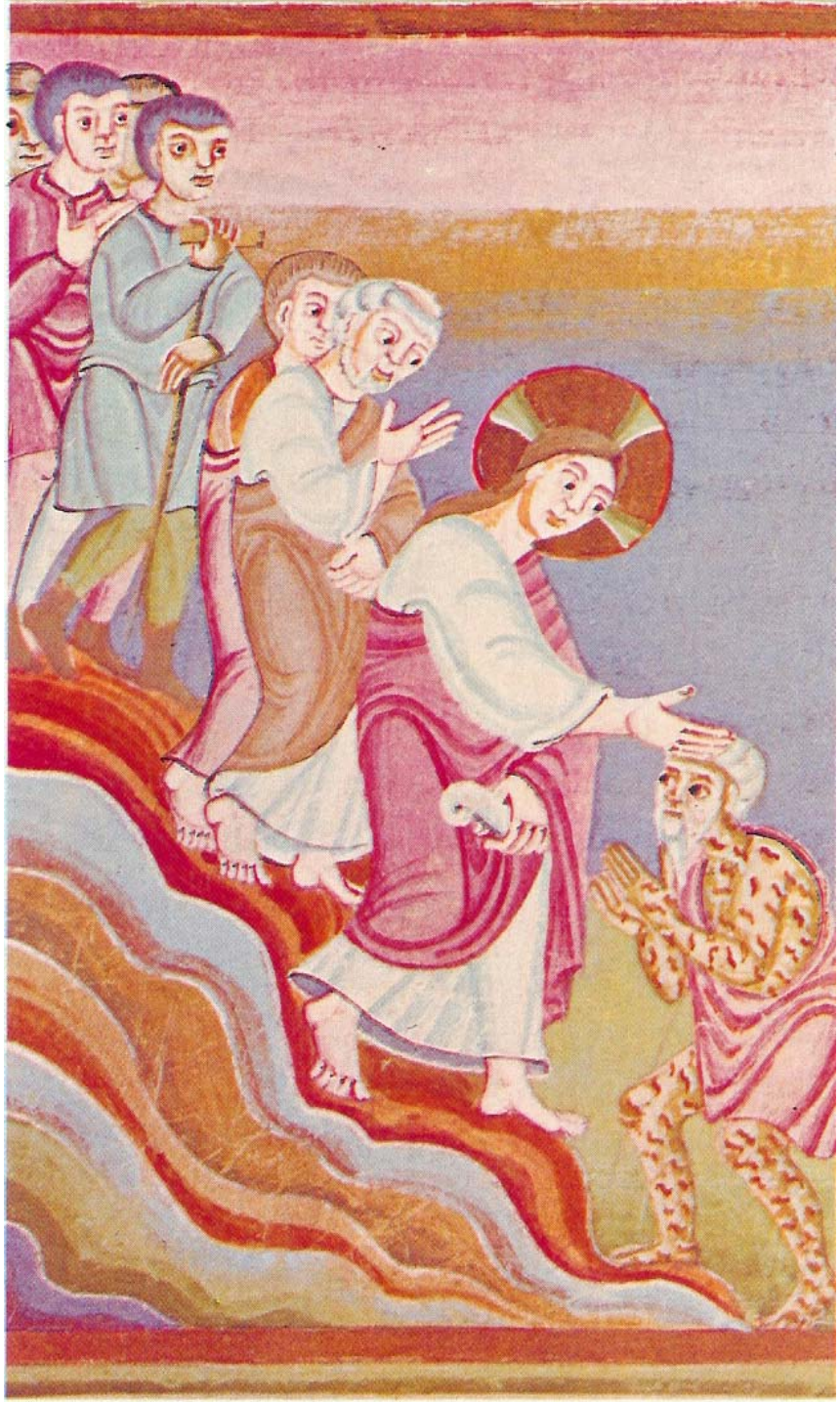
Photo courtesy of Cayusa on Flickr.

When the Barrier Fails: Loss and Regeneration of Skin



Marat on July 13, 1793. Stabbed in his hot tub where he used to go often to get relief from skin disease

David

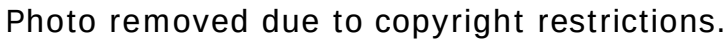


Jesus to leper: “Stand up and go your way”

11th century Echternach Gospels Lectionary

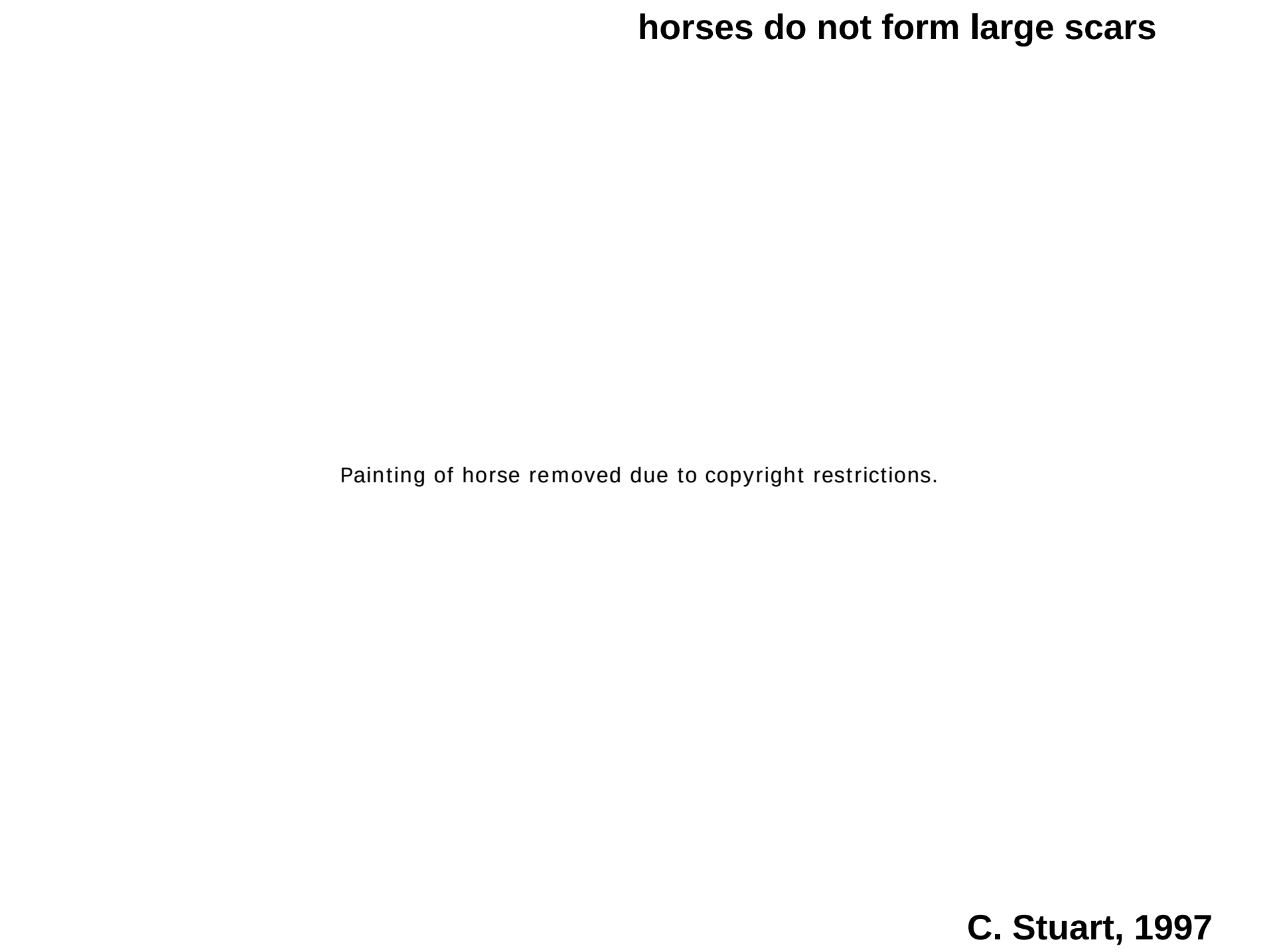
Photo courtesy of Mr.Mac2009 on Flickr.

Trifoliate leaves of poison ivy in autumn



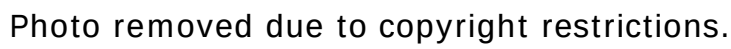
Severely burned victim heals injury by contraction and scar formation

horses do not form large scars



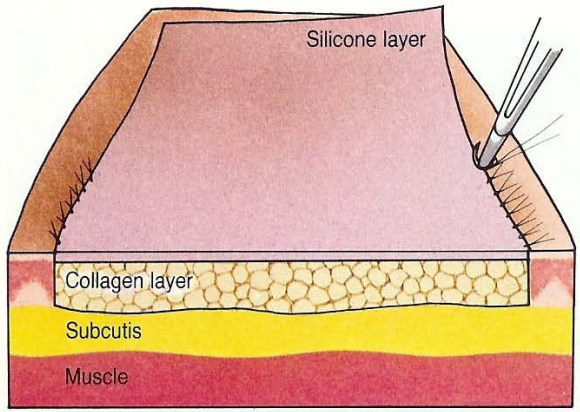
C. Stuart, 1997

Meshed autograft, the patient's own skin



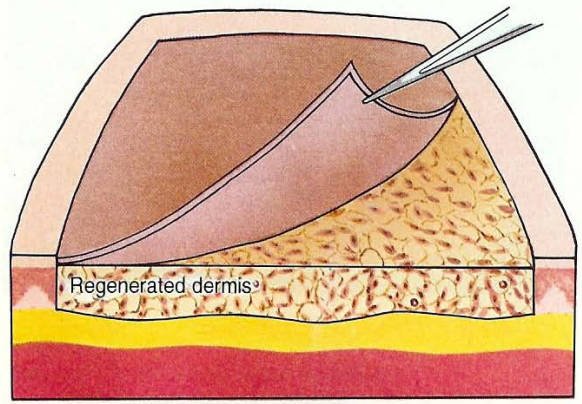
MIT Artificial Skin is FDA-approved.

Used in the clinic to treat massive burns and to "resurface" scarred skin.



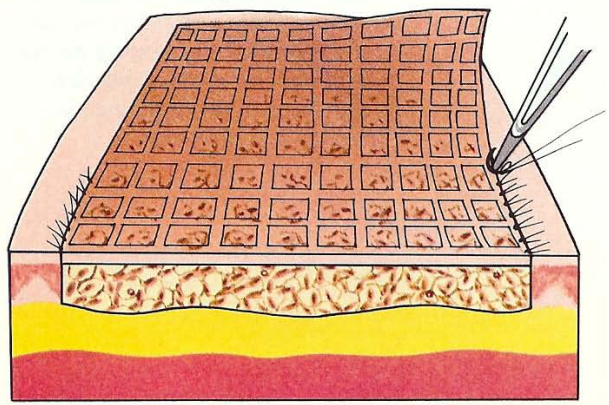
Application of artificial skin to wound

1. Bilayer is grafted.



Removal of silicone layer

2. Silicone layer removed after 15 days, revealing new dermis.


Graft of patient's own skin

3. Patient's epi-dermal graft (no dermis) covers the new dermis.

Conclusion: The heaviest organ also turns out to be quite complex

20.441J / 2.79J / 3.96J / HST.522J Biomaterials-Tissue Interactions

Fall 2009