Why am I giving a talk on skin?

No, really: Why skin?

This audience

We will look at “Skin” as an example of how to look at everything else we do.

Goals of this Lecture

By the end of this talk you should:

1: become more autoptic.
2: understand why beauty may be only skin deep, but ugliness emanates from the subcutaneous musculature.
3: learn that Langer’s lines are your friend.
4: realize that the external exam is the bread and butter of forensic pathology.
5: not be surprised that you got more out of this talk than the title implies.

What does everyone in this room have in common?

We all do “forensics”

We do investigations

We examine things:

- Historical data, Records, Scenes,
- Bodies, Lab tests, Micro slides, ...

We then “opine”

We all ......
Forensic Pathologists do Autopsies

What is an Autopsy?

The eye does not see what the mind does not know

“...O foolish people ...without understanding;
...have eyes, and see not;
...have ears, and hear not.”

Jeremiah 5:21 (KJV)

No, really: Why skin?

We will look at “Skin” as an example of how to look at everything else we do.

External Examination:

- Age
- Sex
- Race
- Complexion
- Height
- Weight
- Rigor mortis
- Livor mortis
- Temperature
- Hair color
- Eye color
- Dentition
- Moles, warts, acne
- Rashes, vesicles, etc.
- Scars: trauma v. surgical
- Needle or track marks
- Tattoos
- Piercings
- Circumcision status
- Patterned injuries
- Blunt trauma
- Abrasions
- Contusions
- Lacerations
- Sharp injuries
- Incised v. stab
- Perforating injuries
- Entrance v. exit
- Thermal Injuries
- Degree of burn
- % of TBSA

Some Cool Facts About Skin

The integumentary system, which includes skin, hair, nails, glands, and nerve receptors is only a few millimeters thick, but is the largest organ in the human body.

In an average adult the skin covers a surface area of about 18-20 square feet.

In an average adult: the skin weighs about six to 10 pounds.

It sheds itself about once every 27 days.
Things to know about skin

Anatomically:
- Epidermis
- Dermis
- Hypodermis

Accessories / Appendages
- Hair
- Nails
- Sebaceous glands
- Sweat glands (eccrine, apocrine)
- [Ceruminous gland]

Physiologically:
- Physical barrier
- Maintains hydration status
- Thermal insulation
- Radiation (esp. UV) barrier
- Immunologically active
- Synthesizes Vitamin D
- Sensory functions
- Secretory functions
- Excretory functions
- Artistic expression
Vision
is the art of seeing what
is invisible to others.

....Jonathan Swift

More things to know about skin

Inherent orientation
- Skin moves in response to the underlying forces that direct the movement.
- This creates an “orientation” to the surface structure of the skin.
- The epidermis aligns parallel to the collagen fibers in the dermis.
- The collagen fibers in the dermis aligns parallel to the underlying superficial muscles.
- The linear pattern of wrinkles and creases in skin is relatively fixed.
- The mapping of this pattern results in “Langer’s Lines”

SKIN: The ultimate key to wound interpretation

- Blunt force trauma and patterned injuries
- Sharp injuries
- Penetrating / Perforating injuries
- Burns
- Chronic physiologic stress
- Other forensic matters
Definitions

abrasion (ə-brə'shən) [L. abrasio] 1. the wearing away of a substance or structure (such as the skin or the teeth) through some unusual or abnormal mechanical process; see also planing. 2. an area of body surface denuded of skin or mucous membrane by some unusual or abnormal mechanical process.

contusion (kan-tu'shən) [L. contusio, from contundere to bruise] an injury of a part without a break in the skin and with a subcutaneous hemorrhage. Called also bruise.

laceration (ləsər'a-shən) [L. laceratio] 1. the act of tearing. 2. a torn, ragged, mangled wound.
Don't Just See; Observe!

What Sherlock Holmes can teach us about mindful decisions.

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Orientation of blade

Dermis is markedly prominent on lower left aspect

Skin is undermined on upper right aspect

Direction of thrust

Dermis is markedly prominent on lower left aspect
What skin tells us about sharp injuries

- Number of injuries
- Incised vs stab wounds
- Type of instrument used if stabbing
- Knife vs other; single vs double edged, serrated, ...
- Maximum width of blade
- Orientation of blade during stabbing
- Angle of penetration during stabbing
- Target site on body
- Whether or not self inflicted (Manner of Death)

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ENTRANCE WOUND

Entry perpendicular to skin

- Perforation
- Abraded margin

Entry at angle to skin

- Perforation
- Abraded margin

EXIT WOUND

Skin unsupported outside

Everted ragged flaps
More things to know about skin

Growth, repair, and regeneration:

Epithelial cells are formed only from other epithelial cells
The only mitotic epithelia of skin are in the basal layer
The basal epithelial layer of any skin or appendage can differentiate into any other skin or appendage
What skin tells us about gunshot wounds

- Number of injuries
- Target site on body
- Entrance vs exit wounds
- Direction and angle of entrance
- Range of fire
- (Whether or not self inflicted)

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Skin Resistance to Burns

- Skin that is more resistant to heat requires a higher temperature and longer exposure to burn than less resistant skin.
- Thicker skin offers more insulation from heat.
- Factors specific to site on body, such as vascularity and amount of perfusion, can effect the dissipation of heat from the surface.
- Factors external to the skin proper, such as hair, moisture or oils, can also ease or delay the burn.

Things to know about burns

- The minimum temperature that can cause a burn in a finite amount of time is 44 °C (111 °F).
- From 44° to 51 °C (111° to 124 °F), the rate of burn increases by a factor of approximately four with each Celsius degree risen or twice per Fahrenheit degree risen, from six hours down to six seconds.
- A burn can develop in less than a second if the exposure temperature is at least 70 °C (160 °F).

Approximate Temperature of Frequently Encountered Hot Liquids

<table>
<thead>
<tr>
<th>Hot Liquid</th>
<th>Approximate Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spa/Jacuzzi</td>
<td>100-104 degrees F</td>
</tr>
<tr>
<td>Fast food coffee</td>
<td>175-185 degrees F</td>
</tr>
<tr>
<td>Boiling water</td>
<td>212 degrees F</td>
</tr>
<tr>
<td>Frying grease</td>
<td>300-500 degrees F</td>
</tr>
</tbody>
</table>

Approximate Time and Temperature Relationship to Severe Burns in Children and the Elderly

<table>
<thead>
<tr>
<th>Water Temperature</th>
<th>Time for 3rd Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td>104 degrees F</td>
<td>Safe for bathing</td>
</tr>
<tr>
<td>120 degrees F</td>
<td>5 minutes</td>
</tr>
<tr>
<td>125 degrees F</td>
<td>2 minutes</td>
</tr>
<tr>
<td>130 degrees F</td>
<td>10 seconds</td>
</tr>
<tr>
<td>140 degrees F</td>
<td>3 seconds</td>
</tr>
<tr>
<td>144 degrees F</td>
<td>2 seconds</td>
</tr>
<tr>
<td>155 degrees F</td>
<td>1 second</td>
</tr>
</tbody>
</table>
Epidemiology of Burns

About 1 in 30 of those victims (75,000) are hospitalized, with 1/3 of those patients staying more than 2 months. About 14,000 Americans die each year from burns.

Children

Thermal burns are one of the most common mode of early childhood injury. In the U.S. burns are 3rd most common cause of accidental death. Worldwide, deaths due to thermal burns: 2004 ≈ 96,000

2008 ≈ 61,400

Deaths from burns dropped by 55% from 1999 to 2011. Burns are the only mode of unintentional injury where more girls suffer from it than boys worldwide, including by fire.

Babies and children are not miniature adults!

The head gets smaller and the thighs get larger.

Prognosis of Burns Patients

Age: >60 and <5 years have worst prognoses

Percentage chance of survival =

100 - (age in years + % of TBSA)

For example, two people (one 60 and one 20 years old), each with 30% TBSA burns:

100 - (60 + 30) = 10% chance of survival
100 - (20 + 30) = 50% chance of survival
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Cutaneous Markers of Chronic Stress

- Finger (or toe) Nails
- Hair (specifically, the loss thereof)

Nail: Color changes

<table>
<thead>
<tr>
<th>Mark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terry's nails</td>
<td>White color change, typically located at the base of the nail</td>
</tr>
<tr>
<td>Azure lunula</td>
<td>Common in hepatic failure, cirrhosis, diabetes mellitus, CHF, hyperthyroidism, malnutrition</td>
</tr>
<tr>
<td>Half-and-half nails</td>
<td>Specific for renal failure</td>
</tr>
<tr>
<td>Muehrcke's lines</td>
<td>Specific for hypoalbuminemia</td>
</tr>
<tr>
<td>Dark longitudinal streaks</td>
<td>Melanoma, benign nevus, chemical staining, normal variant in darkly pigmented people</td>
</tr>
<tr>
<td>Longitudinal striations</td>
<td>Alopecia areata, vitiligo, atopic dermatitis, psoriasis</td>
</tr>
<tr>
<td>Splinter hemorrhage</td>
<td>Subacute bacterial endocarditis, SLE, rheumatoid arthritis, antiphospholipid syndrome, peptic ulcer disease, malignancies, oral contraceptive use, pregnancy, psoriasis, trauma</td>
</tr>
<tr>
<td>Telangiectasia</td>
<td>Rheumatoid arthritis, SLE, dermatomyositis, scleroderma</td>
</tr>
</tbody>
</table>

Nail: Shape or growth changes

<table>
<thead>
<tr>
<th>Mark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clubbing</td>
<td>Inflammatory bowel disease, pulmonary malignancy, asbestosis, chronic bronchitis, COPD, cirrhosis, congenital heart disease, endocarditis, atrioventricular malformations, fistula</td>
</tr>
<tr>
<td>Koilonychia</td>
<td>Iron deficiency anemia, hemochromatosis, Raynaud's disease, SLE, trauma, nail-patella syndrome</td>
</tr>
<tr>
<td>Onycholyis</td>
<td>Psoriasis, infection, hyperthyroidism, sarcoidosis, trauma, amyloidity, connective tissue disorders</td>
</tr>
<tr>
<td>Pitting</td>
<td>Psoriasis, Reiter's syndrome, incontinentia pigmenti, alopecia areata</td>
</tr>
<tr>
<td>Beau's lines</td>
<td>Any severe systemic illness that disrupts nail growth, Raynaud's disease, pemphigus, trauma</td>
</tr>
<tr>
<td>Yellow nail</td>
<td>Lymphedema, pleural effusion, immunodeficiency, bronchiectasis, sinusitis, rheumatoid arthritis, nephrotic syndrome, thyrotoxicosis, tuberculosis, Raynaud's disease</td>
</tr>
</tbody>
</table>
Some Basic Facts About Nails

• Human nails grow at a rate which varies with age, and the finger or toe in question as well as nutrition.
• Fingernails grow at about 0.1mm/day and toenails at about 0.05mm/day.
• With this in mind the date of the stress causing Beau's lines and other identifiable marks on nails can be estimated.

Cutaneous Markers of Chronic Stress

• Finger (or toe) Nails
• Hair (specifically, the loss thereof)

Some Cool Facts About Hair

• Hair helps to protect the body from UV radiation by preventing sunlight from striking the skin. Hair also insulates the body by trapping air around the skin.
• The few hairless parts of the body (glabrous skin) include the palmar surface of the hands, plantar surface of the feet, dorsal surfaces of terminal phalanges, lips, labia minora, and glans penis.
• Trivia Question: The longest hairs on the body are obviously on the scalp; where are the shortest hairs?
• Answer: Hair on eyelids are so short that they do not protrude beyond the follicles that contain them!!

Some Not So Cool Facts About Hair

• Hair loss = “Alopecia” (“Balding”)
• Can be diffuse or focal, depending on etiology
• Hormonal / Genetic: Male pattern, Female pattern
• Traumatic: Scarring or non-scarring
• Drug induced: prescribed meds, heavy metal, etc.
• Anything that interferes with or alters the normal growth cycle:

Some Basic Facts About Hair

• Growth Cycle
  – Anagen
    • Active growing cycle. For scalp measured in years
  – Catagen
    • Involution of follicular structures. Mitoses end. For scalp ≈ 2-3 weeks
  – Telogen
    • Resting phase. For scalp = several months

Telogen Effluvium

• Transient increased shedding of normal hairs from resting scalp follicles
• Secondary to accelerated shift of anagen to catagen to telogen
• Results in increased daily hair loss and if severe, diffuse thinning of scalp hair
• Usually becomes manifest ≈ 3-4 months after triggering event
• Etiology: A reaction pattern to a variety of physical or mental stressors
Etiologies of Telogen Effluvium

- Endocrine
- Nutritional deficiencies
- Rapid weight loss
- Physical stress
- Psychological stress
- Heavy metals (Thallium, Mercury, Arsenic)
- Drugs
- More prevalent in women (2º to parturition, crash dieting)

Three Cases of Physical and Psychological Stress

- Two-and-a half year old, four year old, and ten year old children
- All died from fatal child abuse
- All had well documented, long term, “chronic”, physical and psychological stress
- All had microscopical findings corroborative of chronic physiological stress (and torture)

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Scarlet Fever

*Strep pyogenes*
I hope by now you:

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Thank You.