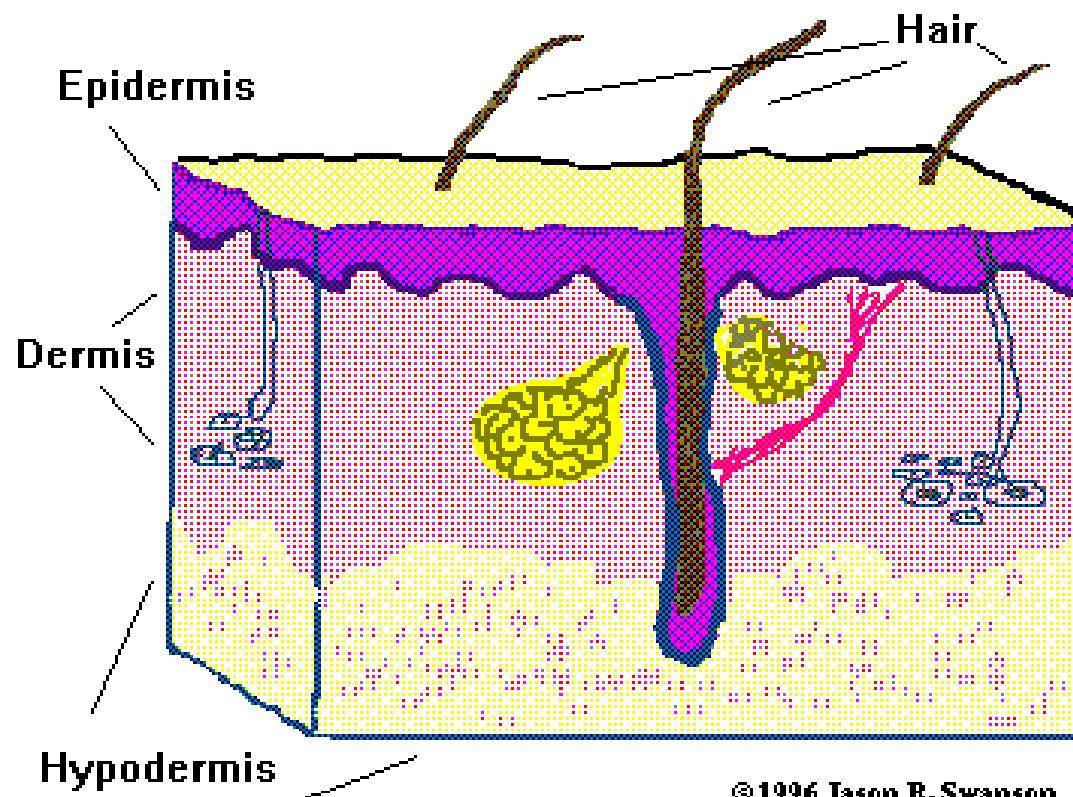


ULTRA VIOLET RAYS
EFFECTS OF ULTRA
VIOLET RAYS

SKIN LAYERS

- ⊠ Skin is made up of two primary layers that differ in function, thickness, and strength.
 - ⊠ Epidermis
 - ⊠ Dermis
 - ⊠ Subcutaneous tissue or hypodermis
-
- ⊠ The two layers are further differentiated by their respective amounts of hair follicle, pigmentation, cell formation, gland makeup, and blood supply.





EPIDERMIS

- ⊠ The epidermis is the most superficial layer of the skin and provides the first barrier of protection from the invasion of foreign substances into the body. The principal cell of the epidermis is called a keratinocyte. The epidermis is subdivided into five layers or strata,



1. Stratum germinativum
2. Stratum spinosum
3. Stratum granulosum
4. Stratum lucidum
5. Stratum corneum



STRATUM GERMINATIVUM

- ⊠ The stratum germinativum (**SG**) provides the germinal cells necessary for the regeneration of the layers of the epidermis.
- ⊠ These germinal cells are separated from the dermis by a thin layer of basement membrane.
- ⊠ After a mitotic division a newly formed cell will undergo a progressive maturation called keratinization as its migrates to the surface.



STRATUM SPINOSUM

- ⊠ The cells that divide in the stratum germinativum soon begin to accumulate many desmosomes on their outer surface which provide the characteristic "prickles" of the stratum spinosum (**SS**), which is often called the prickle-cell layer.



STRATUM GRANULOSUM

- ⊠ The progressive maturation of a keratinocyte is characterized by the accumulation of keratin, called keratinization.
- ⊠ The cells of the stratum granulosum (**SGR**) accumulate dense basophilic keratohyalin granules .
- ⊠ These granules contain lipids, which along with the desmosomal connections, help to form a waterproof barrier that functions to prevent fluid loss from the body

STRATUM LUCIDUM

- ⊠ Epidermis varies in thickness throughout the body depending mainly on frictional forces and is thickest on the palms of the hands and soles of the feet.
- ⊠ The stratum lucidum is normally only well seen in thick epidermis and represents a transition from the stratum granulosum to the stratum corneum.



STRATUM CORNEUM

- ⊠ As a cell accumulates keratinohyalin granules, it is thought that rupture of lysosomal membranes release lysosomal enzymes that eventually cause cell death.
- ⊠ The dead and dying cells filled with mature keratin form the stratum corneum (**SC**).
- ⊠ The deeper cells of the stratum corneum retain their desmosomal junctions, but as they are pushed to the surface by newly forming cells of the stratum germinativum (**SG**), the dead cells gradually break apart and are lost, a process called desquamation.



- ⊠ In stratum lucidum and stratum corneum cells are flattened,, lost their nuclei
- ⊠ A blister following UV is caused by the effusion between SL and SG and heal without scarring, cells of growing layer remain intact
- ⊠ While in ulcer, these cells are destroyed and heal by scarring



DERMIS

- ⊠ The dermis (**D**) assumes the important functions of thermoregulation and supports the vascular network to supply the avascular epidermis with nutrients.
- ⊠ The dermis is typically subdivided into two zones, a papillary dermis and a reticular layer.
- ⊠ Papillary dermis contains blood vessels
- ⊠ The dermis contains mostly fibroblasts which are responsible for secreting collagen, elastin and ground substance that give the support and elasticity of the skin.
- ⊠ Also present are immune cells that are involved in defense against foreign invaders passing through the epidermis.

- ⊠ The deeper part of dermis contains sweat glands, whose ducts pass in spiral manner to the surface
- ⊠ Hair follicles extends from the dermis to the surface of the skin.
- ⊠ The ducts of the sebaceous glands open into the hair follicles in the dermis
- ⊠ Whenever the hair is erected by contraction of the erector pili muscle
- ⊠ Sebum is squeezed out of the gland into the hair follicle, and to the surface
- ⊠ Sebum is a fatty material which is absorbed into the superficial part of the skin and keep it supple.
- ⊠ Sebum contains cholesterol and associated substance 7-dehydrocholesterol,
- ⊠ Nerve fibers ending in touch corpuscles and other sensory end organs
- ⊠ Below the dermis is superficial fascia containing fat.
- ⊠ **The skin is between ½ and 2 mm in thickness, being thickest in the palms of hands and soles of the feet.**



PENETRATION OF RAYS IN THE SKIN

- ⊠ UV rays 2900__1890A, absorbed in superficial epidermis
- ⊠ UV rays 3300__2900A, absorbed in deep epidermis
- ⊠ UV rays 3900__3300A, absorbed in the blood of superficial capillary loops in the dermis
- ⊠ When compression therapy is given by Karomayer lamp, blood is driven out of the capillaries and long UV rays can penetrate more deeply
- ⊠ VR 5000__3900A(the violet end) absorbed in superficial capillaries of the dermis
- ⊠ VR 5000__7700A(the red end) penetrate more deeply and can pass through the skin(sun appear red on foggy days)
- ⊠ Short IR rays 12000__7700A, penetrate the subcutaneous tissues
- ⊠ Long IR >12000A absorbed in superficial epidermis

PHYSIOLOGICAL EFFECTS

1. Local
2. General



LOCAL EFECTS



ERYTHEMA REACTION

- ⊠ UV rays, when absorbed in the skin can cause chemical action, results in irritation and destruction of cells
- ⊠ Liberation of H substance, produces triple response same as Histamine(inflammation)
 1. Dilatation of capillaries: directly due to the chemical action of substance H
 2. Dilatation of arterioles: axonal reflex
 3. Exudation of fluid into the tissue: increased permeability of capillary walls
- ⊠ Erythema may be the inflammatory response
- ⊠ **Intensity of reaction**
 1. **Mild dose:** slight reddening, no other symptoms, soon fades
 2. **Longer exposure:** red, hot and sore, marked vasodilatation, exudations and white blood corpuscles into the skin
- ⊠ Edema of the skin results, if the exudate separates the stratum granulosum and stratum lucidum, a blister is formed
- ⊠

⊠ Rays of different wavelength

1. Wavelength in the region of 2500A:
absorbed in superficial epidermis, cause changes, erythema results. If superficial epidermis is absent, the effect is reduced as the reaction the produces are peculiar to the superficial epidermis
2. Wavelength in the region of 2970A:
absorbed in deep epidermis, reaction, erythema etc. effects of these rays are increased if epidermis is removed, as they can penetrate deeper.



- ⊠ Following UV irradiation erythema appears up to 12 hrs after the exposure
- ⊠ Can be visible sooner after stronger dose than a weaker one
- ⊠ While IR rays produce erythema during exposure(a way it differ from UV erythema)
- ⊠ IR rays produce erythema by direct affecting the blood vessels, while UV indirectly by chemical reaction



FOUR DEGREES OF ERYTHEMA

⊠ **1st degree erythema;**

⊠ Slight reddening of skin, with no irritation or soreness. It fades within 24 hrs

⊠ **2nd degree erythema;**

⊠ More marked reddening, with slight irritation. It fades in 2 or 3 days.

⊠ **3rd degree erythema;**

⊠ Marked reddening, which is hot, sore and edematous. Redness does not disappear on pressure, last for about a week

⊠ **4th degree erythema;**

⊠ Similar to 3rd degree but blisters form

THICKENING OF EPIDERMIS

- ⊠ Destruction of superficial cells _____ increase production in SG_____ so epidermal thickening_____ protection against rays_____ stronger dose to repeat erythema



DESQUAMATION

- ⊠ Casting off dead cell from the surface of body
 - ⊠ Occur after erythema
 - ⊠ Accelerate normal process(UV damages the cell)
 - ⊠ Amount of peeling depends on strength of erythema reaction
1. 1st degree____ imperceptible
 2. 2nd degree____ fine powdery peeling
 3. 3rd & 4th degree____ free peeling

PIGMENTATION

- ⊠ Rays of wavelength 2900__3300A absorb in deep epidermis
- ⊠ Convert tyrosine into melanin
- ⊠ More marked on darker complexion than lighter
- ⊠ Pigmentation by sun and carbon arc is brown
- ⊠ By mercury vapour lamp is greyish
- ⊠ Pigmentation protect against skin carcinomas and infections



EFFECTS OF ABIOTIC RAYS

⊠ ABIOTIC RAYS;

⊠ UV <2900A

⊠ As they are inimical to life

⊠ They may inhibit the growth of seedling and kill bacteria on skin(considerable exposure is necessary)

⊠ do not effect the under lying tissue but may cause damage to superficial layers

⊠ BIOTIC RAYS;

⊠ >2900A

⊠ Beneficial to life



GENERAL EFFECTS



FORMATION OF VITAMIN D

- ⊠ UV rays of 2700 __3100A
- ⊠ Convert dehydrocholesterol to vitamin D
- ⊠ Sebum__ on the surface of skin
- ⊠ Function of vitamin D



ESOPHYLACTIC EFFECTS

- ⊠ The reticulo-endothelial system is important in body's defense against infection
- ⊠ The ingest bacteria n produce antibodies
- ⊠ The stimulus necessary to cause this reaction is presence of bacteria and their toxins
- ⊠ UV rays lower the threshold of cells, so that antibodies are produced more readily.
- ⊠ This is known as the esophylactic effect
- ⊠ UV rays of $>2900 \text{ \AA}$ is used so they may penetrate to the level where reticulo endothelial cells are found

GENERAL TONIC EFFECTS

- ⊠ General tonic effect
- ⊠ Appetite and sleep being improved
- ⊠ Irritability reduced



THERAPEUTIC EFFECTS



EFFECTS OF GENERAL ULTRA VIOLET IRRADIATION



FORMATION OF VITAMIN D

- ⊠ Beneficial for rickets and other vitamin D deficiencies
- ⊠ Prevention as well as treatment
- ⊠ Wave length_____
- ⊠ Larger areas to irradiated and prolonged course of time
- ⊠ Fluorescent tubes are more likely to used



IMPROVED RESISTANCE TO INFECTION

- ⊠ The principle of esophylactic effect



PIGMENTATION AND IMPROVED CONDITION OF THE SKIN

- ⊠ Especially psoriasis get benefit from UV rays
- ⊠ Mechanism of action is not clear
- ⊠ May be due to increase blood supply to skin



GENERAL TONIC EFFECTS

- ⊠ Patient suffering from debility
- ⊠ Under weight children



EFFECTS OF LOCAL ULTRA VIOLET IRRADIATION



INCREASED BLOOD SUPPLY TO THE SKIN

- ⊠ Vasodilatation
- ⊠ Increased blood flow
- ⊠ Increased O₂ and food stuff
- ⊠ Treatment of;
 1. Bedsores
 2. Indolent wound
 3. Psoriasis
 4. Acne
 5. Alopecia
 6. Chilblains
- ⊠ 2nd / 3rd degree erythema dose is given



DESTRUCTION OF BACTERIA

- ⊠ UV initiate inflammatory process_____
- ⊠ Reinforce normal body mechanism of destroying bacterias
- ⊠ Treatment of superficial bacterial infection i.e. boils, infected wounds, adenitis, acne
- ⊠ **Dose**
- ⊠ Infected wound____ 4th degree erythema
- ⊠ Boil _____ 3rd degree erythema
- ⊠ Acne _____ 2nd degree erythema
- ⊠ Abiotic rays

DESTRUCTION OF TISSUE

- ⊠ Strong doses of UV may damage the superficial cells
- ⊠ Treatment of indolent wounds
- ⊠ Shorter UV rays
- ⊠ 4th degree erythema



STIMULATION OF GROWTH OF EPIDERMIS

- ⊠ UV irradiation, thickening of epidermis
- ⊠ Production of repair hormone
- ⊠ Accelerate the healing process
- ⊠ Rx____ indolent wound



INCREASED RESISTANCE OF SKIN TO INFECTION

- ⊠ Due the result of
Increased blood supply, WBCs,
pigmentation
- ⊠ Prevention of spread of infection
- ⊠ Boils n acne
- ⊠ 2nd n 3rd degree erythema



DESQUAMATION

- ⊠ Rx of acne
- ⊠ In acne thickening of epidermis, hair follicles are narrowed, sebum can not escape
- ⊠ Peeling result in removal of thickened epidermis and escape of sebum
- ⊠ Not a permanent Rx but improves skin condition
- ⊠ Free peeling with 3rd degree erythema is more affective but not applicable
- ⊠ So 2nd degree erythema dose is recommended

COUNTER IRRITATION

- ⊠ Absorption of UV irritate the superficial nerves
- ⊠ So relief pain by counter irritation
- ⊠ 3rd degree erythema dose is satisfactory
- ⊠ Karomayer lamp____ lesion is localized
- ⊠ Air cooled lamp____ area is 250 cm²
- ⊠ **Advantages**
- ⊠ Effect is maintained for several days
- ⊠ Can be applied to the skin with defective skin sensation i.e. heat treatment is unsafe

SENSITIZERS



⊠ “UNDER CERTAIN CIRCUMSTANCES AN INDIVIDUAL MAY BECOME MORE SUSCEPTIBLE THAN NORMAL TO THE EFFECTS OF SOME AGENT, AND ANY FACTOR THAT INCREASE THE SENSITIVITY IN THIS WAY IS TERMED AS SENSITIZR”



SENSITIZERS TO UV RAYS

- ⊠ **Coal tar ointment;**
- ⊠ Applied to psoriasis
- ⊠ This is used intentionally before irradiation to increase the effect of rays
- ⊠ **Infra red irradiation;**
- ⊠ Acts as sensitizer, when the erythema by IR is present
- ⊠ **Some medicine;**
- ⊠ Gold, sulphonamide, insulin, thyroid extracts, quinine, tetracycline group etc.
- ⊠ Results in excessive erythema reaction or rash
- ⊠ **Certain foods;**
- ⊠ Strawberries, eggs, lobster
- ⊠ **Some local applications;**
- ⊠ Aniline dyes

CONTRAINDICATIONS

⊠ Some individuals;

⊠ Sensitive skin

⊠ Who develops headache, nausea, vomiting rise of temperature following exposure,

⊠ Treatments

⊠ Not use in conjunction with drugs acts as sensitizer

⊠ Recent X-rays treatment(skin carcinoma)

⊠ Diseases

⊠ Pulmonary tuberculosis

⊠ Acute eczema or dermatitis

⊠ Rise in temperature(from any cause)

