Sun protection
Sunscreen and beyond

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- No relevant conflict of interest

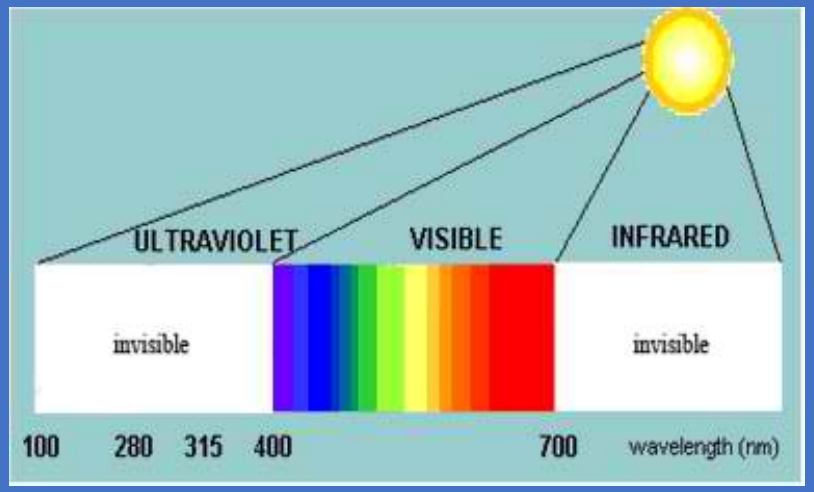
- Advisory board member of :
- Penthrox
- Johnson & Johnson
- SanofiGenzyme
- Galderma

Outlines

- To discuss the harmful effects of sun exposure
- To discuss different types of sunscreens
- To discuss other methods of sun protection
- To discuss current sunscreen controversies

Sun rays

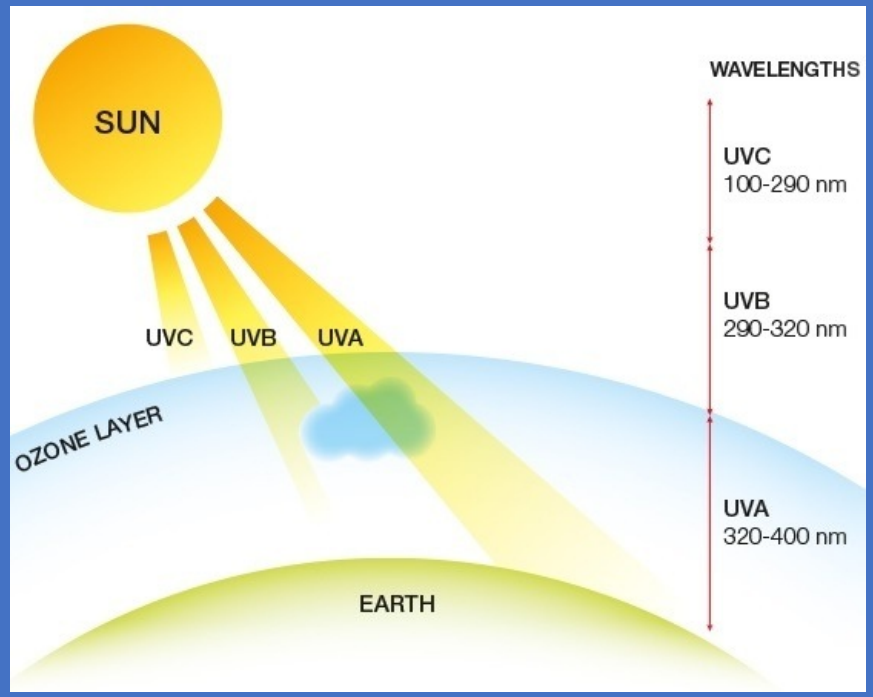
- The Sun emits its energy as the electromagnetic waves
- 99% of sun's rays are visible light, infrared and UV
- UV is the most important modifiable risk factor for skin cancer
- Sun exposure may have some health benefits



http://www.generationalenergy.com/images/window%20light%20spectrum%20pic.jpg

Ultraviolet light

- Divided into three different bands:
- UVC is completely absorbed by earth atmosphere
- UVB is mostly absorbed :5% of UV at earth surface
- UVA is less absorbed: 95% of UV at earth surface



https://qph.fs.quoracdn.net/main-qimg-82e6b5933740db4fb5a9332c7cbbfe4b-c

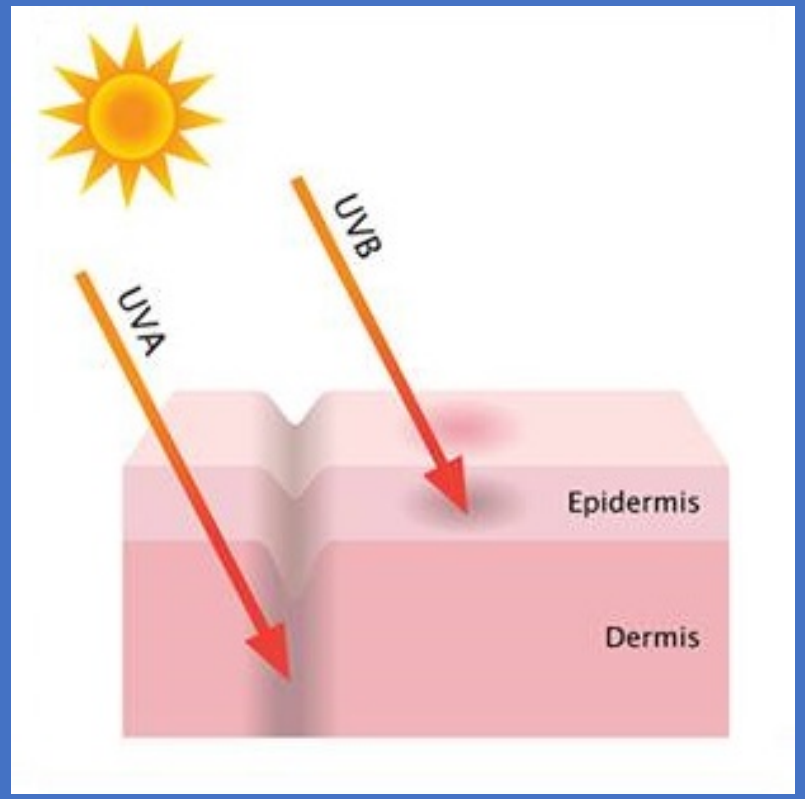
UVA vs UVB

- UVB intensity varies according to time of the day , season and location
- UVA more constant without variations due to the time of day or year
- UVA passes through clouds
- UVB blocked by clouds

http://baydd.org/content/img

UVA vs UVB

- UVA has less energy but penetrates deeper into the skin



http://www.lightcontrolfilm.com/wp-content/uploads/image005-2.jpg

UVA vs UVB: Sunburn

- Sunburn is caused by UV induced inflammation and apoptosis of skin cells
- Mostly mediated by UVB

Wikipedia

UVA vs UVB : Tanning

- The process of the darkening of skin color mostly caused by UVB
- Damaged skin trying to make more melanin to protect against further damage
- Suntan can offer just a SPF of 2 -3

UVA vs UVB :Aging

- Mostly mediated by UVA as penetrates deeper
- For 28 years, the trucker has had his left side exposed to UVA rays transmitted through his window – whereas his right side was covered and relatively unharmed
- Good example of UVA passing through glass

NEJM April 2012
https://sawyer.com/wp-content/uploads/2013/12/tech-sun5.gif

UVA vs UVB : Skin cancer

- Both Non melanoma skin cancers and melanoma are linked to sun exposure
- UV-A causes free radical production, resulting in oxidative damage
- UV-B induces DNA mutation

- Both induce immunosuppression which reduces the body's ability to destroy mutations

History of sun protection

- Before industrial revolution pallor was popular hinting at a indoor life of leisure
- With industrial revolution working class moved into factories and prestige of pale skin faded
- In 1890 the lack of sun exposure was linked to Rickets
- In 1923 Coco Chanel was photographed after tanning on a Mediterranean cruise
- That went viral . Obsession with tanning began
- During the 1990s, dermatologists started serious efforts to promote sun protection

https://harvardneuro.files.wordpress.com/2015/10/coco_chanel_1920.jpg?w=600&h=437

Sun protection

- Sun protection is necessary to decrease the risks associated with UV exposure
- UV exposure can be avoided by following strategies :
- Sunscreens
- Protective clothing
- Shade/Avoidance

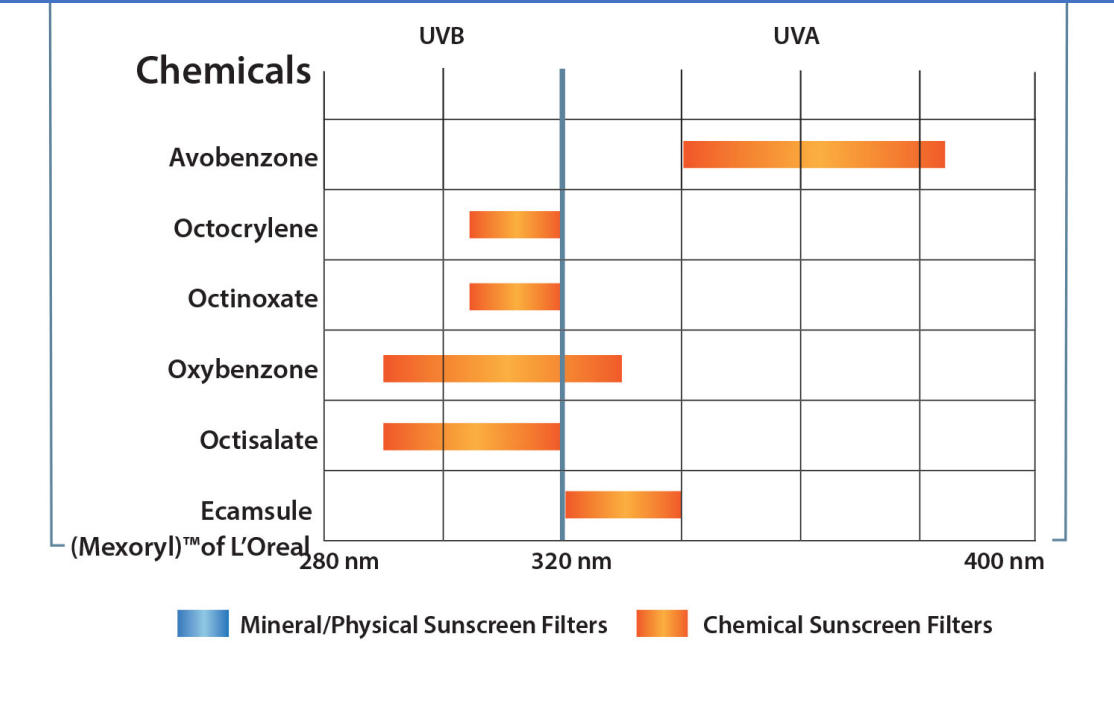
Sun protection : Sunscreens

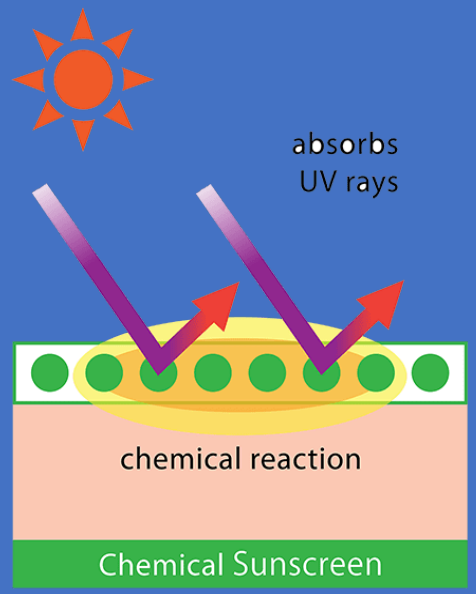
- Form a coating on the surface of skin that “filters out” UV

- Two main groups of sunscreen

Organic (Chemical sunscreens)

- Organic substances that absorb UVB and /or UVA
- The absorbed UV will change to heat
- Used in combination because no single one provides sufficient protection

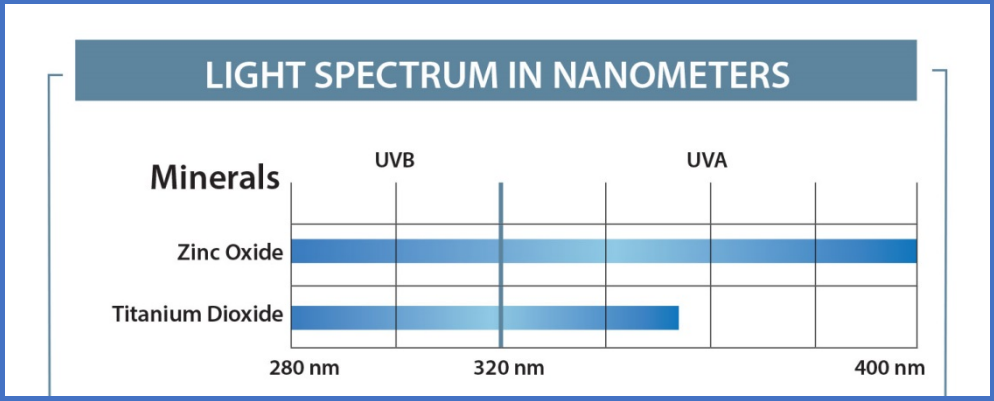


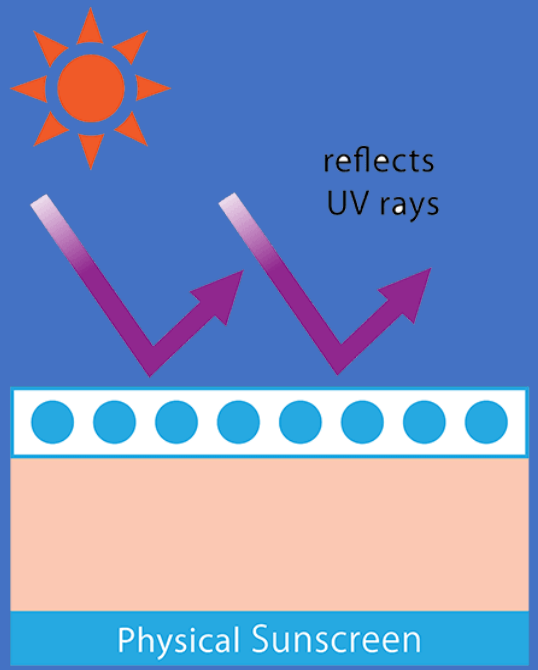


https://49ylquvj9d1n24l11tphxbuc-wpengine.netdna-ssl.com/wp-content/uploads/2018/03/chemical-vs-physical-sunscreens_small-min.png

Inorganic or physical sunscreen

- Reflects and scatter both UVA and UVB
- Mineral compounds such as Titanium dioxide and zinc oxide
- Opaque nature and whitening effects can be problematic
- Improved by micronized forms





http://tizofusion.com/wp-content/uploads/2017/12/chemical_physical-sunscreen-chart.jpg

http://citizensofbeauty.com/wp-content/uploads/2015/05/chemical-vs-physical-sunscreen.jpg

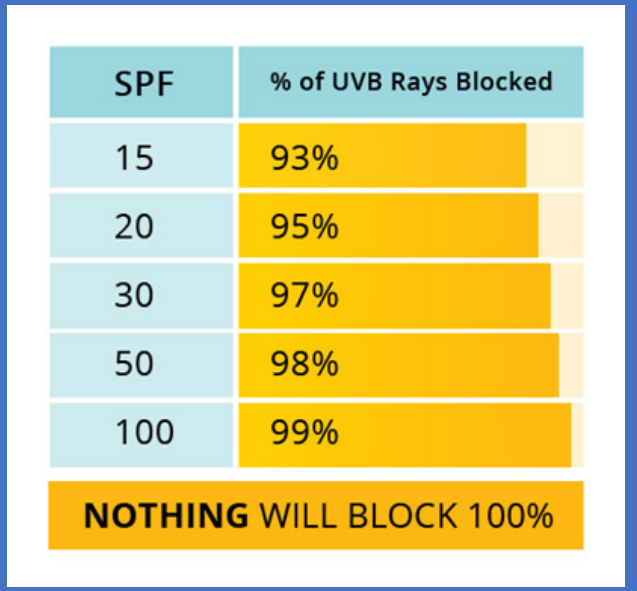
Sunscreen efficacy : SPF

- SPF measures a sunscreen ability to filter UVB
- Protected versus unprotected skin are exposed to simulated sunlight
- SPF is a measure of how much UVB is required to produce sunburn on protected skin (2 mg/cm2 sunscreen) relative to unprotected skin

https://www.derma-tronnier.de/sites/default/files/styles/detail_retina/public/page/_mg_5445.jpg?itok=9VcX-BKo

SPF

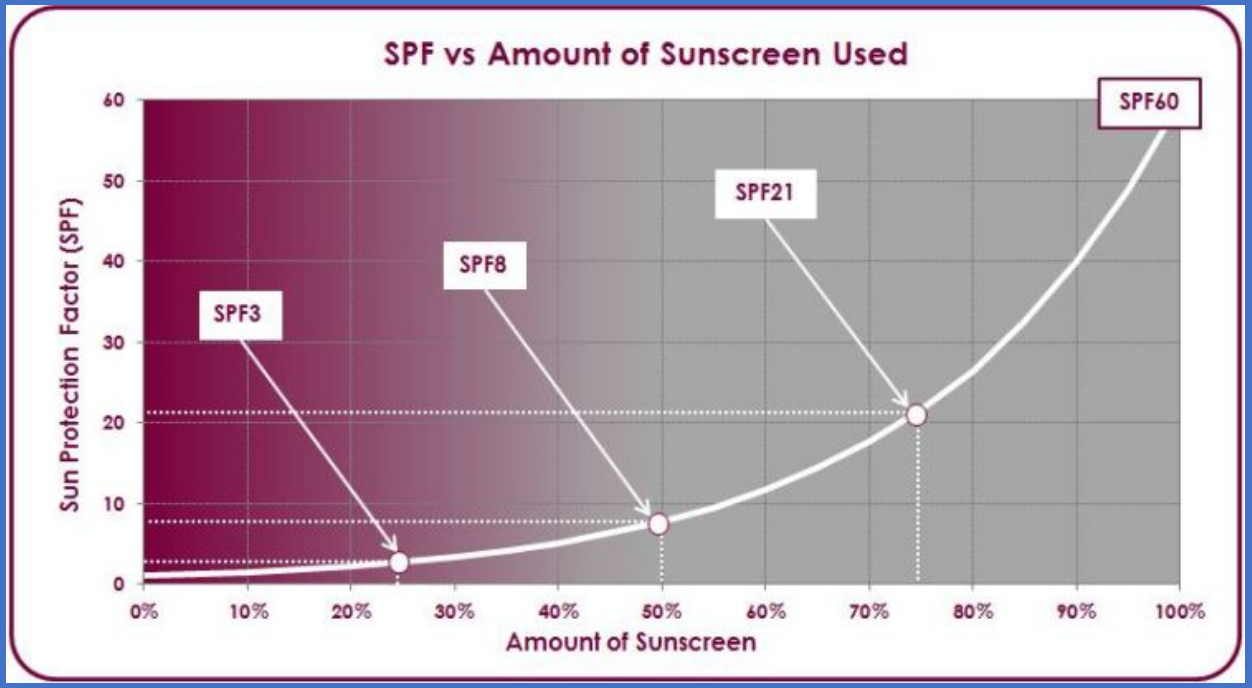
- The larger the SPF value, the greater the sunburn protection
- However SPF higher than 50 offer negligible extra protection
- High-SPF products may encourage staying in the sun longer with a false sense of security
- We usually suggest an SPF of at least 30



https://vvazw1o18pf4bhdd434btzh7-wpengine.netdna-ssl.com/wp-content/uploads/2015/07/uv-block.jpg

Sunscreen efficacy : SPF

- The SPF claimed comes with the amount used when testing
- Most people only apply 25-50% of that
- SPF decreases with inadequate use
- Higher SPF sunscreens may compensate for common underapplication



https://www.badgerbalm.com/blog/wp-content/uploads/2015/07/Applying-Mineral-Sunscreen1.jpg

Sunscreen efficacy : UVA

- UVA is also harmful
- A good Sunscreens should protect from UVA too
- The SPF is not related to protection against UVA-induced damage
- UVA protection factor measurement is complicated
- Look for Broad Spectrum label

Broad spectrum label vs SPF

- Broad spectrum label is just a pass or fail mark
- It does not quantify the UVA protection
- As SPF increases, the UVA protection is not necessarily increasing
- So be careful when using high SPF sunscreen
- You wont burn but you get overexposed to harmful UVA

Sunscreen: How much to use?

- Two milligrams of sunscreen per square centimeter of skin
- It takes 35 gr per application to cover properly an adult body surface area

Sunscreen : Application frequency

- General recommendation: reapply sunscreen every 2-3 hours
- Not tested adequately
- Reapplication can compensate for initial underapplication
- If the appropriate amount is initially used, reapplication is necessary only after activities that remove the sunscreen within an 8-hour period

How Long Before Exposure Should Sunscreen Be Applied?

- 15 to 30 minutes ?
- No data to suggest that there is a delay in sunscreen efficacy
- It seems sunscreen offered immediate protection when applied
- Reasonable to wait 15-30 minutes before water exposure to ensure water resistance

Do people of color need sunscreen?

- The average SPF of black skin is 13.4 as compared with white skin, which is 3.4

- Much less than recommended

Should I use sunscreen when indoor ?

- If windows present :
- Yes as UVA passes through
- If no window ?

- Incandescent bulbs have little to no UV irradiance
- LED does not emit UV
- Halogen lamp usually ok as they are doped or have glass shield
- Fluorescent lamps may increase lifetime UV exposure based on distance from skin.
- Long fluorescent tube safer than compact fluorescent tube
- As long as there is at least 30 cm distance with the light the risk should be very low

https://bchsgroup.com/wp-content/uploads/2018/01/bulbs.png

Are sunscreen safe?

- February 2019 :FDA announced the new proposed sunscreen guidelines
- GRASE “Generally Recognized As Safe and Effective” just for titanium dioxide and zinc oxide as no systemic absorption
- All chemical sunscreen agent need more data to be labels as GRASE

What does it mean?

- FDA has not deemed the chemical sunscreen unsafe
- FDA is asking manufacturers for more data:
- Whether and to what extent, the chemical sunscreens are absorbed into the body
- Whether absorbing sunscreen would increase the risk for cancer, birth defects…

What should be recommended?

- Patient can be assured to continue using the same sunscreens currently using.
- For pregnant women and children, it may be best to suggest mineral sunscreens

Which form of sunscreen ?

- New FDA proposed rules:
- Oils, lotions, creams, gels, pastes, ointments, and sticks are OK.
- Spray sunscreens are Ok as long as they pass inhalation particle size & flammability testing.
- Further data needed for sunscreen powders, wipes, body washes, and shampoos to be deemed GRASE.

Sunscreen and kids

- No sunscreen before 6 months of age as physiologically their skin is immature and potential risks of nanoparticles and UV filters being absorbed

- Photoprotection should be based largely on behavioural modification such as avoiding peak UV hours, seeking shade, and using protective clothing

Sunscreen and coral reef

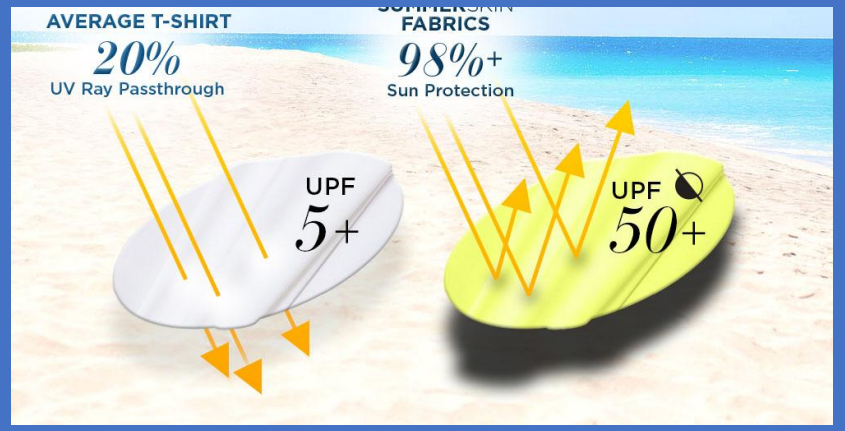
- Coral reefs are colonies of tiny animals found in marine waters

- When under stress Corals “bleach,” meaning turning white
- It seems two sunscreen agents oxybenzone and octinoxate can hurt corals
- Hawaii initiated the first ban of these two sunscreens

https://media.fromthegrapevine.com/assets/images/2015/6/Colorful%20coral%20reef.jpg.824x0_q71_crop-scale.jpg

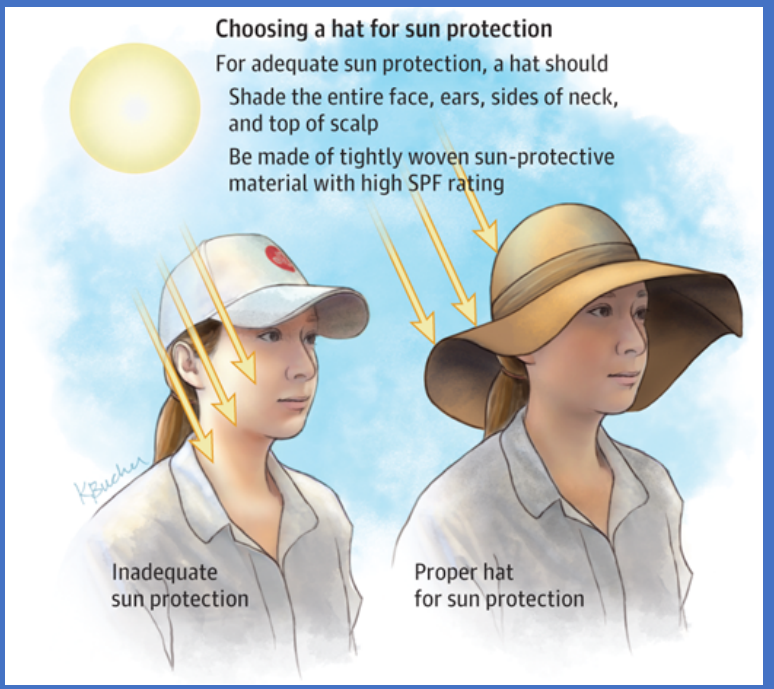
Clothing

- Can be used as a measure of sun protection depending on how much light passes through
- A practical tip :hold the garment up to sun to see how much light shines through
- The efficiency of clothing to block UV is measured by UPF(ultraviolet protection factor)
- UPF indicates how much of the UV is passed through the fabric
- A fabric with UPF of 50 allows $1/50^{th}$=2% of the sun's UV to pass (98% block)
- A UPF rating of 5 : $1/5^{th}$ (20%) of UV to pass through it



Hat

- Should protects face, back of the neck, eyes and ears
- Broad-brimmed, bucket or legionnaire hats are the best
- Baseball or peaked caps and sun visors not recommended



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https://cdn11.bigcommerce.com/s-g4ufd5e/images/stencil/500x500/products/431/1343/Sun-busters-girls-uv-legionnaire-hat-tangelo__13640.1522315667.jpg?c=2&imbypass=on

https://jamanetwork.com/journals/jama/fullarticle/2383280

Sun glasses

- UV exposure : Photokeratitis, cataracts, macular degeneration, pterygium
- Sunglasses should block both UVA and UVB rays
- Usually labeled as UV400 means that the glasses absorb up 400 nanometers
- Wraparound-style frames

Shade

- Can be used as a UV protecting tool
- Blocks only the direct UV
- Reflected UV from surfaces like sand and water can reach skin if just overhead shade
- Amount of indirect UV is proportional to the amount of visible sky from shade

https://i.pinimg.com/originals/a9/08/e2/a908e27d4109072baac61cc6ce85503c.jpg

Sun avoidance

- The most effective way but not very practical
- Avoid being out between 11 am and 3 pm as much as possible

When should sun protection be practiced?
UV index

- To answer this question UV index was developed
- A communication tool to forecast the amount of **sunburn producing UV** on a particular day
- The higher the UV Index, the greater the strength of the erythemogenic UV
- If a light-skinned individual begins to sunburn in 30 minutes at UV Index 5, then that individual will burn in 15 minutes at UV Index 10

When should I practice sun protection?
UV index

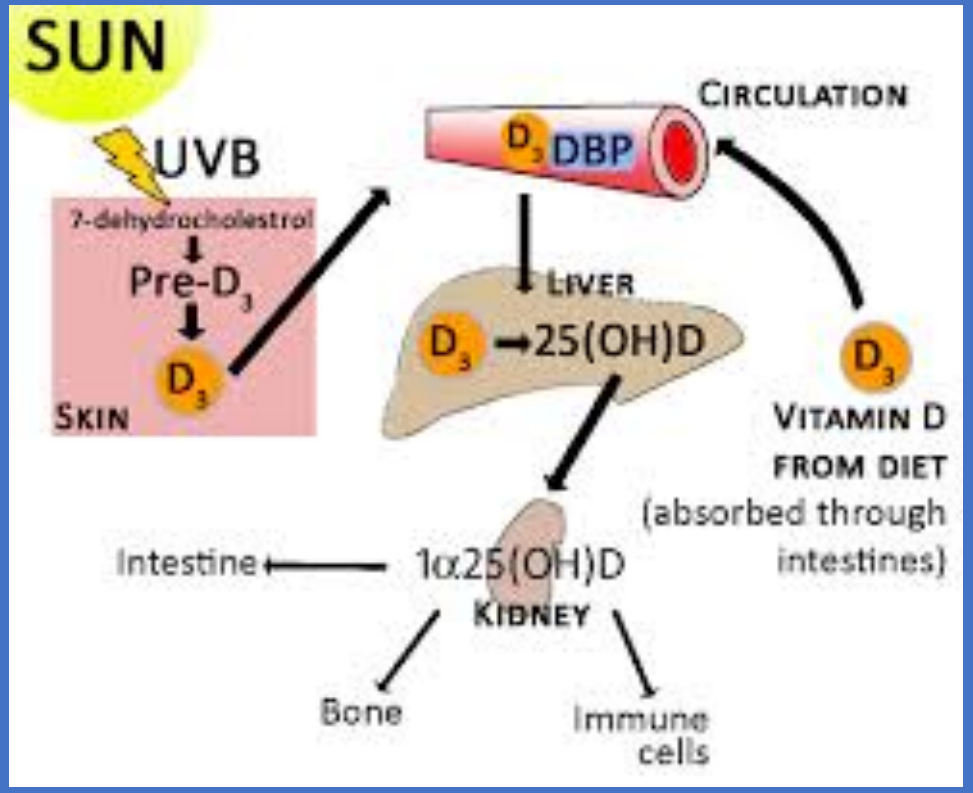
- Public health organizations suggest sun protection if UV index higher than 3
- This focuses on avoiding sunburn since UVI is a measure of erythemal UV

When should I practice sun protection? UV index

- DNA damage occurs even with suberythemal doses of UV radiation
- UVA can be relatively high, even at low UVI
- Sun protection should be practiced all day if the endpoint is to prevent skin cancer and aging
- Dermatologists suggest sun protection even in low UVI all day long all year round

Sunshine vitamin

- Major source of vitamin D
- UVB is absorbed by 7-dehydrocholesterol in the skin
- D3 is metabolized in the liver and kidneys into 25-hydroxyvitamin D and 1,25-dihydroxyvitamin D respectively



http://www.doctortomah.com/dr-tomah-articles/the-sunshine-vitamin

Could we depend on sun to have enough Vit D?

- Our ancestors did.

- They had different work schedule, different clothing and were not aware of risk of skin cancer

- Life expectancy was less than 40 years of age; long-term photodamage was not a concern

Could we depend on sun to have enough Vit D?

- In higher latitudes, early morning and late afternoon and during the winter months the amount of UVB reaching the earth is reduced
- Therefore very little or no vitamin D_3 production
- Forget about making Vitamin D between October till March by exposing yourself to sun (vitamin D winter)

Could we depend on sun to have enough Vit D?

- **Sensible sun exposure during summer?**
- CDA and AAD don’t not encourage intentional sun exposure as a source of vitamin D

- Even if counting on sun exposure to make vitamin D :It's not really known exactly how much time is needed

- Probably a few minutes with forearms, hands or lower legs uncovered in midday sun

Could we depend on sun to have enough Vit D?

- Risk-benefit ratio of sun exposure should be considered
- It seems unlikely to be any completely ‘safe’ level of exposure to make vitamin D
- Darker skin people probably can benefit from moderate sun exposure without having risk of subsequent photoaging and skin cancer
- Fair skin people would have higher risk of precancerous and cancerous lesions with even quite modest exposure
- NO MATTER WHICH COLOR OF SKIN DON’T GET SUNBURN

To take home messages

- UV is the most important modifiable risk factor for skin cancer
- Sunscreen is just one of the measures of sun protection
- FDA is investigating chemical sunscreens
- However they still can be used safely as before
- Be out ,enjoy the sun but be sun smart by using shade ,clothing and sunscreen


THE SLIDE MAN – QUESTION MARK