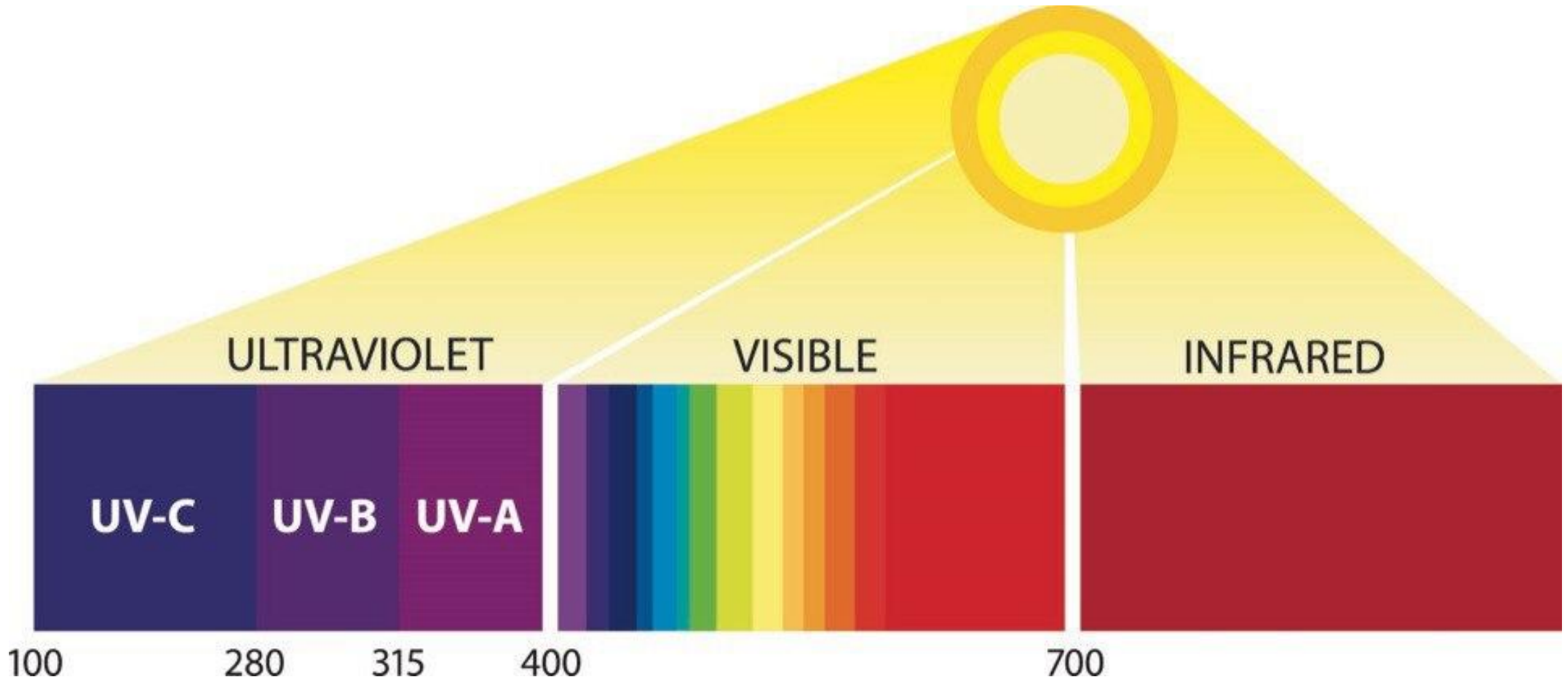
Ultraviolet radiation (UV)

Research questions:

1.What is ultraviolet?
2. What are its mechanisms?
3. How does it influence flora & fauna? Inanimate objects?
4. How is it presently applied by human?

ultraviolet radiation /ˌʌl.trəˈvaɪə.lət ˌreɪ.diˈeɪ.ʃən/- radiation lying in the ultraviolet range; wave lengths shorter than light but longer than X rays. radiation of this kind causes skin to become darker and germs to die.

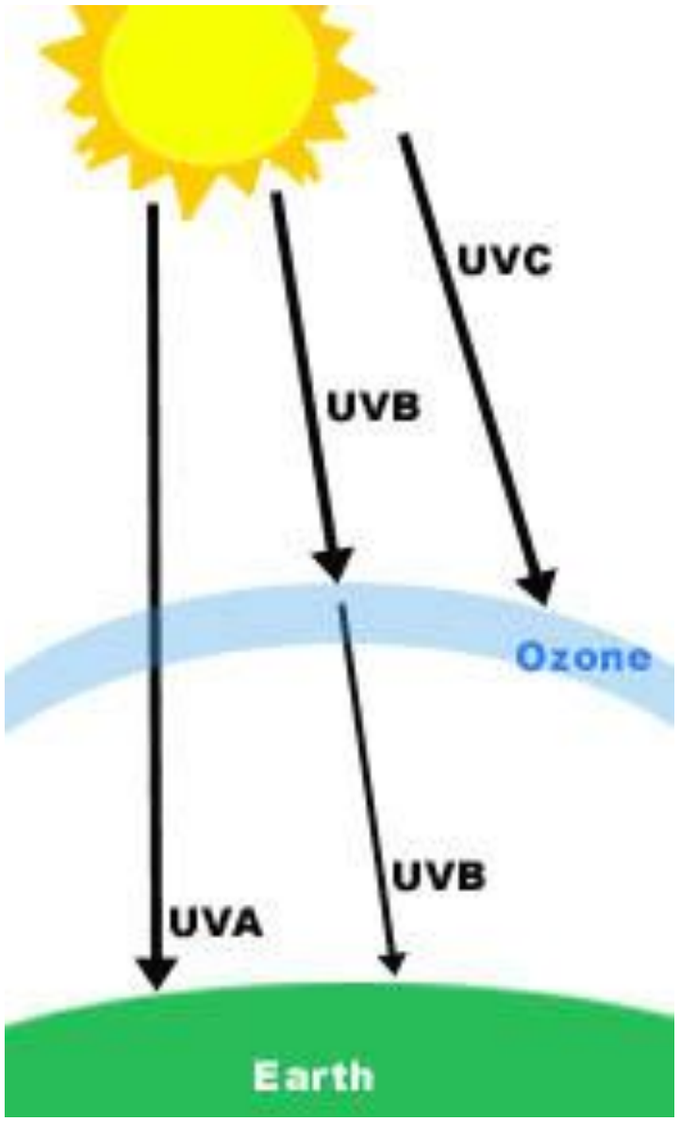


Meet, ultraviolet!

The radiation of the Sun contains a few types of emitting, which differ from one another in the wavelength. The intermediate radiation, or ultraviolet radiation, is believed to have both benign and pernicious impact on the health of living things. It is able to pass through the atmosphere even in cold and cloudy weather.

Let's consider the most common types of UV:

- **UVA** (400-315nm) rays have a relatively long wave length and represent close to 95% of the UV rays that make it to the Earth's surface .
- **UVB** (315-280nm) have a medium wave length. Only its part passes through the atmosphere.



- **UVC** (280-10nm) are considered to be the most harmful, but they do not reach the Earth's surface because they are completely filtered by the ozone layer in the atmosphere.

UVA

UVA rays age skin cells and can damage their DNA. These rays are linked to long-term skin damage such as wrinkles, but they are also thought to play a role in some skin cancers. Most tanning beds give off large amounts of UVA, which has been found to increase skin cancer risk.

UVB

UVB rays have slightly more energy than UVA rays. They can damage skin cells' DNA directly, and are the main rays that cause sunburns. They are also thought to cause most skin cancers.

UVC

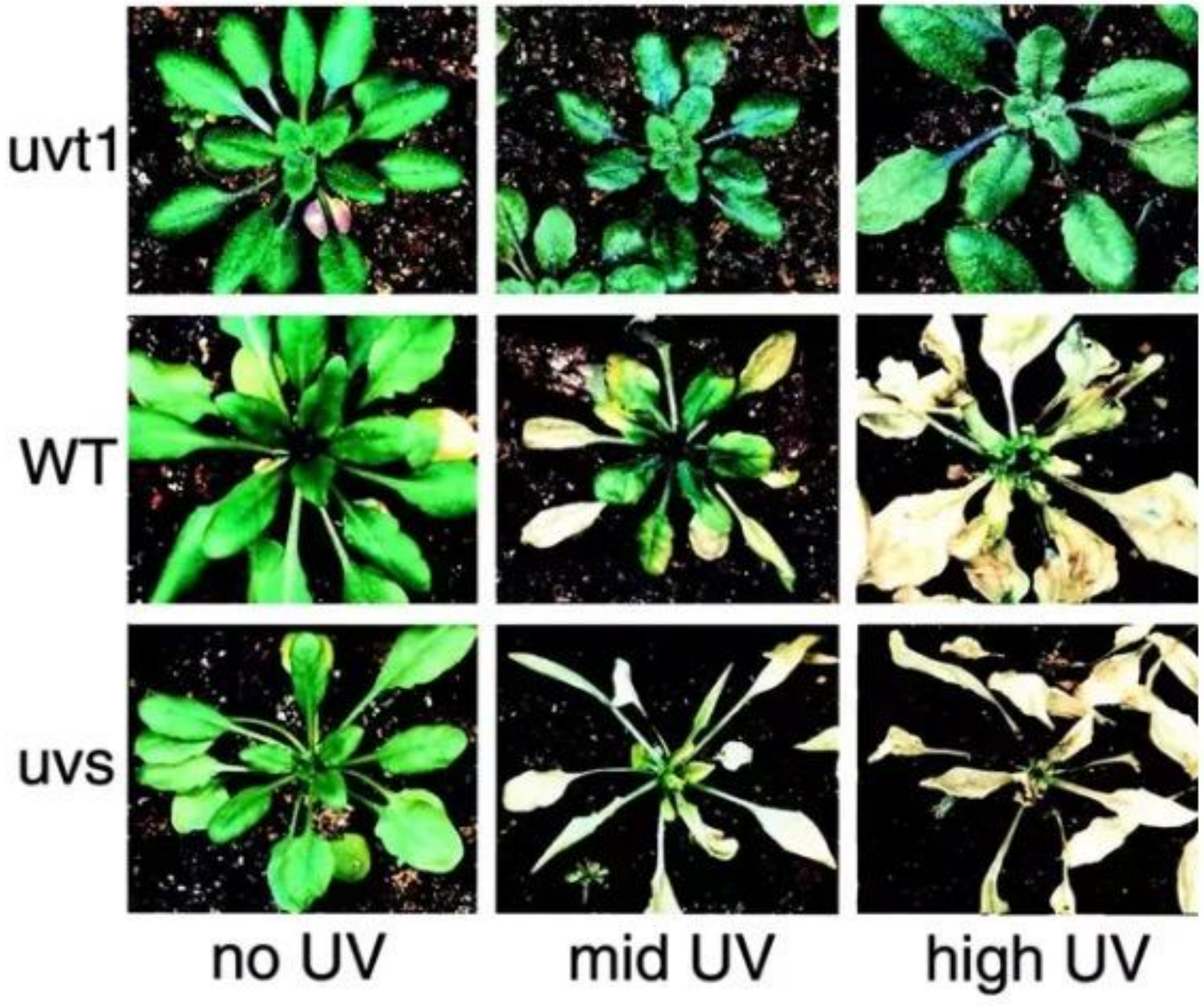
UVC rays have more energy than the other types of UV rays, but they don’t get through our atmosphere and are not in sunlight. They are not normally a cause of skin cancer.

- Both UVA and UVB rays can damage skin and cause skin cancer. UVB rays are a more potent cause of at least some skin cancers, but based on what’s known today, there are no safe UV rays.

What influence do UV rays have on the condition of living things?

Photosynthesis

UV radiation however causes production of reactive oxygen species (ROS) which may cause various type of damage to biomolecules. Extreme damage leads to cell death/chlorosis/necrosis and obviously a loss of photosynthetic process.


uvt1
WT
uvs
no UV
mid UV
high UV

Health effects

The ultraviolet radiation in sunlight has both positive and negative health effects, as it is both a principal source of vitamin D3 and a mutagen.

Beneficial outcomes

The benefits of UV can outweigh manageable risks. The human body needs some UV radiation in order for one to maintain adequate level of viability.

Vitamin D

Reasonable exposure to ultraviolet radiation from the sun can be a good source of vitamin D. Getting enough vitamin D can help stave off autoimmune diseases, cardiovascular disease, many types of cancer, dementia, types 1 and 2 diabetes mellitus, and respiratory tract infections.

Serotonin

Vitamin D promotes the creation of serotonin. The production of serotonin is in direct proportion to the degree of bright sunlight the body receives. Serotonin is a monoamine neurotransmitter that is thought to provide sensations of happiness, well being and serenity to human beings.

Melanin

The amount of the brown pigment melanin in the skin increases after exposure to UV radiation at moderate levels depending on skin type. Melanin is an excellent photoprotectant that absorbs both UVB and UVA radiation and dissipates the energy as harmless heat, protecting the skin against DNA damage.

Effects on eyes

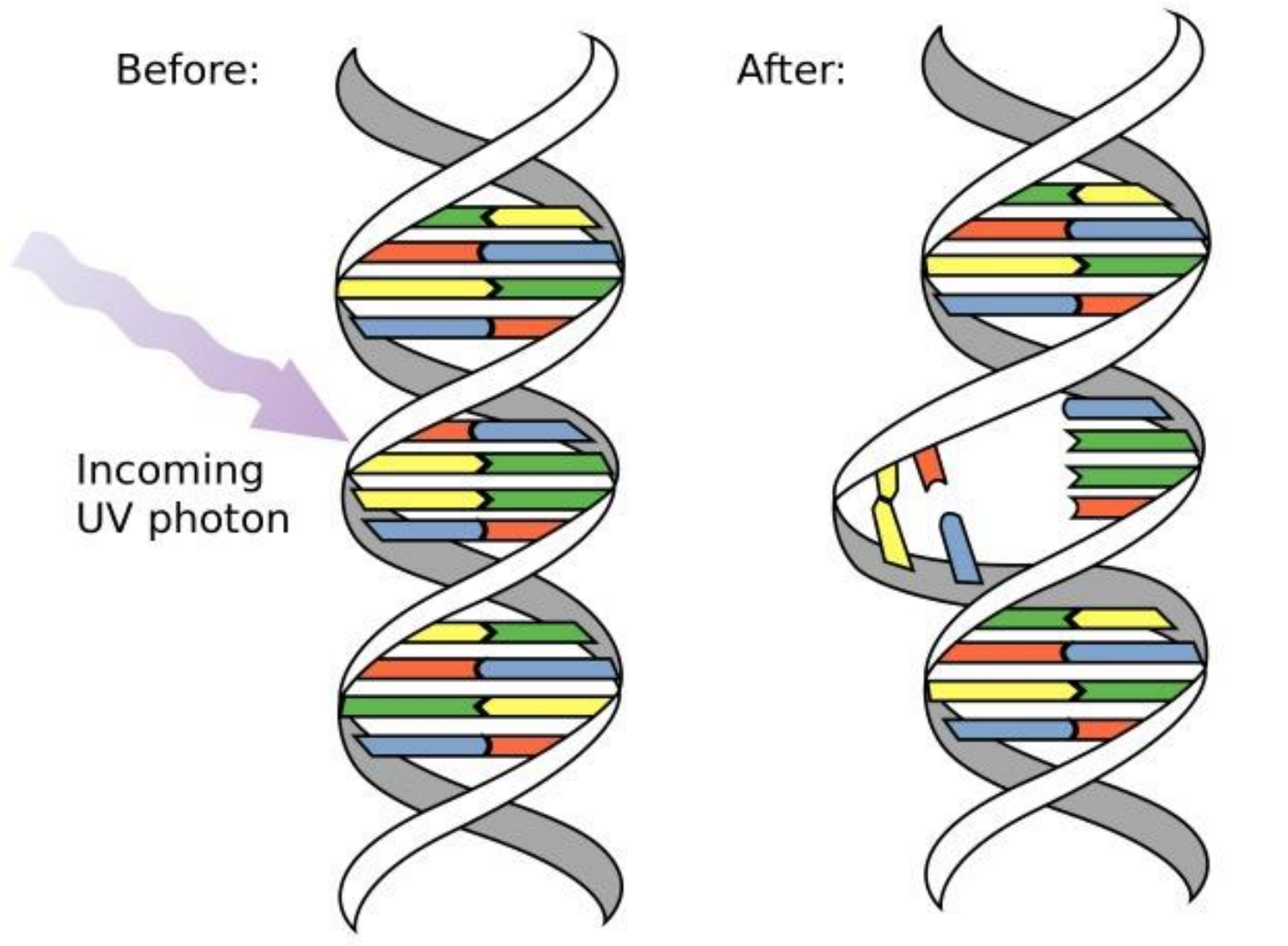
Significant daily exposure to bright light may be necessary for children to avoid myopia (nearsightedness).

Cardiovascular & hypertension

There are significant archives of studies demonstrating that individuals with more sun exposure synthesize more active vitamin D from their diet, which reduces the possibility of problems with blood pressure.

Harmful effects

Excessive exposure to UV radiation can result in acute and chronic harmful effects on the skin, eye, immune system and DNA.



Skin damage

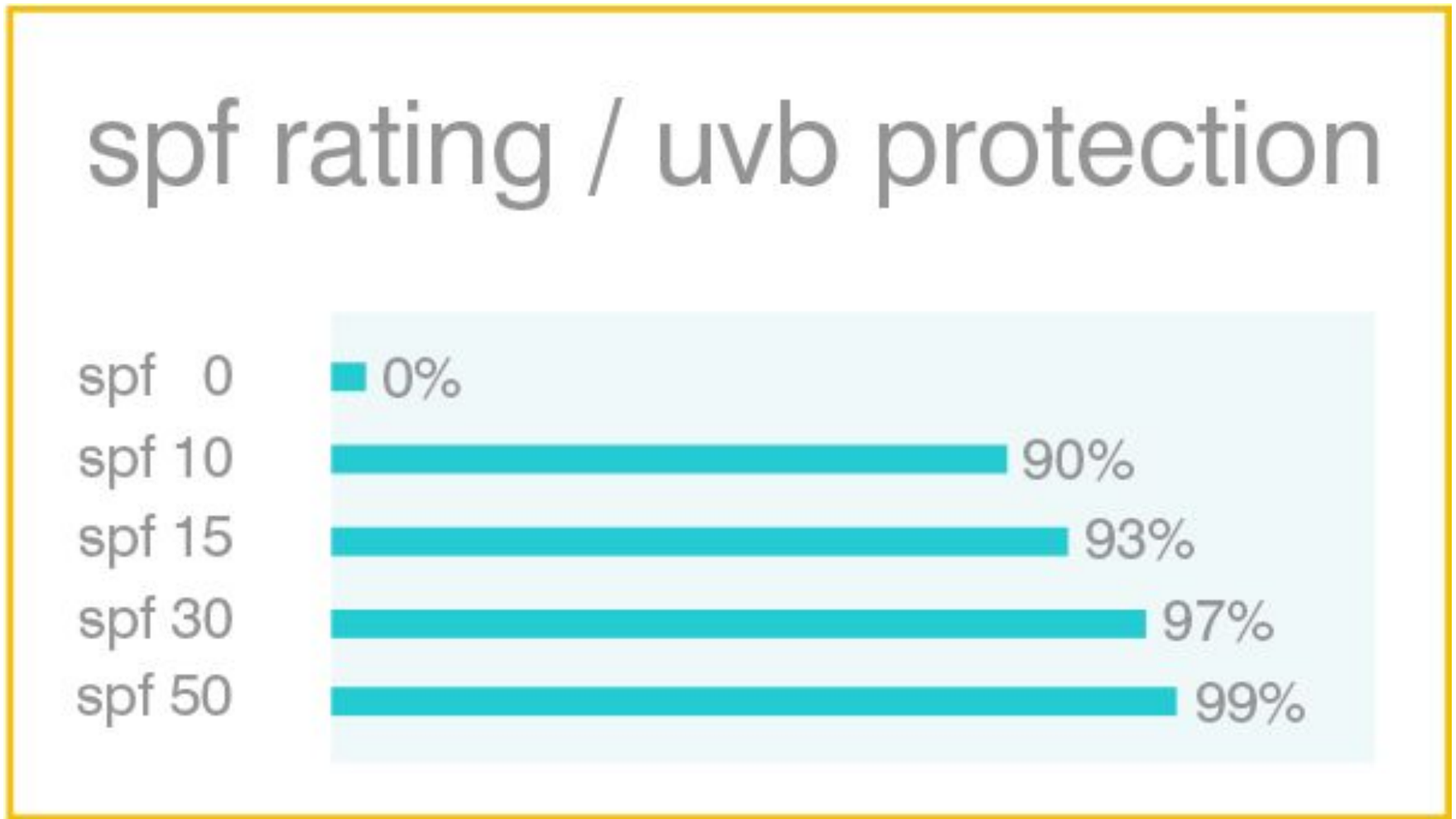
All bands of UV radiation damage collagen fibers and accelerate aging of the skin. Both UVA and UVB destroy vitamin A in skin, which may cause further damage. UVB radiation can cause direct DNA damage.

Eye damage

Prolonged optical exposure to sunlight, especially intense ultraviolet light, may be linked to cortical cataracts. Short-term over-exposure can cause snow blindness, which is analogous to sunburn of the cornea, or can cause solar retinopathy, which is long-lasting retinal damage and vision impairment from sungazing.

UV skin protection

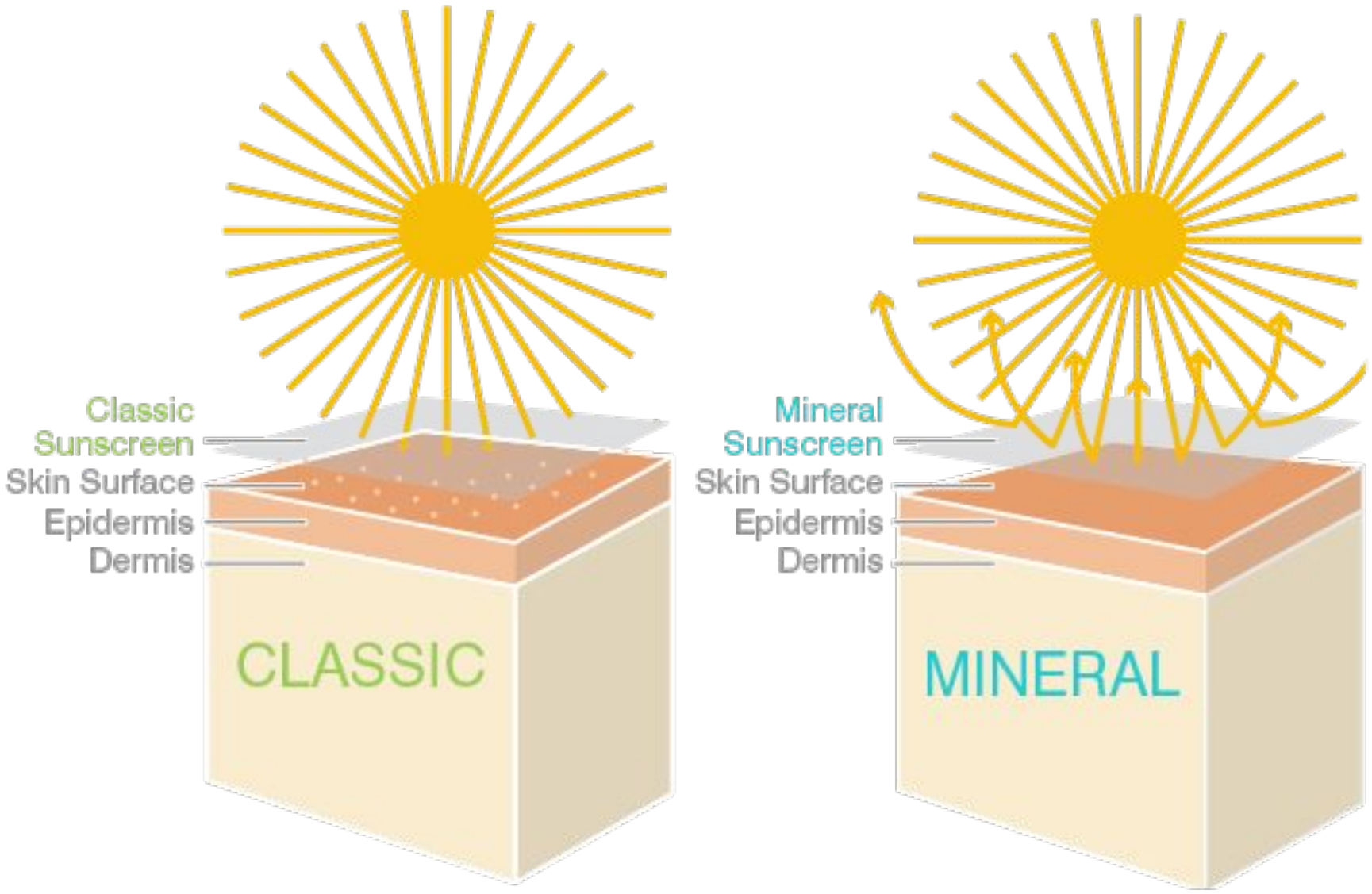
SPF stands for sun protection factor. Sunscreens are classified by an SPF number which refers to their ability to deflect UVB rays. The SPF rating is calculated by comparing the amount of time needed to burn sunscreen-protected skin vs. unprotected skin.



Classic vs. Mineral: Which is Which?

Classic and Mineral Sunscreens are differentiated by their active sun protection ingredients. Classic sunscreens use chemical active ingredients designed to absorb and dissipate UVA/UVB rays, while Mineral sunscreens use mineral active ingredients such as Titanium Dioxide and Zinc Oxide to scatter and reflect UVA/UVB rays.

The effect of classic suntans is based on chemical reactions by swallowing sun radiation and mineral ones create a protective layer on the skin surface.



UV eye protection

To decrease the risk of developing eye-related diseases, it may be wise to wear sunglasses when outdoors, even on overcast days.

But what about inanimate objects?

Degradation of polymers, pigments and dyes

Many natural and synthetic polymers are attacked by ultraviolet radiation, and products using these materials may crack or disintegrate if they are not UV-stable.

UV damaged polypropylene rope (left)
and new rope (right)

Applications

Because of its ability to cause chemical reactions and excite fluorescence in materials, ultraviolet radiation has a number of applications.

Photography

Photography by reflected ultraviolet radiation is useful for medical, scientific, and forensic investigations, in applications as widespread as detecting bruising of skin, alterations of documents, or restoration work on paintings.

Analytic uses

UV is an investigative tool at the crime scene helpful in locating and identifying bodily fluids. Other applications include the authentication of various collectibles and art, and detecting counterfeit currency.

Air purification

Using a catalytic chemical reaction from titanium dioxide and UVC exposure, oxidation of organic matter converts pathogens, pollens, and mold spores into harmless inert byproducts.

Sterilization & disinfection

- Ultraviolet lamps are used to sterilize workspaces and tools used in biology laboratories and medical facilities.

- Solar water disinfection has been researched for cheaply treating contaminated water using natural sunlight. The UV-A radiation and increased water temperature kill organisms in the water.

Insects trapping

Ultraviolet traps called bug zappers are used to eliminate various small flying insects. They are attracted to the UV and are killed using an electric shock, or trapped once they come into contact with the device. Different designs of ultraviolet radiation traps are also used by entomologists for collecting nocturnal insects during faunistic survey studies.

Skin conditions

UV rays also treat certain skin conditions. Modern phototherapy has been used to successfully treat rickets, psoriasis, eczema, jaundice, vitiligo, atopic dermatitis, and localized scleroderma.

Summary findings

- UV occurs to be the one of nature factors which we only have the opportunity to receive with beneficial and harmful sides bound together.
- The effect of the ultraviolet can be used and turned into the tool for the human’s wellbeing.

Sources

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