

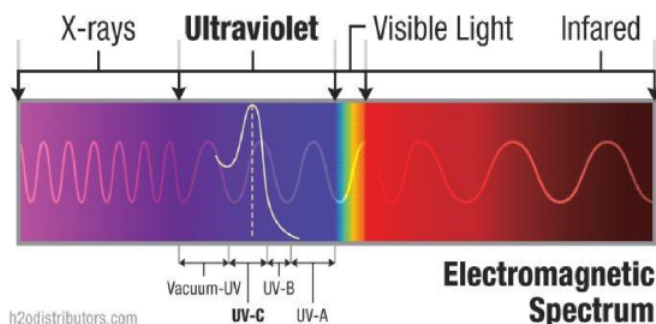
10.2.1: UVA, UVB, UVC and Its' Effect

Learning Objectives

- Differentiate the three regions of UV radiation based on their energy, impact on human molecules, and wavelength.
- Explain how UV radiation impacts the skin leading to sunburn and skin cancer
- Understand the link between UV exposure and eye damage like cataracts

UV Radiation

Solar energy (sunlight) contains light we can see, and some we cannot. *Visible light* has wavelengths of 750 to 400 nm. *Ultraviolet (UV) light* has shorter wavelengths, cannot be seen, and has higher energy. Infrared (IR) radiation is the major source of heat for Earth. Though UV is a fraction of sunlight, it can be damaging to living organisms. All of these are forms of energy in the *electromagnetic spectrum*.



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Just as visible light components have names (red, orange, yellow, green, blue, indigo, violet), so do the types of UV light: UV-A, UV-B, UV-C and vacuum-UV. UV-A has lowest energy and is least damaging; UV-A is also called “black light.” UV-B and UV-C have higher energies and can cause break bonds of molecules, causing changes in DNA and thus skin cancers.

The majority of UV-B is absorbed by ozone in the stratosphere. Though UV-C is most damaging, it is totally absorbed by oxygen and ozone. In recent years, depletion of the ozone layer has allowed more UV light to reach us, resulting in more cases of skin cancers. Consequently, we have become aware of the need to protect ourselves from UV light.

What protects us from UV light? One strategy would be to avoid exposure to any type of sunlight. Since we cannot avoid sunlight while outdoors, we can physically or chemically block the sun. A wide variety of commercial sunscreens are available with *sun protection factors (SPF)* ranging from SPF 2 to SPF 100. These lotions contain organic molecules that absorb UV light. Some materials, such as glass and plastic also absorb UV light, while still allowing visible light through.

UV light type	Wavelength	Relative Energy	Comments
UV-A	320 – 400 nm	lowest energy	reaches Earth in greatest amount
UV-B	280 – 320 nm	higher energy than UV-A, but less than UV-C	most is absorbed by ozone
UV-C	200 – 280 nm	highest energy	absorbed by ozone and oxygen

Health Effects of UV Radiation

Here is an overview of the major health problems linked to overexposure to UV radiation. Understanding these risks and taking sensible precautions will help you enjoy the sun while reducing your chances of sun-related health problems.

Skin Cancer

Each year, more new cases of skin cancer are diagnosed in the U.S. than new cases of breast, prostate, lung, and colon cancer combined. One in five Americans will develop skin cancer in their lifetime. One American dies from skin cancer every hour.

Unprotected exposure to UV radiation is the most preventable risk factor for skin cancer.

Melanoma

Melanoma, the most serious form of skin cancer, is now one of the most common cancers among adolescents and young adults ages 15-29. While melanoma accounts for about three percent of skin cancer cases, it causes more than 75 percent of skin cancer deaths. UV exposure and sunburns, particularly during childhood, are risk factors for the disease. Not all melanomas are exclusively sun-related—other possible influences include genetic factors and immune system deficiencies.

Nonmelanoma Skin Cancers

Non-melanoma skin cancers are less deadly than melanomas. Nevertheless, they can spread if left untreated, causing disfigurement and more serious health problems. There are two primary types of non-melanoma skin cancers: basal cell and squamous cell carcinomas. If caught and treated early, these two cancers are rarely fatal.

- **Basal cell carcinomas** are the most common type of skin cancer tumors. They usually appear as small, fleshy bumps or nodules on the head and neck, but can occur on other skin areas. Basal cell carcinoma grows slowly, and it rarely spreads to other parts of the body. It can, however, penetrate to the bone and cause considerable damage.
- **Squamous cell carcinomas** are tumors that may appear as nodules or as red, scaly patches. This cancer can develop into large masses, and unlike basal cell carcinoma, it can spread to other parts of the body.

Premature Aging and Other Skin Damage

Other UV-related skin disorders include actinic keratoses and premature aging of the skin. Actinic keratoses are skin growths that occur on body areas exposed to the sun. The face, hands, forearms, and the “V” of the neck are especially susceptible to this type of lesion. Although premalignant, actinic keratoses are a risk factor for squamous cell carcinoma. Look for raised, reddish, rough-textured growths and seek prompt medical attention if you discover them.

Chronic exposure to the sun also causes premature aging, which over time can make the skin become thick, wrinkled, and leathery. Since it occurs gradually, often manifesting itself many years after the majority of a person’s sun exposure, premature aging is often regarded as an unavoidable, normal part of growing older. However, up to 90 percent of the visible skin changes commonly attributed to aging are caused by the sun. With proper protection from UV radiation, most premature aging of the skin can be avoided.

Cataracts and Other Eye Damage

Cataracts are a form of eye damage in which a loss of transparency in the lens of the eye clouds vision. If left untreated, cataracts can lead to blindness. Research has shown that UV radiation increases the likelihood of certain cataracts. Although curable with modern eye surgery, cataracts diminish the eyesight of millions of Americans and cost billions of dollars in medical care each year.

Other kinds of eye damage include pterygium (tissue growth that can block vision), skin cancer around the eyes, and degeneration of the macula (the part of the retina where visual perception is most acute). All of these problems can be lessened with proper eye protection. Look for sunglasses, glasses or contact lenses if you wear them, that offer 99 to 100 percent UV protection.

Immune System Suppression

Scientists have found that overexposure to UV radiation may suppress proper functioning of the body’s immune system and the skin’s natural defenses. For example, the skin normally mounts a defense against foreign invaders such as cancers and infections. But overexposure to UV radiation can weaken the immune system, reducing the skin’s ability to protect against these invaders.

Original Source for 'Health Effects of UV Radiation': <https://www.epa.gov/sunsafety/health-effects-uv-radiation>

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