

Research Paper Outline

I. Introduction: Ultraviolet Radiation

Main Ideas:

- Description & Origins of Term
- Ultraviolet Classification
- Sources of UV
- Blocking UV
- Variability of UV
- Beneficial Effects
- Harmful Effects
- Skin Damage
- Skin Cancer

Focus: To understand what ultraviolet radiation and its general effects; narrow down these effects to skin damage and raise awareness of the risks of too much UV exposure and ways to prevent it.

II. Description

A. Definition:

- Electromagnetic radiation that is more energetic and has a shorter wavelength than visible radiation.
 - Shorter wavelength=more energy& more dangerous
 - 100 nanometers-400nm; whereas visible—400-780nm
 - Ultraviolet is invisible to human eye

B. Origins of Term:

- Means “beyond violet” in Latin – violet being the shortest wavelength of visible light& UV light having shorter wavelengths than violet – the name is derived

III. Ultraviolet Classification

A. General:

- Most ultraviolet is non-ionizing radiation(radiation that can only move around atoms/make them vibrate
 - Higher energies(from about 150nm) are ionizing(radiation that can remove tight electrons from atoms, creating ions), but are blocked by air

B. Specific:

- The levels UV is divided into(UV A, B&C) are ways of classifying rays based on the amount of energy they contain and their effects of biological matter
 - UVC is the most energetic & harmful, while UVA is the least so & UVB is in between

IV. Sources of UV

A. Natural (Sun):

- Major source – emits all different electromagnetic radiation
- 99% of rays are visible light, UV light, or infrared rays(heat)
 - Gives off UVA, UVB, & UVC bands
- 98.7% of UV radiation emitted is UVA(which reaches the Earth's surface)
 - Although all 3 types are emitted, UVA&B are the only ones that reach Earth.
 - UVC is blocked by the atmosphere

B. Natural (Stars):

- Extremely hot stars can also emit even more UV radiation than the sun

C. Unnatural:

- Some unnatural sources of UV are ultraviolet fluorescent lamps, ultraviolet light-emitting diodes, ultraviolet lasers, gas-discharge lamps& most commonly black lights(a lamp that emits long rays of UV & little visible light.)

V. Blocking UV

A, Ozone (UVC):

- UVC & other energetic radiation is responsible for the generation of the ozone layer& its formation there.
 - UVC meets ozone molecules at high layers of the atmosphere – its energy is enough to break the bond of the molecule & absorb energy – UVC never makes contact with the Earth
 - Man-made UVC rays are used in some professions such as welding – can be hazardous

B. Ozone (UVB):

- Not enough energy to split ozone molecule, so some radiation reaches the Earth's surface

C. Ozone (UVA):

- Not enough to break apart bonds of ozone
 - UVA passes Earth's atmosphere almost unfiltered

D. Sunscreen: works in two ways

- Scatters oncoming UV rays away from skin(physical sunscreen)

- Absorbs UV rays before they reach skin(chemical sunscreen)

VI. Variability of UV

A. Sun's Position:

- UV levels are not constant over day/ year & sun's position is one factor of this
 - Ex: electromagnetic waves emitted from the sun travel shorter paths through the atmosphere at noon than at 5 p.m. – noon-time intensity is stronger

B. 2nd Factor: amount of ozone present in the stratosphere to obstruct UV

C. Clouds:

- Cloudy days – UV levels are lower as clouds can deflect rays up into space, but they can also increase UV levels.
 - Ex: if clouds are close but not obscuring sun, they can reflect additional radiation to ground

D. Altitude:

- UV increases 4% every 1000ft gain in altitude–increase has nothing to do with being closer to sun
 - Any elevation gain is irrelevant compared to the distance from Earth to Sun

E. Albedos:

- Sand, snow, and water are albedos – they tend to reflect UV rays

F. Equator:

- The closer to the equator, the more exposure – sun is usually higher in the sky at lower latitudes
 - The ozone is also thinner at the equator

VII. Beneficial Effects

A. Vitamin D:

- UV radiation exposure induces production of Vitamin D in skin at a rate of up to 1000 IU's per minute – important for calcium metabolism, immunity, cell proliferation, insulin secretion, & blood pressure.
- Too little UVB can result in a lack of Vitamin D

B. Medical Uses:

- Used as a treatment for certain skin conditions like psoriasis and vitiligo

VIII. Harmful Effects:

A. General Effects

- UV can have too much energy – instead of causing molecules to just shake, it can cause molecules to split up – this can cause cell damage & deformities—mutating genetic code
 - Can also cause chronic health effects on skin, eye, & immune system

B. UVA:

- Penetrates skin deeply, but can't cause sunburns – does not damage DNA directly
 - Instead it can develop highly reactive chemicals which can in turn damage DNA
- Does not cause sunburn, so can't be measured in SPF testing & there isn't a good clinical measurement, but it is important for sunscreen to contain both UVA + UVB
- Some scientists blame lack of UVA filters in sunscreens for higher melanoma risks in sunscreen users
 - UVA+ UVB destroy Vitamin A in skin
 - All UV: UV irradiation in sunlight= environmental human carcinogen (any agent directly involved in causing cancer)

C. UVB:

- Overexposure to UVB can cause sunburn & some forms of skin cancer – but malignant melanoma (most deadly form of skin cancer) is *mostly* not caused by UV
 - Can cause direct DNA damage – mutation – cancerous growths

D. UVC:

- Highest energy & most dangerous, but is blocked by atmosphere
 - Still, it is used in such things as pond sterilization & poses an exposure risk

IX. Skin Damage

A. Wrinkles:

- UVA damages collagen (protein that holds skin together firm & smooth) resulting in wrinkles
 - Once collagen is damaged it can't repair itself – up to 80% of skin aging from sun

B. Freckles+ Sunspots:

- Signs of skin damage and too much exposure

C. Sun Tan:

- Not healthy – sign of damage to skin – when exposed to UV skin produces melanin (dark pigment that creates tan)
- Tan= skin's attempt to prevent UV from damaging sensitive skin cells
 - Does not prevent from getting sunburn in future

D. Sunburn:

- When UV rays kill living cells – it leads to DNA damage
 - Repeated sunburns increase risk of skin cancer b/c of damage to DNA

X. Skin Cancer

A. General:

- Chance of getting skin cancer= 1 out of 5 – about 90% of skin cancers is sun-related
 - 3 types of skin cancer: Basal Cell, Squamous Cell, & Melanoma

B. Basal Cell:

- Most common form of skin cancer – looks like a sore that won't heal – does not spread – If detected early & treated – 95% cure rate

C. Squamous Cell:

- Most common form, has 95% cure rate if treated early – like Basal cell –can spread if not treated

D. Melanoma:

- Least common – can spread – often on areas not exposed to the sun
 - Soles of the feet, between toes
- Most deadly form – more than 80% skin cancer deaths
- As few as 2 severe sunburns before age 18 doubles risk of melanoma

XI. Conclusion

A. Summary: Restate main ideas

- Awareness that UV's danger is potent
- What kinds of UV exposed to
- Its vitality, but also its harmful effects
- Its variability – when it can harm you

B. Universal Thought:

- Precautions need to be taken: Sunscreen that has both UVA + UVB
 - Avoiding sun between 11 a.m. – 3 p.m. (daylight saving time)
 - Reduces UV exposure by +50%

