UV SAFETY

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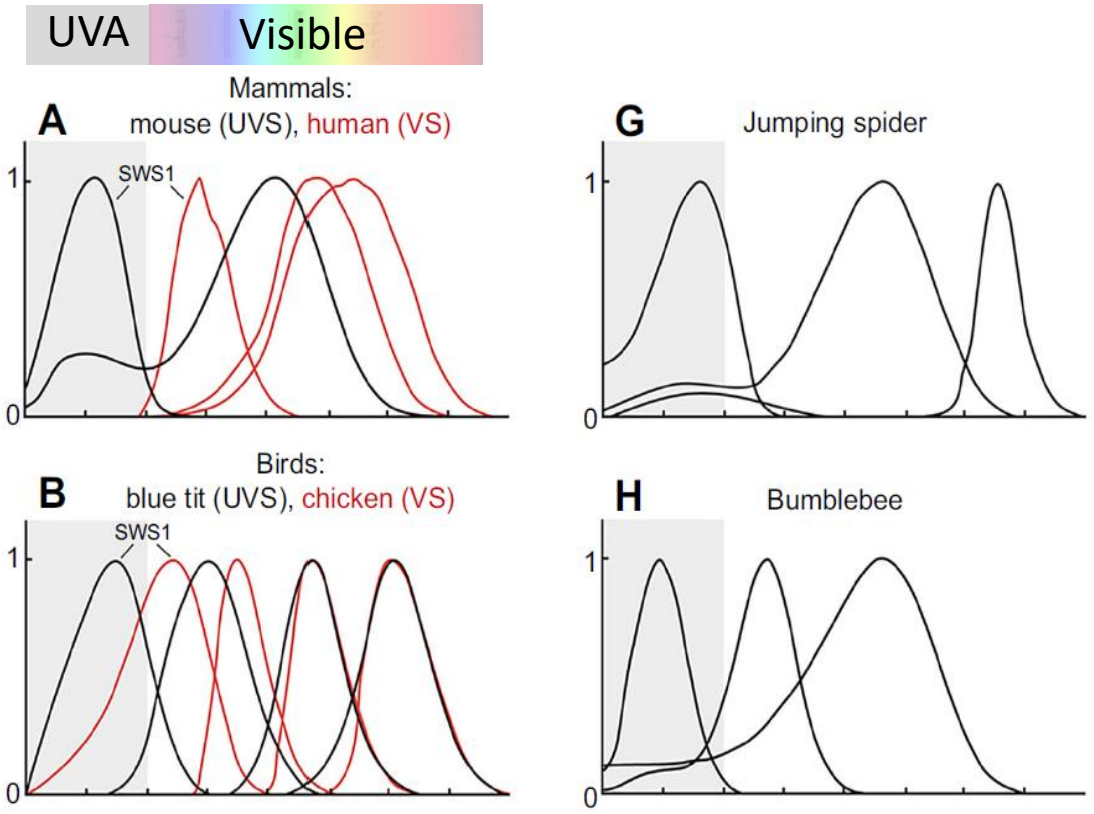
Strongly Agree | ✓ Somewhat Agree | ✗ Somewhat Disagree | Strongly Disagree

“UV is invisible”

- Human photoreceptors are practically insensitive to UV.
- Other species (incl. birds and insects) can see UVA.
- Birds have 4 different colour receptors increasing the range and type of colours they can see.



Photoreceptor spectral sensitivities

Photoreception and vision in the ultraviolet
Thomas W. Cronin, Michael J. Bok, Journal of Experimental Biology, 2016

Strongly Agree | Somewhat Agree | Somewhat Disagree | ✗ Strongly Disagree

“UV is visible for humans”

- Any light we see from UV sources are higher wavelength impurities
- A typical low pressure mercury vapour UVC lamp emits mainly UVC (250 mn peak) but also some lower intensity visible light
- Emissions of LED UV light sources or UV lasers will be completely invisible

SO advice

Do contact us if:

- Planning new UV work/systems (pure UV or broadband UV/visible)
- Insufficient information provided for equipment
- New application planned for existing equipment
- Any incidents: e.g. gaps in shielding
- Associated hazards: e.g. mercury release after bulb failure (LED replacement systems available)

Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree

“My naturally dark skin will protect me from UV”

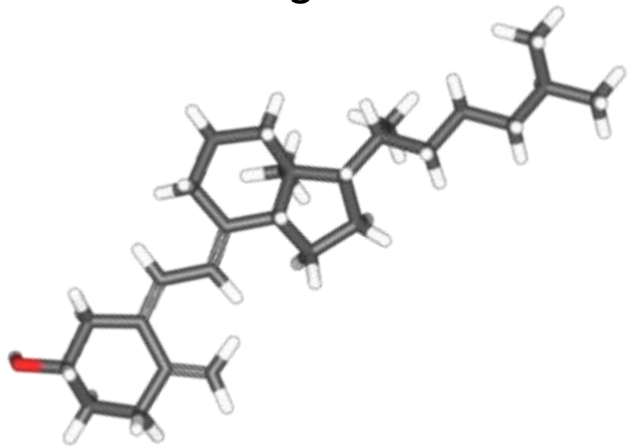
- If you are naturally dark skinned, you are statistically less likely to develop erythema (sunburn) or skin cancer.
- Melanin can act as a photosensitizer at high doses of UV, causing oxidative damage to DNA.
- UV will still cause photokeratitis (arc eye or snow blindness), which is very painful damage to the epithelial cells on top of the cornea of the eyes.

Inuit goggles to prevent snow blindness

Strongly Agree | ✓ Somewhat Agree | ✗ Somewhat Disagree | Strongly Disagree

“UV is essential for Vitamin D levels”

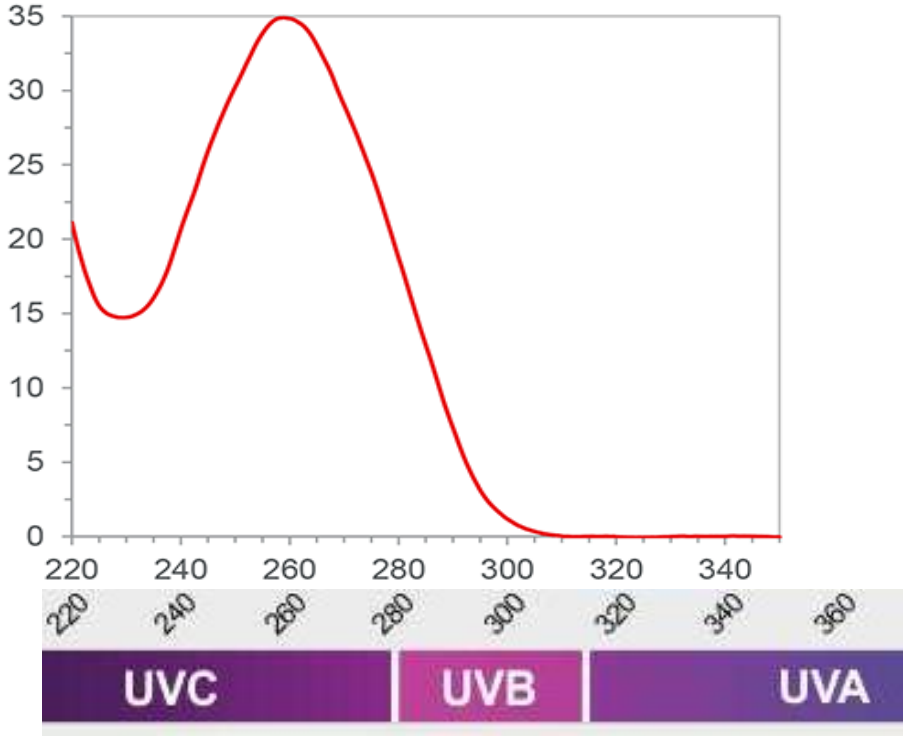
- To produce Vitamin D_3, the precursor of the active 1,25 dihydroxy vitamin D, the skin needs to be exposed to UVB.
- Dietary sources of Vit D_3 are also effective (e.g. supplements or fortified breakfast cereals).
- Relatively short exposures to sunlight produce sufficient Vit D_3 (in summer a few minutes may be sufficient).
- Vit D_3 is crucial for Calcium and Phosphate uptake.
- See current NHS guidelines here.



“UVA does not damage DNA as it isn’t absorbed by DNA”

- Only UVB and UVC are absorbed by DNA and cause direct DNA damage.
- But, UVA still produces free radicals which in turn damage DNA.

☞UVA is less harmful but NOT SAFE!



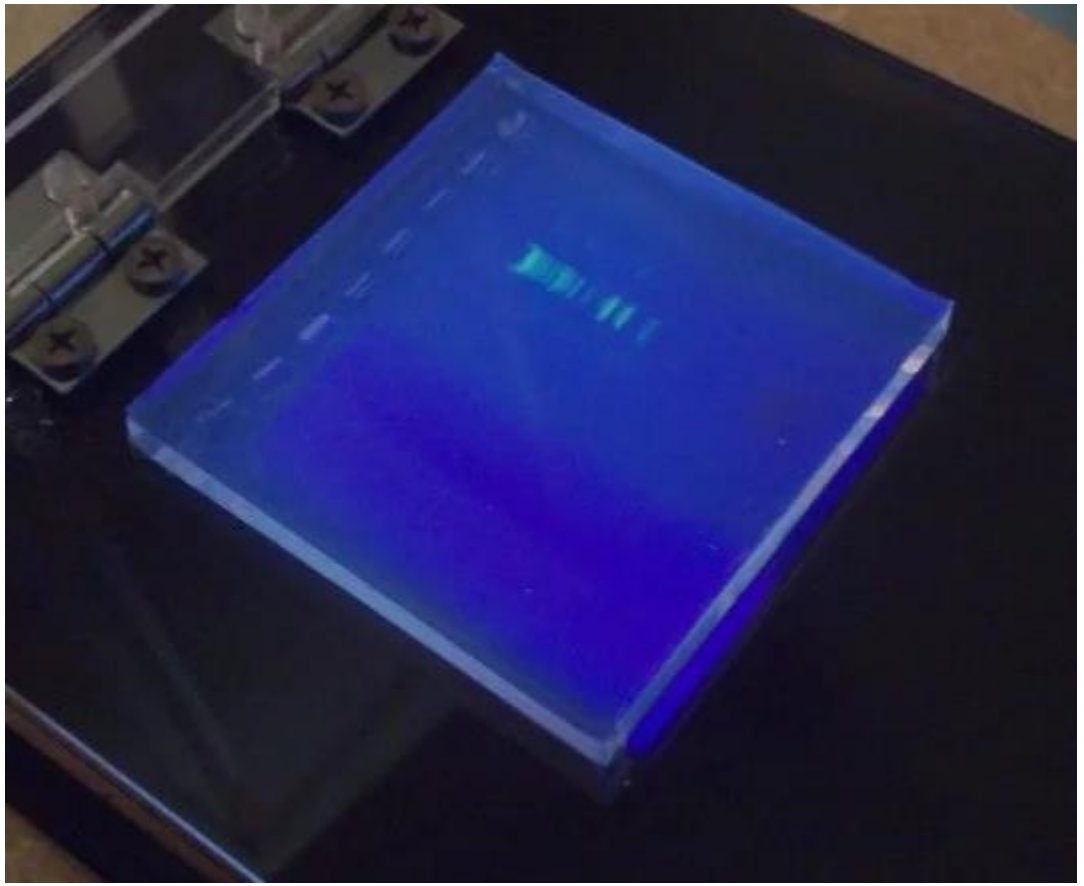
Absorption spectrum of DNA

“Artificial sources of UV aren’t very bright”

- We only see the non-UV component, most of the photons emitted are in the invisible spectrum.
- UV-Transilluminators (UV-TI) can be far more hazardous than sunlight.

  Sun: <10 μW/cm^2 (UV only)

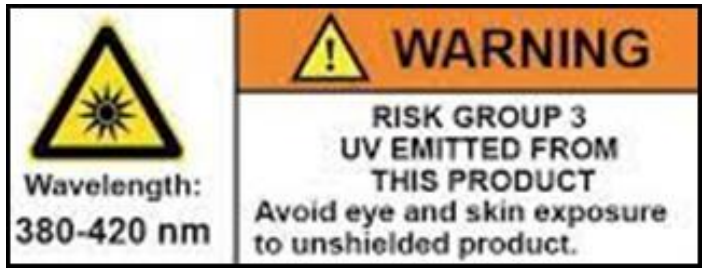
  UV-TI: 20-500 μW/cm^2 (@1.2m-6cm)
- Depending on distance, exposure limits can be exceeded within seconds!



What to look out for during acquisition and assessment of equipment

Quality of information

Minimum: Risk Group and spectral information



Ideal: Effective Irradiance at relevant exposure distance

Hazard Distance (safe distance)

	Exempt	**Risk Group 1**	**Risk Group 2**	**Risk Group 3**
	No Hazard	*Low-Risk*	*Moderate Risk*	*High-Risk*
Type of Hazard	Exposure limit not exceeded for exposure durations up to: (i.e. exceeded for exposure durations beyond:)			Exposure limit exceeded within:
Actinic UV (skin and eye)	30 000 s	10000 s	1000 s	< 1000 s

How to minimise risk from UV exposure

Avoid: Use alternative non-UV option

Enclose source

Reduce: Increase distance to source (less effective for focussed beams)

Reduce exposure time

Use appropriate shielding

Manage: Provide training and appropriate PPE

Restrict access

Table 2 – Explanation of labelling information and guidance on control measures

Hazard	Exempt Risk Group	Risk Group 1	Risk Group 2	Risk Group 3
Ultraviolet hazard 200 nm to 400 nm	Not required	Minimise exposure to eyes or skin. Use appropriate shielding.	Eye or skin irritation may result from exposure. Use appropriate shielding.	Avoid eye and skin exposure to unshielded product.

Strongly Agree | Somewhat Agree | Somewhat Disagree | ✘ Strongly Disagree

“A UV face shield will provide 100% UV protection”

Label:

BS EN 170
2-1.2

Scale number	Maximum spectral transmittance in the ultraviolet τ(λ)		Luminous transmittance τv	
	UVB %	UVA %	maximum %	minimum %
2-1.2	0.0003	10	100	74.4
~~2-1.4~~	~~0.0003~~	~~9~~	~~74.4~~	~~58.1~~
2-1.7	0.0003	7	58.1	43.2
2-2	0.0003	5	43.2	29.1
2-2.5	0.0003	3	29.1	17.8

The most common UV shields will only guarantee 90% UVA protection!

Even face shields designed for UV protection will only block a portion of UVA. Keep exposure time minimal and maximise distance!

On the topic of face shields...

- OBERON face shield – no CE mark, no UV safety standard mark
- Illegal to sell PPE without CE or UKCA mark
- Other non-UV specific visors: remove or label clearly (e.g. Covid face shields, orange safety glasses for blue light exposure)

Table B.1 – Designation, properties and typical applications

Scale number	Colour perception	Typical applications	Typical sources [a]
2-1,2 2-1,4 2-1,7	May be impaired, unless marked 2C-shade	For use with sources which emit predominantly ultra violet radiation at wavelengths shorter than 313 nm and when glare is not an important factor. This covers the UVC and most of the UVB bands [b].	Low-pressure mercury lamps such as lamps used to stimulate fluorescence or "black lights", actinic lamps and germicidal lamps.
2-2 2-2,5	May be impaired, unless marked 2C-shade	For use with sources which emit intense radiation in both the UV and visible spectral regions and therefore require the attenuation of visible radiation.	Medium pressure mercury lamps such as photochemical lamps.
2-3 2-4			High-pressure mercury lamps and metal halide lamps such as sun lamps for solaria.
2-5			Pulsed lamp systems. High and very high-pressure mercury lamps such as sun lamps for solaria.

[a] The examples given are for general guidance.

[b] The wavelengths of these bands are as recommended by CIE (that is, 280 nm to 315 nm for UVB and 100 nm to 280 nm for UVC).

UV safety course

- The University UV safety course gives more background on safe use of artificial sources of UV light.
- For all work with sources of UV, practical training and an adequate risk assessment must be in place.
- For policy and guidance, see HSD014R - Safe Use of Artificial Sources of Ultraviolet Radiation.