Detecting and protecting against damaging free radicals produced in skin by sunlight: a new era in skin protection

The damaging, as opposed to protective, effects of the sun are constantly in the spotlight. The positive effects of sun exposure of well being and relaxation, and vitamin D synthesis (protective against cancers), are counterbalanced by a darker side which is the increased incidence of skin cancers, higher now than at the beginning of the century when to be pale was fashionable.

www.raft.ac.uk

Five years ago the medical research charity **RAFT** provoked national and international response with the publication of its research showing that sunscreens provided little protection against UVA and free radicals. Free radicals are highly reactive chemicals linked to cancer.

RAFT's research has moved on and the latest findings are being published in the scientific journal *Free Radical Biology and Medicine* showing –

- UVA and visible light generate widespread free radical damage to the proteins and fats in skin of Caucasians but considerably less damage to skin of people adapted to sunlight such as the Afro-Caribbean's and Asians

- The degree of free radical damage is strongly linked to the intensity of sunlight, thus is faster and greater in strong sunlight typical of hotter countries compared to that of the UK

- The damage is highly variable amongst different individuals

Despite earlier warnings, many holidaymakers are at risk due to inadequate sunscreen protection against UVA rays. The incidence of skin cancer is rising faster than that for any other form of cancer. In our research, we detected severe skin damage in Caucasian skin at about 20 minutes exposure to the equivalent of the Mediterranean sun.

The research method developed could be of significant benefit to the sunscreen industry in its quest to develop improved UVA and free radical protection. It enables not only improved testing of sunscreens and cosmetics designed to protect skin from damage, but also the screening and advice to people at risk as regards their own personalised safety in the sun.

With the uncertainty about the amount of sunlight which is beneficial, our findings do not disagree with the recently suggested requirement for moderate sun exposure (to produce vitamin D which requires a small amount of UVB light) although exposure of skin to moderate sunshine for long periods will inevitably cause some free radical damage to skin. Our findings agree with the concerns over excessive sunlight exposure, particularly UVA exposure, which leads to skin cancers. Exposure of Caucasian skin to “moderate” sunlight, such as that in a UK summer, generates less and slower free radical damage than exposure to “strong” sunlight typical of hotter countries. Our research suggests that protection against free radical damage (caused by UVA and visible light) is particularly important in sensitive skin (lacking the natural sunscreen melanin).

The EU (and latterly the US) has recently recognised the importance of effective sunscreen protection, and issued a consultation document on “the efficacy of sunscreen products and claims relating thereto”.

In this document, the EU defines the three main worries as

1. Products should contain protection against ALL dangerous UV radiation (**RAFT**’s 2003 paper questioned the level of protection sunscreens offered against UVA light)
2. Products should provide guidance on the correct application of the product.
3. Products and claims should provide sufficient guidance to aid in choosing the appropriate product.

Methods of validating sunscreens protection mentioned by the EU are Persistent Pigment Darkening (which uses human volunteers and exposes

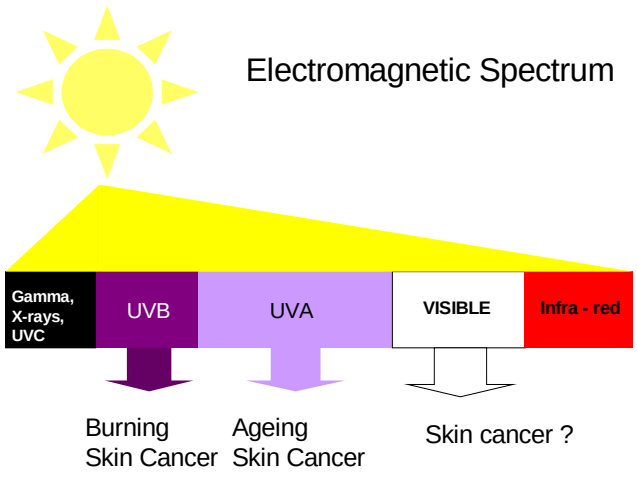
them to significant doses of sun radiation) and the Critical Wavelength method (which is carried out in the laboratory and not on human skin at all). Both of these come with advantages and disadvantages.

The technique we have developed enables quick and rapid screening of free radical damage to skin and a means of measuring protection by sunscreens against all forms of the suns radiation.

SO WHAT NEXT

- **RAFT** would like to work with the sunscreen industry to help develop better UVA and free radical protection
- We will develop our testing for an individual's sensitivity to free radical damage, skin cancer and skin ageing.

The incidence of skin cancer continues to rise and prevention remains the most potent weapon in the armoury against these cancers as treatment has remained relatively ineffective and unchanged for around half a century. Skin cancers can kill and they can affect the young as well as the elderly, and surely we must find some simple ways to tackle these cancers.



A graphic representation of the full spectrum of sunlight. Sunlight can cause biological damage to the skin and RAFT's research is examining why and how this happens and whether it is possible to prevent or minimise such damage.

References

[1] Haywood, R., P. Wardman, R. Sanders and C. Linge (2003) *Sunscreens inadequately protect against ultraviolet-A-induced free radicals in skin: Implications for skin ageing and melanoma?* J Invest. Dermatol. *121, 862-868.*

[2] EU consultation document *"On the efficacy of sunscreen products and claims relating thereto."* Europa Enterprise & Industry: Sunscreen Products Web Page

[3] Haywood, R (2006) *Relevance of sunscreen application method, visible light and sunlight intensity to free-radical protection afforded by sunscreens* Photochemistry and Photobiology *82, 1123-1131.*

[4] US Federal register /Vol. 72, no. 165: Department of Health and Human Services (Food and Drug administration) (2007) *"Sunscreen Drug Products for Over-the-Counter Human use; Proposed Amendment of Final Monograph".*

[5] Haywood, R, Rogge and M. Lee (2008) *Protein, lipid and DNA radicals to measure skin UVA damage and modulation by melanin Free Radical Biology and Medicine (15 March).*