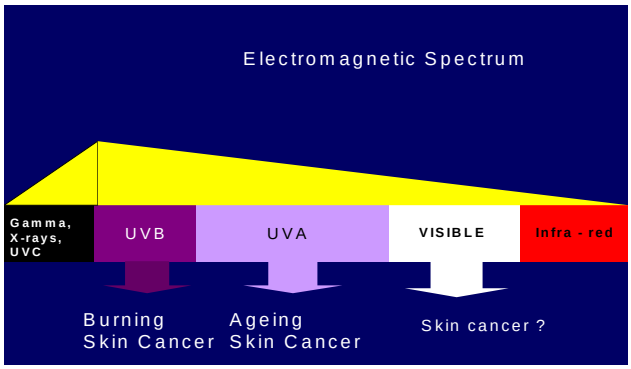
THE DARK SIDE OF THE SUN:

FURTHER DEVELOPMENTS IN SKIN CANCER PREVENTION & AGAINST AGEING OF THE SKIN

We know the sun brings certain benefits and we know that we all feel healthy and glowing with a tan. However, there is the dark side of the sun.

Three years ago the medical research charity RAFT provoked national and international response to its research, highlighting a need for better protection against the UVA portion of sunlight. This research broke new ground by measuring agents of biological damage (free radicals) directly generated within the skin by sunlight. The results showed that whilst the best combined UVB/UVA-rated sunscreens then available adequately protected against UVB, their measured protection against UVA was comparatively low. This demonstrated imbalance means that protecting against UVB (which causes sunburn) encourages longer periods of sunbathing which therefore increases exposure to UVA. Importantly UVA is increasingly linked with the lethal form of skin cancer, malignant melanoma.



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.

RAFT's research has moved on and the latest findings are being published in the scientific journal *PhotoChemistry & PhotoBiology* stating that –

- **Does how you apply sunscreens matter?**
  The typical person on the beach applies sunscreens by rubbing them into the skin. Unlike our previous publication which found that the manufacturers recommendation of 2mg/cm^2 sunscreen (4 star-rated) applied as an even film, affords approximately 50% protection, this latest research shows if this amount is rubbed into the skin the UVA protection is minimal. This research highlights the need for changes in application methods or sunscreen formulation.

- **What about visible light – let alone UVA/UVB?**
  In addition RAFT research demonstrates that one-third of the damaging free radicals are generated by the visible component of sunlight (visible light enables us to see and is part of the spectrum that is not protected against in the current formulations of sunscreens).

- **How do our natural defences cope?**
  Another of our research findings regards Vitamin C - the body's chemical 'mopping-up device' against the damaging free radicals – it is an antioxidant. However our studies show that it gets used up quickly when sun intensity is high and therefore leaves the body somewhat defenceless.

- **Take home message: Use a good, broad spectrum sunscreen (maximum UVA rated) but don't stay out too long, at least until we have better sunscreens more suitable for prolonged sunbathing.**

We have updated and reproduced (as Appendix 1) extracts from our original Press Release of 29th September 2003 as this contains the core information on skin cancer and UV sunlight.

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RAFT's method of research involves using human skin from consenting patients which would normally be discarded after surgical procedures. The skin is exposed to sunlight at varying intensities with and without sunscreens and the presence of the dangerous free radicals is monitored using Electron Spin Resonance (ESR). This technically replicates as closely as possible how the screens perform or fail to perform in the way we normally use them.

Antioxidants (eg vitamin C which is present in apples, oranges, blueberries etc) are known to help prevent cancers of all kinds and we are encouraged to eat our 5 portions of fruit and vegetables every day to maximise our body's defence. Sunscreen manufacturers are hoping to exploit the properties of such antioxidants to boost protection against the damaging free radicals. The RAFT technique, which produces results, can detect the efficacy of antioxidants quickly and in a standard, reproducible way and could be of significant benefit to the sunscreen industry in its quest to develop better and more effective protection.

RAFT's research is timely:
Quite apart from the fact that our research comes in the summer when we are all thinking about holidays, the EU also has expressed concerns.

Recently, the EU recognising the importance of setting a new standard of sunscreen protection, 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 more balanced protection against ALL dangerous UV radiation
2. Products should provide guidance on the correct application of the product.
3. Products and claims should be simplified and provide sufficient guidance to aid in choosing the appropriate product and should not claim total protection.

Fuelled by emerging public concern and reflecting current scientific thought, the EU eventually intends to produce a recommendation of the various aspects of sunscreen efficacy and claims relating to them, including what can and cannot be claimed for sunscreen protection, and simple understandable labelling to help consumers make well-informed choices.

Standard techniques of validating the UVA protection offered by sunscreens currently recommended by the EU are the Persistent Pigment Darkening method (requiring the exposure of human volunteers to sun radiation) and the Critical Wavelength method (simply measuring the light absorbing properties of the sunscreen). Both of these have advantages and disadvantages.

The ESR method developed at RAFT offers a new quantitative method which may be of use to the EU and the sunscreen industry and allows the direct measurement of free radicals production by the whole spectrum of UVA, UVB, and Visible light. A patent application has been filed for this method

SO WHAT NEXT

- RAFT is seeking to work closely with the sunscreen industry to help develop better protection.
- Study whether the RAFT technique can be used effectively with artificial skin. This would allow faster generation of data.
- Continue to investigate antioxidant use for protection against free radicals.
- Our research also includes testing for an individual's sensitivity to free radical damage which may identify people at particular risk of developing melanoma.

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THROUGH RECONSTRUCTIVE PLASTIC SURGERY RESEARCH

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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 nearly half a century. Skin cancers can kill and can affect both young and elderly alike.

In the case of these cancers the opposite of an old proverb might be true:

"The best offence is a good defence"

RAFT's research is providing insights into better protection for all

Attached:

1. **List of references**
2. **Appendix 1 – extracts from our previous press release of 23/09/03**
3. **Notes for Editors – an updated version of the notes used to accompany the original press release.**

PRESS RELEASE ENDS

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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."* http://ec.europa.eu/comm/enterprise/cosmetics/sunscreens/index_en.htm

[3] Haywood, R (2006) Relevance of sunscreen application method, visible light and sunlight intensity to free-radical protection afforded by sunscreens **Photochemistry and Photobiology** *(accepted for publication DOI: 10.1562/2006-02-08-RA-799)*

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EXTRACT FROM PRESS RELEASE DATED Monday 29th September 2003
(with updated figures)

THE DARK SIDE OF THE SUN
RAFT SCIENTISTS MEASURE THE DAMAGE
Cancer of the skin & premature ageing

Whilst getting a sun tan we think we are safe from cancer and ageing of the skin if we apply a sunscreen cream – but are we?

New research, undertaken by scientists at RAFT (*see Note 1)*, shows that even when sunscreen creams are applied in the correct dosage, the sun's UVA light penetrates through to the skin and causes the release of free radicals (*see Note 2)* – which probably causes the skin cancer Melanoma and premature ageing of the skin. This work is reported in the current issue of The Journal of Investigative Dermatology.

The incidence of skin cancer is increasing alarmingly and for Melanoma, the most sinister and aggressive form, the lifetime risk is doubling every decade. In 2003 it is now 1:68, and by the year 2010 it is likely to be 1:50.

WHAT THE RAFT RESEARCH TEAM HAS DONE

RAFT has developed a novel method of measuring the UVA protection, or lack of it, afforded by sun protection creams actually on human skin.

WHAT DO WE KNOW?

- The incidence of skin cancer is rising alarmingly
- Skin cancer and ageing are more common in those who get sun burnt
- Skin cancer and ageing occur more often in areas of the body exposed to the sun
- Free radicals cause DNA damage
- DNA damage may lead to cancer
- Free radical damage leads to skin ageing
- Ambient sunlight consists of visible light, UVA and UVB
- Most of the UV radiation in ambient sunlight is UVA
- Exposure to UVB leads to Basal Cell Carcinoma and Squamous Cell Carcinoma
- Exposure to UVA is linked with skin ageing and there is high level of concern that UVA causes Melanoma.
- Historically sunscreen creams have concentrated on protecting mainly against UVB, measured by the protection factor (SPF)

NOTES

1. *RAFT (The Restoration of Appearance & Function Trust) is a medical research charity based at Mount Vernon Hospital, Northwood, Middlesex – providing the environment for surgeons and scientists to work together in the fields of reconstructive plastic surgery and burn injury treatment.*

2. *Free radicals are highly reactive chemicals capable of causing widespread destruction to living cells and tissues – they can react with DNA and alter its structure causing abnormal cell reproduction which may lead to cancer formation and damage to proteins causing ageing.*

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RAFT RESEARCH REVEALS THAT:

(a) the protection afforded by sunscreen creams against UVA is not what might be expected.

(b) even when sunscreens are applied in the recommended concentration (*see Note 3)* they afford much lower protection against the melanoma-inducing and ageing effects of sunlight.

HOW HAS THIS BEEN DONE?

RAFT has used a technique known as Electron Spin Resonance (ESR) to detect free radicals in human skin.

- Skin which is discarded from consenting patients undergoing surgery (ie such as breast reduction) is exposed to UVA light at intensities similar to that of sunlight. The release of free radicals is monitored.

- Three commonly available typical high SPF sunscreen creams (which indicated that they contained some UVA protection) have been applied to the skin in recommended doses and are seen NOT to protect sufficiently against the release of free radicals.

WHAT RAFT NEEDS

- Further funding to take the work forward – RAFT relies on charitable support, and funding is now needed to progress the research.
- To collaborate with the sunscreen manufacturers to test and develop more effective creams to protect against the Melanoma - inducing and ageing effects of sunlight.

WHAT'S THE ALTERNATIVE?

- Keep out of the sun
- Cover up completely

CONCLUSION

Since the use of sunscreen creams encourage people to stay longer in the sun and the protection afforded by these creams against UVB far outweighs that against UVA – the use of sunscreen creams may therefore indirectly increase the risk of developing the skin malignancy Melanoma rather than protect against it.

NOTE 3

$2mg/cm^2$ is the recommended thickness of the application of the cream – ie extremely thick coating all over – but this is much thicker than most people apply.

For further information please see RAFT's website – www.raft.ac.uk

See Notes for Editors attached **PRESS RELEASE ENDS**

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NOTES FOR EDITORS

Why is this type of cancer now occurring so frequently?

Mainly due to our habits of sunbathing (including living in the sun, foreign holidays and exposure to sunlight) possibly coupled with the depletion in the ozone layer.

Why is the prevention of skin cancer so important?

The evidence is that sun damage in childhood predisposes us to getting skin cancer when we reach adulthood.

The incidence of skin cancer is rising faster than that for any other form of cancer. Despite medical and scientific advances, treatment of skin cancers is still quite basic and is very similar to that of 50 years ago. Melanoma, the most sinister and aggressive form, is a killer and occurs not only in the elderly but also increasingly in young adults.

RAFT has undertaken the innovative research which shows that UVA light is getting through the sunscreen creams and causing the release of free radicals

Why is sunshine so damaging?

Sunlight contains ultra violet rays – UVA and UVB.

- UVB rays cause the redness and burning and some forms of skin cancer
- UVA rays, which previously had been thought to be less damaging, are now causing great concern that they may be the rays responsible for ageing and the main cause of the killer skin cancer – Melanoma.

What about all those sophisticated sun protection creams?

Most sunscreens protect well against the UVB rays – thus helping to protect against the burning, encouraging users to stay longer in the sun. Creams now quote ratings for their sun protection factor against UVB (SPF) which indicate how much longer a user can stay in the sun than if no cream had been used.

Some filters against UVA rays are being introduced into sun protection creams; however, these seem inadequate against Melanoma and skin ageing – particularly when the UVB filters encourage users to stay longer in the sun.

There is no standard rating available for the assessment of UVA filters.

Free radicals

The free radicals which cause damage in the skin are difficult to detect, but the ascorbate or vitamin C radical (not in itself the radical which causes damage but a 'buffer' radical which acts to minimise radical damage) can be used to measure the amount of UVA penetrating the skin. This can also be used to measure the protection against damaging free radicals.

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BRIEF DETAILS OF MELANOMA

MELANOMA

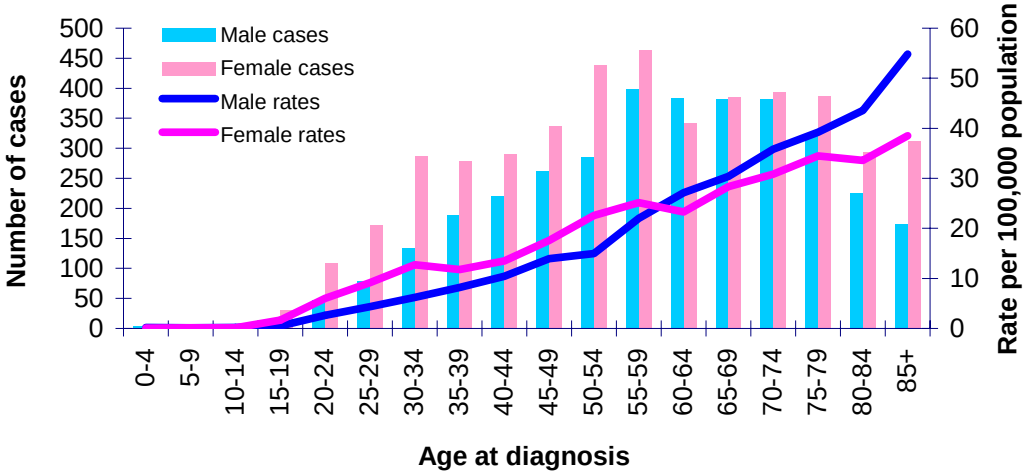
The incidence of cutaneous melanoma has continued to rise over the last 50 years; in fact its incidence is now rising faster than that for any other cancer in the UK. Between 1993 and 2002 melanoma was shown to have increased by 42% in men and 27% in women (Cancer Research UK 2002).

Incidence

Country	Male (incidence per 100,000)	Female (incidence per 100,000)
New Zealand[a]	56.2	56.2
Australia[a]	28.9	25.3
USA[a]	18.3	13.0
Scotland – alone[b]	14.1	18.7
UK overall[b]	12.2	15.0
Worldwide[a]	2.4	2.21

Table showing the incidence of melanoma according to country and sex

(Source : [a]Epidemiology of Malignant Melanoma, Desmond & Soong, Surgical Clinics of North America, Vol 83 (2003) 1-2, and [b]Cancer Research UK website 2002)



Graph showing the number of new cases diagnosed and age specific rates per 100,000 population of melanoma, by sex, UK, 2002
(Source: Cancer Research UK website)

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Overall mortality from melanoma is also rising. Recent UK mortality figures are illustrated below.

Mortality

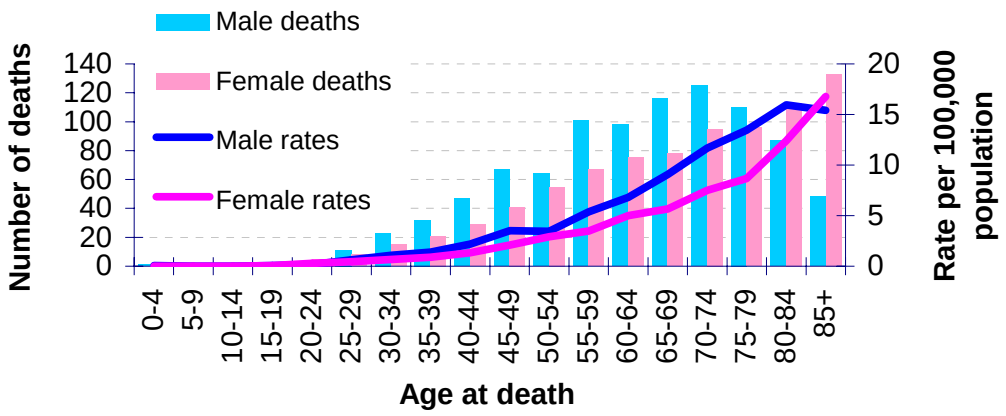
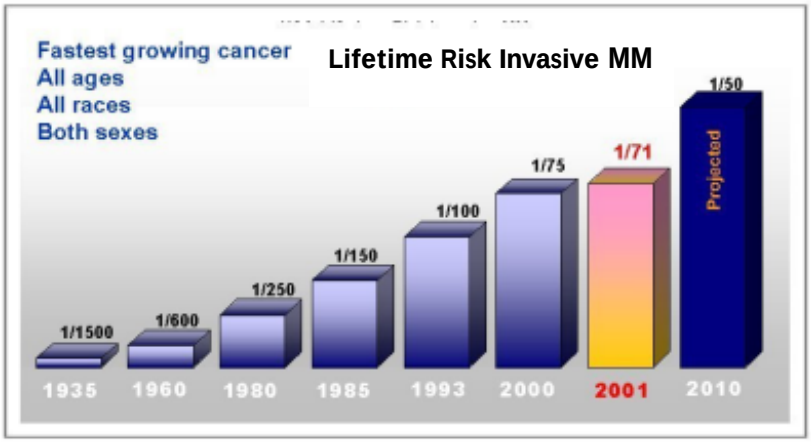


Figure: Number of deaths and age specific mortality rates per 100,000 population from melanoma, by sex, UK, 2003 **(Source: Cancer Research UK *website*).**

Probability



Source: Rigel et al, NYU Melanoma Cooperative Group, 2001

(Adapted from American Cancer Society Website 2001)

Ageing

Wrinkles, dry leathery skin, loss of elasticity and abnormal pigmentation

For further information there is an excellent publication "Photodamaged Skin - Clinical Signs, Causes and Management" published by Martin Dunitz, ISBN 1 85317 345 2

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