

# Apparent contradiction between negative effects of UV radiation and positive effects of sun exposure

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## Text

We would like to comment on the three contributions in the Journal of the National Cancer Institute, Vol. 97, No. 3, February 2, 2005:

· Kathleen M. Egan, Jeffrey A. Sosman, William J. Blot: Editorial: Sunlight and Reduced Risk of Cancer: Is the Real Story Vitamin D? (pp. 161-163) [1]

· Marianne Berwick, Bruce K. Armstrong, Leah Ben-Porat, Judith Fine, Anne Kricke, Carey Eberle, Raymond Barnhill: Sun Exposure and Mortality From Melanoma. (pp. 195-199) [2]

· Karin Ekström Smedby, Henrik Hjalgrim, Mads Melbye, Anna Torrång, Klaus Rostgaard, Lars Munksgaard, et al.: Ultraviolet Radiation Exposure and Risk of Malignant Lymphomas. (pp. 199-209) [3]

The apparent contradiction between the well known negative effects of UV radiation on humans and the newly described positive effects of sun exposure (like reduced risk of cancer) is easily solved, when taking into account, that sun exposure ("sunlight") consists of at least three biologically active parts of radiation: ultraviolet radiation (UV), visible light (VIS) und infrared (IR).

Especially infrared-A (780-1400 nm) with adequate irradiation intensity has been shown not only to be harmless to human skin [4], but to have protective abilities against damage caused by UV radiation [5], [6]!

In moderate climatic zones, sun radiation is filtered by water vapor in the atmosphere before reaching the surface of the earth, by this decreasing infrared-C, infrared-B and the absorption bands within infrared-A, leaving a large amount of water-filtered infrared-A (wIRA) with good penetration properties into skin and without bringing

much thermal burden to the surface of the skin [7]. Infrared-A, especially water-filtered infrared-A, is able to increase tissue temperature, tissue perfusion and tissue oxygen partial pressure [7], [8]: these three thermal effects are prerequisites of a high energy production in tissue and can therefore improve energy dependent immunologic reactions. Beside this, wavelengths within infrared-A, especially near to visible light (approximately 780-1000 nm), have been shown to stimulate cells in a positive manner even with very low irradiation intensities (below intensities with thermal effects) [9], [10], [11], [12].

In addition, sunlight includes high irradiation intensities of all five absorption bands of protoporphyrin IX (approximately 406 nm, 505 nm, 540 nm, 574 nm, 629 nm [13]), which can react with endogenously formed protoporphyrin IX with and without oxygen in photooxidative reactions (type I and type II), giving a mild form of a photodynamic therapy (PDT), being able to modulate the immune system or to bring damaged cells to apoptosis [7], [13].

Furthermore, it is well known that modalities of UV irradiation, like its dose, increase, quality and the frequency of applications, are of crucial importance whether wanted or unwanted effects will take place. With a given daily sun exposure of less than .3 Minimal Erythema Doses (MED) vitamin D status is sufficient in babies. We calculated a simple diagram which shows how to get .3 MED at different times of the day and different seasons [14]. As a minor remark: Although the main statements of the publications of Berwick and Smedby will most likely be unchanged, both publications miss an alpha error adjustment, which is necessary in cases of multiple testing and which typically leads to a marked decrease in the number of significant differences or effects, when large numbers of tests are done.

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