

Breakup Of The Ward Ice Shelf
Antarctica 2004



Stratospheric
Ozone
and
Human
Health



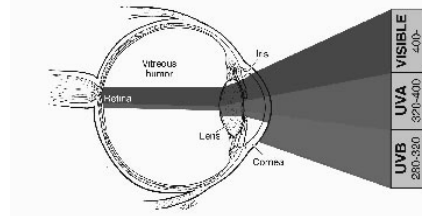
<http://sedac.ciesin.org/ozone/docs/uvd-home.html>

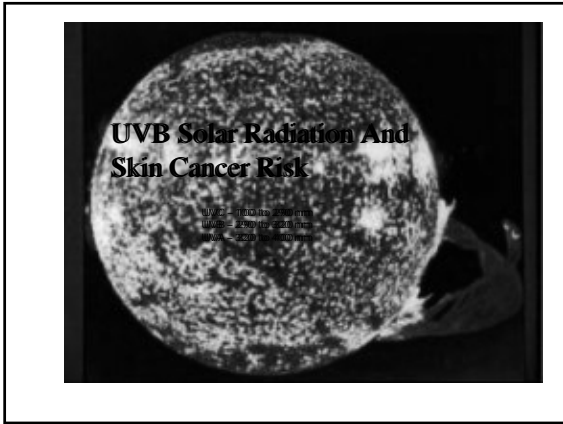
Medical Ecology Of
Stratospheric Ozone Depletion:
Impacts on the Human Condition

Photo Aging

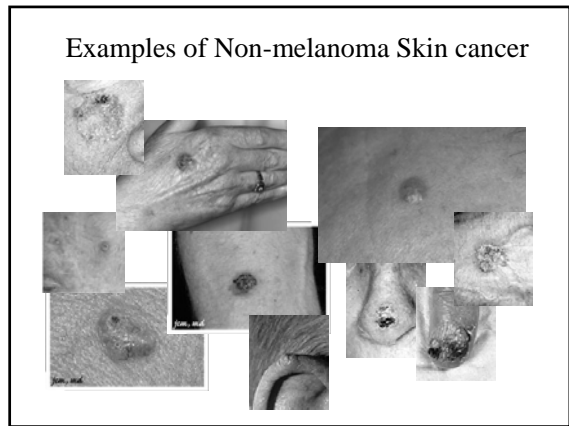
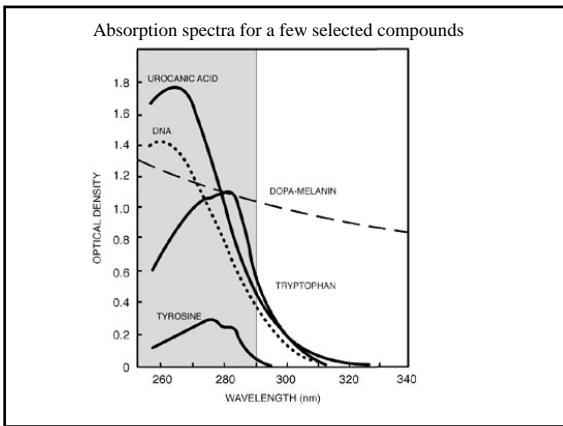


Some 20 million people worldwide are currently blind as a result of cataracts. Of these, WHO estimates that as many as 20% may be due to UV exposure. Experts believe that each 1% sustained decrease in stratospheric ozone would result in an increase of 0.5% in the number of cataracts caused by solar UV.





Skin Cancer (non-melanoma)



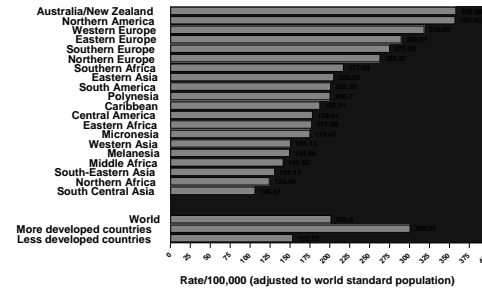
Examples of Non-melanoma Skin cancer

Incidence of Skin Cancers

INCIDENCE

- Excluding carcinoma in situ (noninvasive cancer) of any site except urinary bladder or basal and squamous cell skin cancers
- In 2002 ~ 1,284,900 new cancer cases are expected
 - Men 637,500
 - Women 647,400
- More than 1 million cases of basal and squamous cell skin cancers are expected to be diagnosed this year
- Since 1990, nearly 16 million new cancer cases have been diagnosed

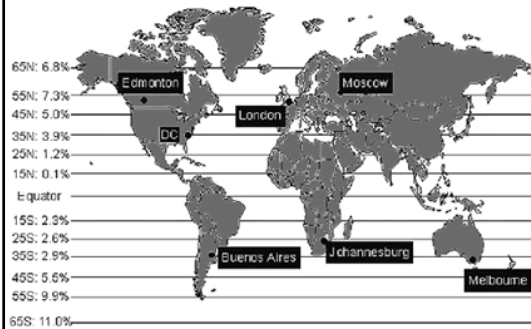
Age-Adjusted Incidence Rates from Cancer in Males by Geographic Region



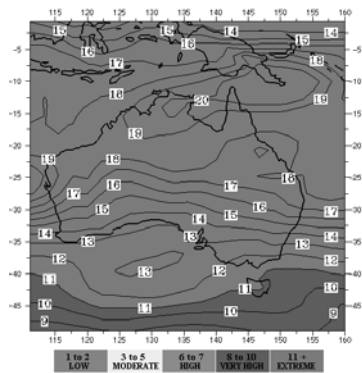
J. Ferlay, F. Bray, P. Pisani and D.M. Parkin, GLOBOCAN 2000: Cancer Incidence, Mortality and Prevalence Worldwide, Version 1.0.1
ARC CancerBase No. 5, Lyon, IARC Press, 2001.

Epidemiology

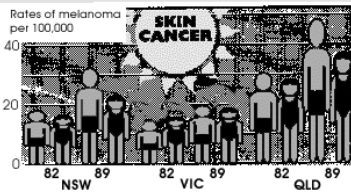
UV-b Radiation Increases by Latitude

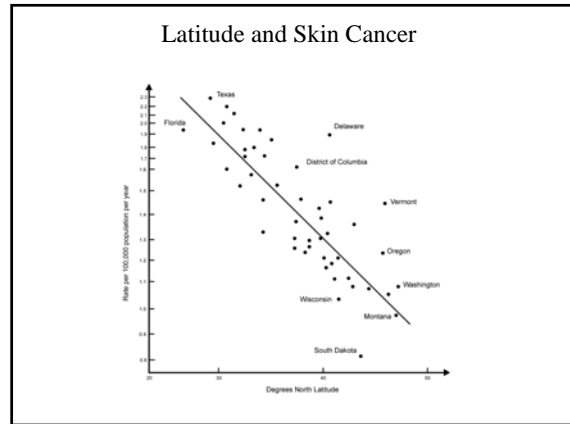
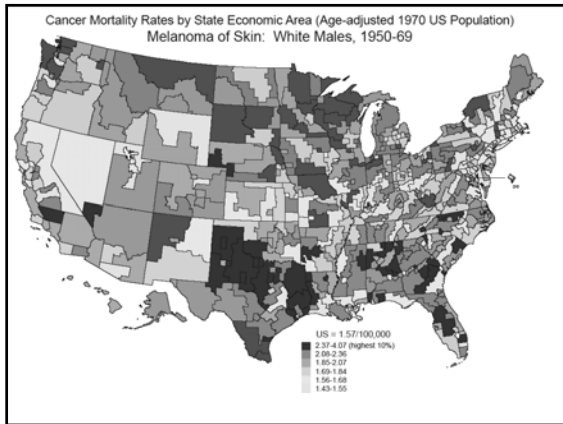


FORECAST CLEAR SKY UV INDEX FOR LOCAL NOON SAT 10 JAN 04

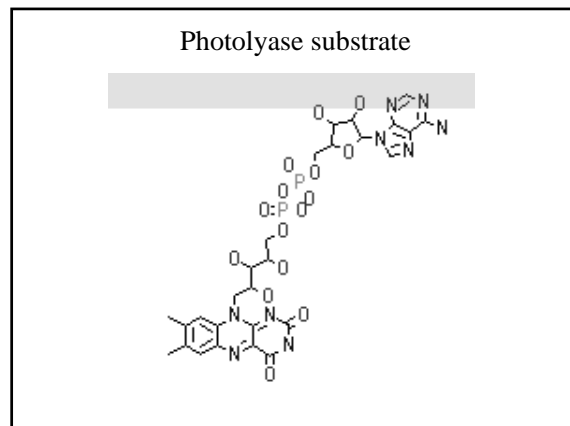


Geography and Skin Cancer





Molecular Mechanisms

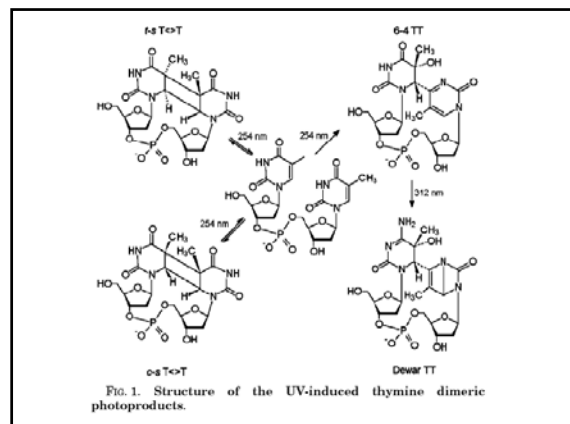


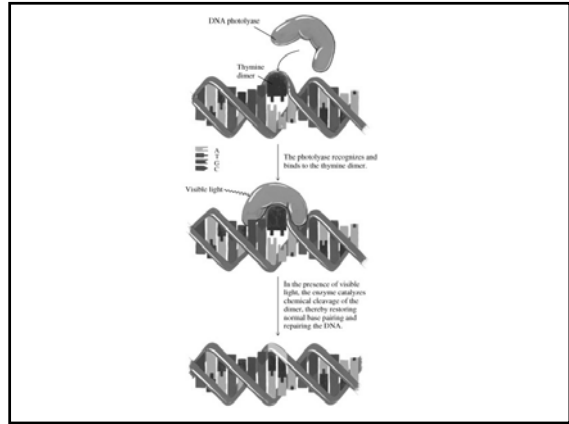
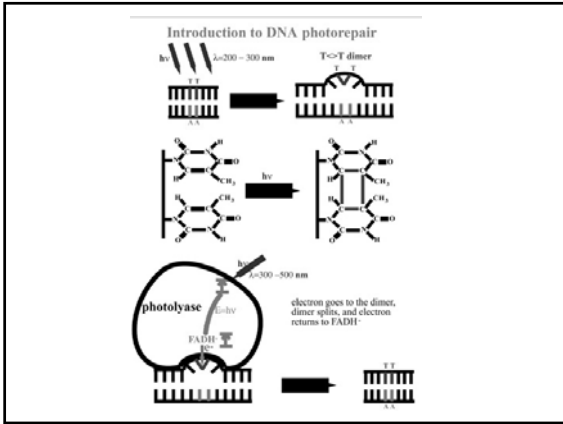
Exposure-specific mutations

Some mutations have been linked (epidemiological and experimental evidence) to specific exposure and tumor sites:

Tumor	Mutation	Exposure
HCC	G > T (Arg > Ser) at codon 249	HBV, Aflatoxin
Skin cancer (non melanoma)	CC > TT	UV radiations
Lung cancer	G > T (codons 157, 158, 245, 248, 249, 273)	Tobacco smoke (benzo(a)pyrene)
Bladder cancer	G > C	Arylamines (tobacco smoke, chemical dye)

May 2003
Magali Olivier, Pierre Hainaut, IARC





Proc Natl Acad Sci U S A. 2000 February 15; 97 (4): 1790-1795
Medical Sciences

Enzyme plus light therapy to repair DNA damage in ultraviolet-B-irradiated human skin
Helger Sigge,¹ Len Rozsa,² Arie A. Vink,³ Markus Grewe,² Thomas Ruzicka,² Susanne Grether-Beck,² and Jean Krutmann^{1,2}

Topical application of photolyase reversed CBDs by 50 - 60%

Cellular functions of p53:

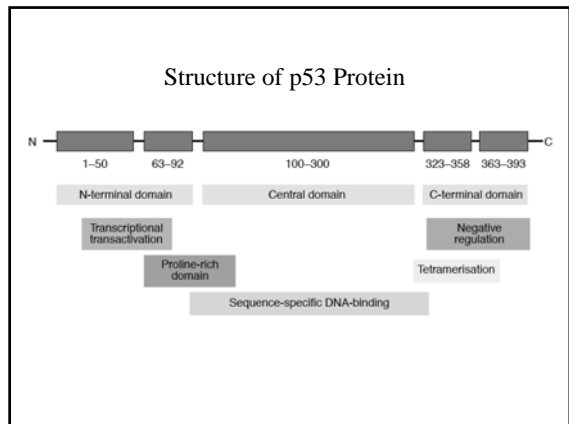
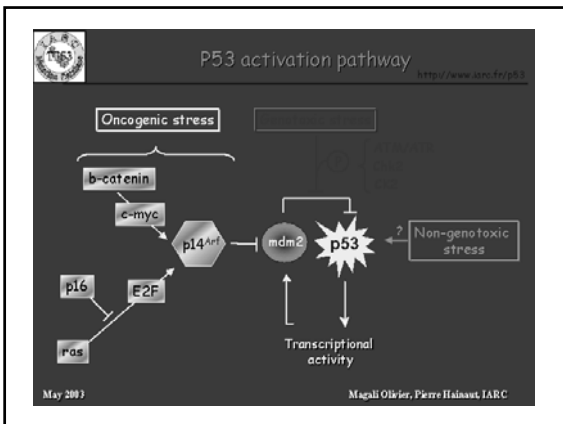
1. Suppresses progression through the **cell cycle** in response to **DNA damage**, thereby allowing **DNA repair** to occur before replicating the genome; hence, p53 prevents the transmission of damaged genetic information from one cell **generation** to the next
2. Initiates **apoptosis** if the damage to the cell is severe (this protects the organism from the *growth of damaged cells*, and so loss of p53 function is a key step in the *neoplastic cascade*).

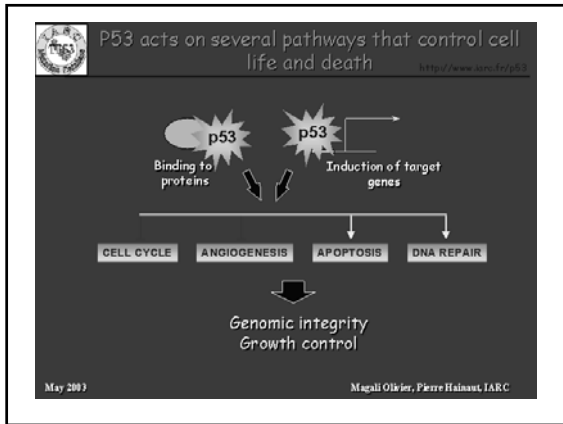
Mediators of this effect: [bax \[Ref.\]](#)

3. Often as a **tumour suppressor**: Mutations in p53 can cause cells to become *oncogenically transformed* and transfection studies have shown that p53 acts as a potent **transdominant tumour suppressor**, able to **restore** some level of **normal growth** to cancerous cells in vitro (!)
4. p53 is a potent **transcription factor** and once activated, it represses transcription of one set of genes (several of which are involved in stimulating cell growth) while stimulating expression of other genes involved in cell cycle control

[5. the p53 pathway](#) (picture summarizing the *cellular functions* of p53, 996, by [Hall PA et al.](#))

<http://bioinformatics.weizmann.ac.il/hotmolebase/entries/p53.htm>

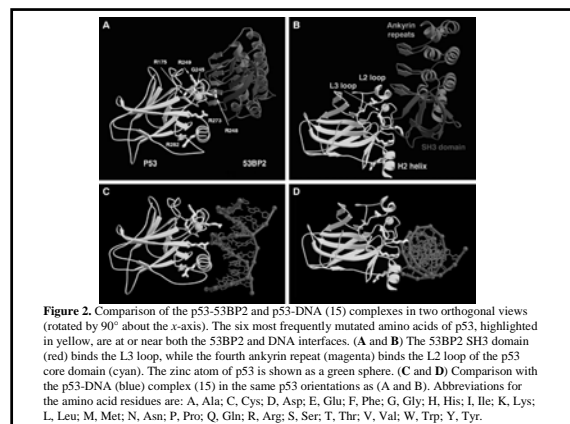
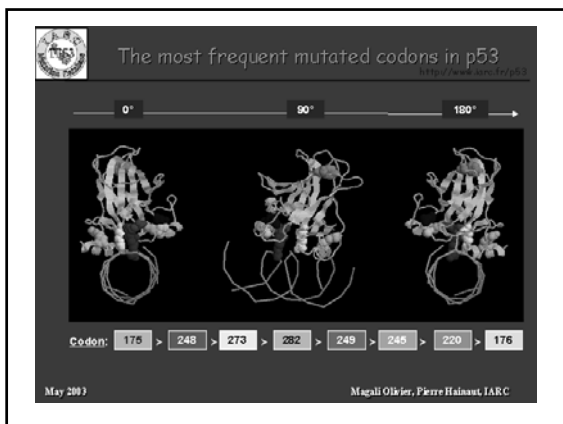
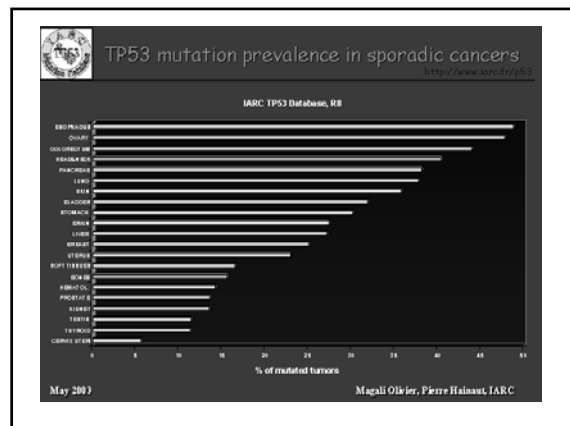
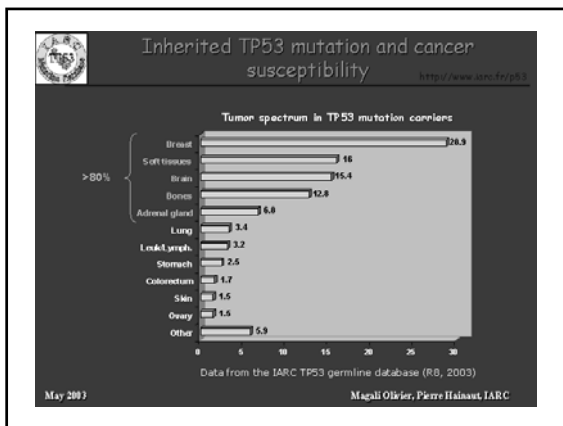




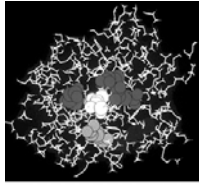
Oncogene, 1999 Jul 22;18(29):4247-53.
 Nature publishing group

p53 protects against skin cancer induction by UV-B radiation.

Jiang W, Ananthaswamy HN, Muller HK, Kripke ML.

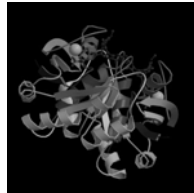


The Ras (Rause-associated sarcoma) Oncogene



The three-dimensional structure of Ras protein. Many of the mutations of Ras observed in human cancers have been site-pointed and mapped onto this structure. [Image credit: Mark Boguski, NCI, NIH, Bethesda, USA.]

In about 30% of human cancers, Ras is mutated so that it is permanently switched on, telling the cell to grow regardless of whether receptors on the cell surface are activated or not



Mol Carcinog. 2003 Jul;37(3):149-57.

Related Articles, Links

InterScience

Elevated basal reactive oxygen species and phospho-Akt in murine keratinocytes resistant to ultraviolet B-induced apoptosis.

Butts BD, Kwei KA, Bowden GT, Briehl MM.

Our model, which suggests that steady-state levels of increased ROS contribute to malignancy through an upregulation of Akt activity, has some correlative support from a recent report by Segrelles et al. on Akt in mouse skin tumorigenesis [42]. This in vivo study

(Akt = serine-threonine kinase)

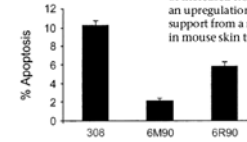


Figure 1. Decreased ultraviolet (UV) B-induced apoptosis in the two malignant variants, 6M90 and 6R90, compared to the parental 308 keratinocyte cell line. Cells were exposed to a 300 J/m² dose of UVB and harvested 13 h later. Percent apoptosis was determined by morphological assessment of 200 cells per slide (see Materials and Methods). All values are the mean ± the standard error of the mean (SEM) from six independent experiments.

Selected References

Sitalo, LA, Tibudan, SS, and Denning, MF. Activation of caspase-9 is required for UV-induced apoptosis of human keratinocytes. *J Biol Chem.* 2002;277:19346-19352.

Denning MF, Dlugosz AA, Threadgill DW, Magnuson T, Yuspa SH. Activation of the epidermal growth factor receptor signal transduction pathway stimulates tyrosine phosphorylation of protein kinase C. *J Biol Chem.* 1996;271:5325-5331.

Kowalczyk AP, Bornslaeger EA, Borgwardt JE, Palka HL, Dhaliwal AS, Corcoran CM, Denning MF, Green KJ. The amino-terminal domain of desmoplakin associates with and clusters desmosomal cadherin-plakoglobin complexes: Reconstituting the desmosomal plaque. *J Cell Biol.* 1997;139:773-784.

Denning MF, Guy SG, Ellerbroek SM, Norvell SM, Kowalczyk AP, Green KJ. The expression of desmoglein isoforms in cultured human keratinocytes is regulated by calcium, serum, and protein kinase C. *Exp Cell Res.* 1998;239:50-59.

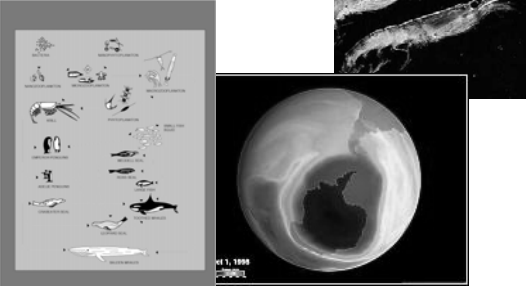
Medical Ecology Of Stratospheric Ozone Depletion:

The Rest of Life on Earth

Large losses of total ozone in Antarctica reveal seasonal ClOx/NOx interaction

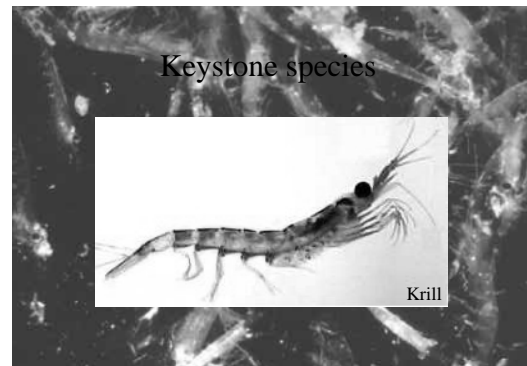
Nature 315: 207-10.

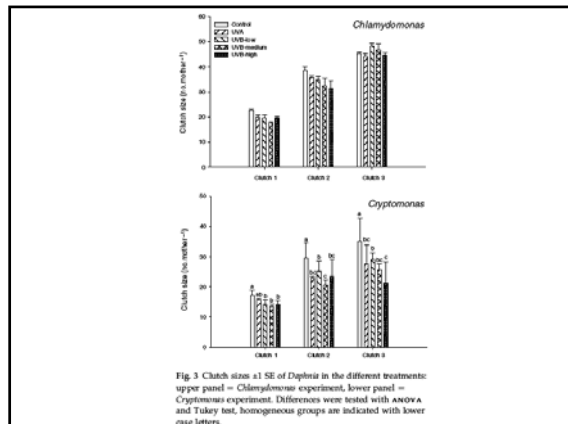
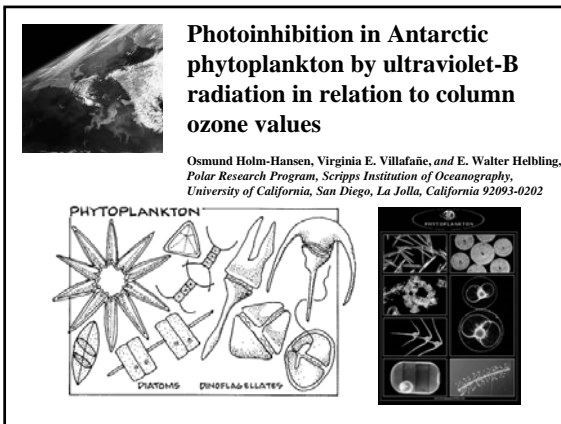
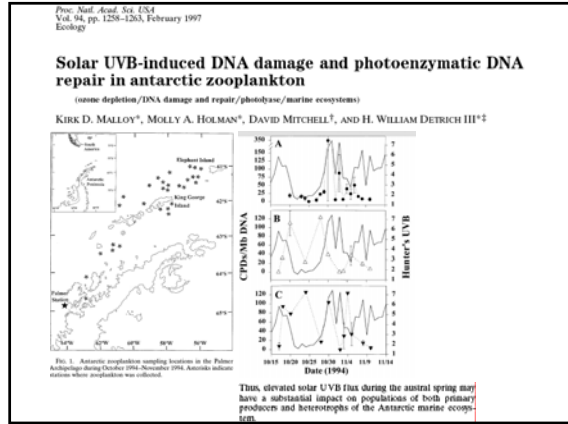
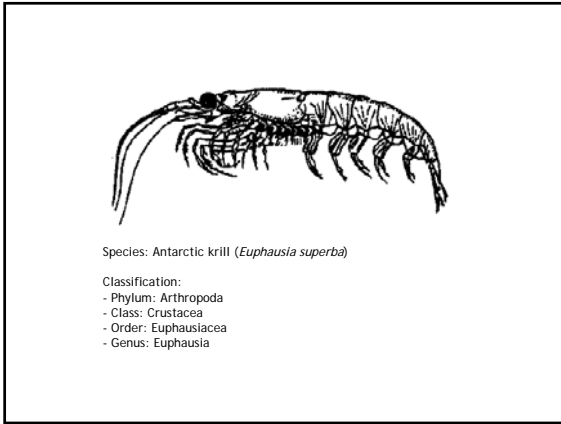
J. C. Farman, B. G. Gardiner & J. D. Shanklin*



* First article to document ozone hole over Antarctica

Keystone species





Freshwater Biology (2003) 48, 678–686

Negative effects of UVB-irradiated phytoplankton on life history traits and fitness of *Daphnia magna*

HENDRIKA J. DE LANGE AND PAUL L. VAN REEUWIJK
Aquatic Ecology and Water Quality Management Group, Department of Environmental Sciences, Wageningen University, Wageningen, The Netherlands

SUMMARY

1. We tested the effect of ultraviolet-B (UVB)-irradiated phytoplankton on life history characteristics of *Daphnia magna*. Two phytoplankton species were used, *Chlamydomonas reinhardtii* and *Cryptomonas pyrenoidifera*. The phytoplankton species were cultured under photosynthetically active radiation (PAR) conditions, and under PAR supplemented with ultraviolet-A and ultraviolet-B radiation, and fed to *Daphnia*.
2. Life history traits of *Daphnia* were negatively affected when fed on UVB-irradiated *Cryptomonas*. Size at maturity was depressed and fewer juveniles with lower fitness were produced in the UVB treatments. In the *Chlamydomonas* experiment, no significant effects were found.
3. The cause of the observed UVB effects is likely to be constraints in food quality. Ultraviolet-B radiation thus has the potential of inhibiting energy transfer from the first to the second trophic level.

Smithsonian Environmental Research Center

Ecological effects of ultraviolet solar radiation

Thompson, A., E. A. Early, J. Deluisi, P. Disterhoft, W. D., J. Kerr, J. Rives, Y. Sun, T. Lucas, M. Duhig and P. J. Neale. 1997. The 1994 North American interagency intercomparison of Ultraviolet monitoring spectroradiometers. National Institutes of Standards and Technology Journal of Research. 102: 270-322.

Neale, P. J., R. A. Davis & J. J. Cullen. 1998. Interactive effects of ozone depletion and vertical mixing on photosynthesis of Antarctic phytoplankton. *Nature* 392: 585-589.

Neale, P. J., J. J. Cullen and R. F. Davis. 1998. Inhibition of marine photosynthesis by ultraviolet radiation: Variable sensitivity of phytoplankton in the Weddell-Scotia Sea during the austral spring. *Limnol. Oceanogr.* 43: 433-448.

Minimal effects of UVB radiation on Antarctic diatoms over the past 20 years

A. McMinn^a, H. Heijnis[†] & D. Hodgson[†]

Minimal compositional changes in 20-year sequences of diatom assemblages from the Vestfold Hills suggest that the enhanced UVB levels resulting from the 'ozone hole' has had little effect on the diatom component of the phytoplankton community. In coastal areas such as this one, the presence of an

NATURE · VOL 370 · 18 AUGUST 1994

Blaustein, A.R., J.M. Kiesecker, D.P. Chivers, and R.G. Anthony. 1997. Ambient UV-B radiation causes deformities in amphibian embryos. Proc. Natl. Acad. Sci. USA 94:13735-13737.

BioScience: Vol. 53, No. 11, pp. 1028-1029.

Amphibians in a Very Bad Light

ANDREW R. BLAUSTEIN^a and LEE B. KATS^b

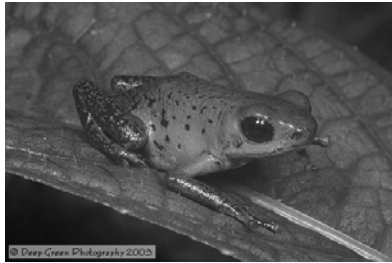
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^bFrank R. Seaver Chair, in Natural Science, Natural Science Division, Pepperdine University, Malibu, CA 90263

Evolution & Development
Volume 5 Issue 1 Page 89 - January 2003
doi:10.1046/j.1525-142X.2003.03014.x

Amphibian defenses against ultraviolet-B radiation

Andrew R. Blaustein^a, and Lisa K. Belden^b



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INTEGRATED RESEARCH CHALLENGES IN ENVIRONMENTAL BIOLOGY

The Global Decline of Amphibians

OVERVIEW OBJECTIVES MEMBERS PUBLICATIONS PROTOCOLS LINKS NEWS

HOST-PATHOGEN BIOLOGY AND THE GLOBAL DECLINE OF AMPHIBIANS



Biological Resources



Evaluation of Solar Ultraviolet Radiation as a Factor in Amphibian Decline in Montane Habitats

Duration: February 1999 - September 2003

Principal Contact: Dr. Edward E. Little, USGS Columbia Environmental Research Center

