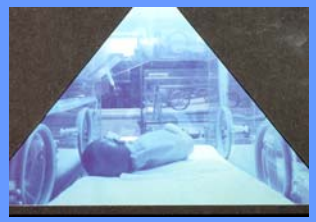
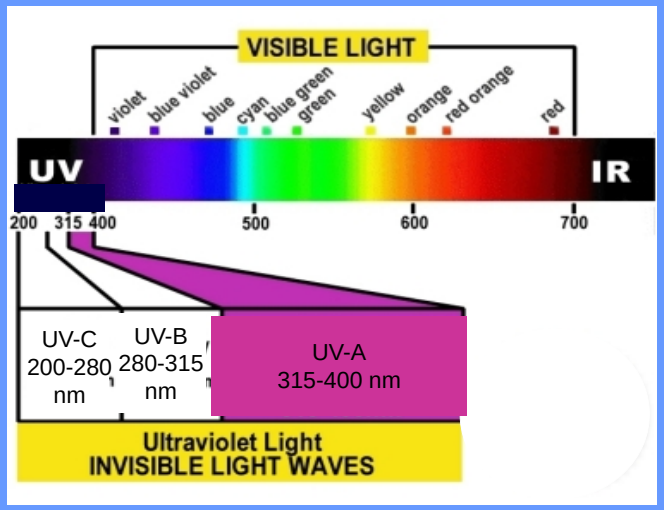

# Biological effects of light



## Optical reagon of EM spectrum




## Steps leading to the photobiological alterations

Photophysical processe
(absorption of light)

↓

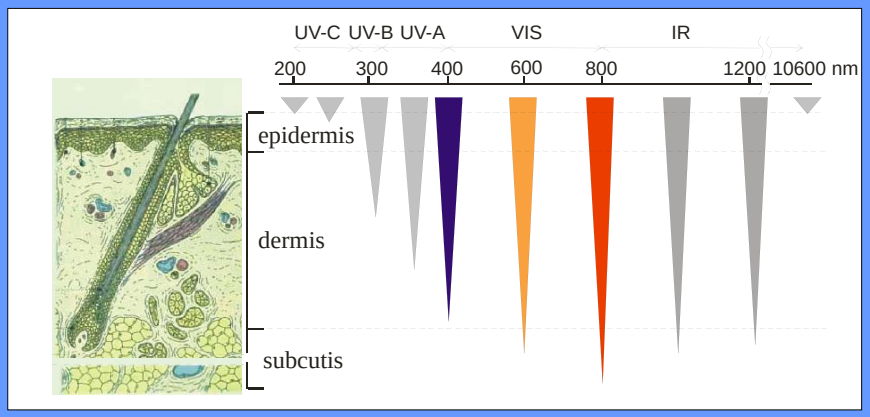
Photochemical reaction

↓

Photobiological processes

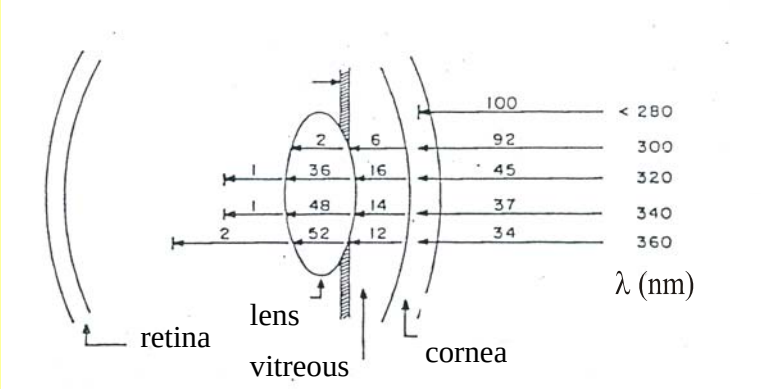
*Absorption of light is a prerequisite of photobiological processes*

## Penetration distance of light into skin




*Penetration depth is wavelength dependent*

## Penetration distance of light into eye




## Ligth absorbers (chromophores) in human tissues

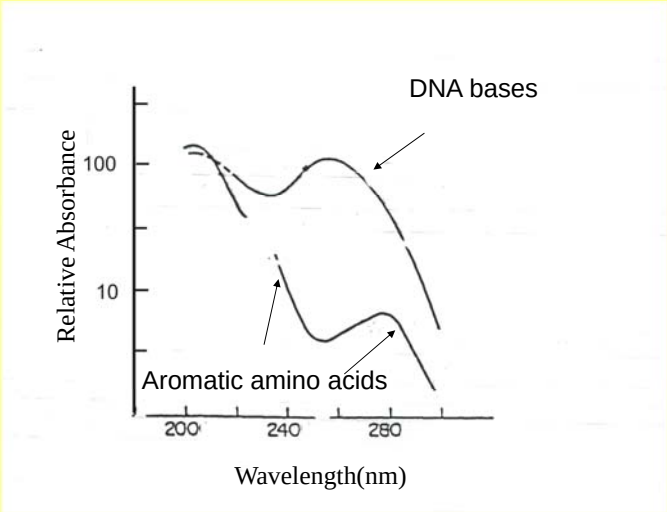
Endogenous

e.g. nucleic acids
proteins
melanin
opsins

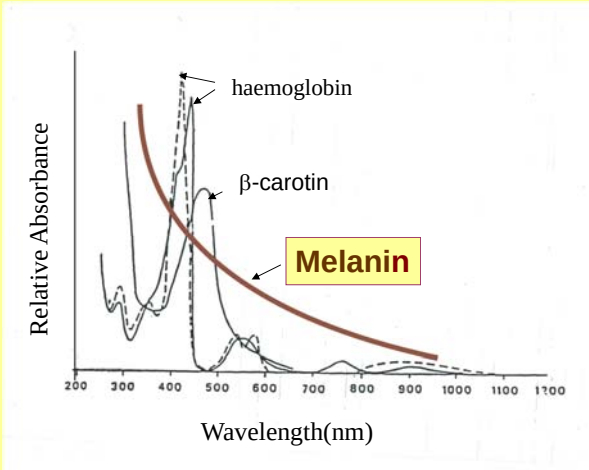
Exogenous

e.g. food coloring dyes
cosmetics
drugs

## Absorption spectra of endogenous chromophores (1)

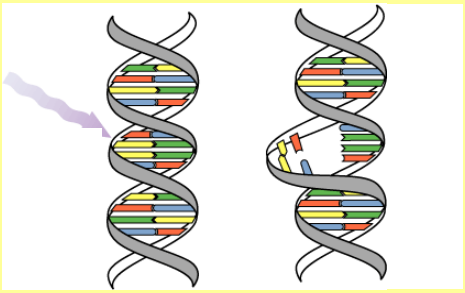


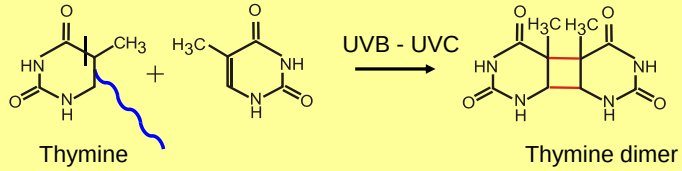

## Absorption spectra of endogenous chromophores (2)



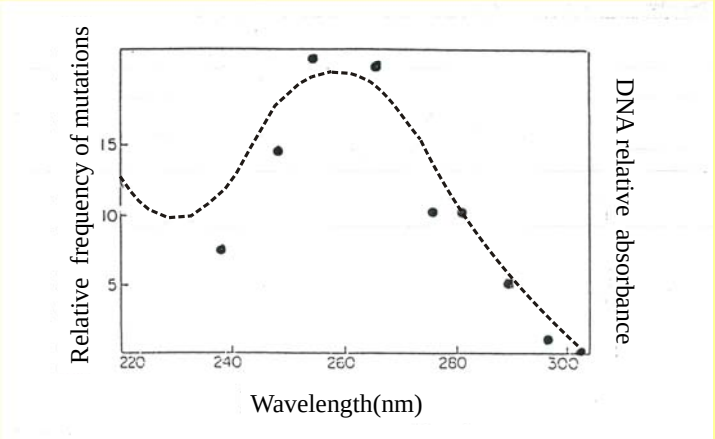
## Direct photochemical reactions

## Formation of DNA damages






## Biological consequences of DNA damages in E. coli




*Efficiency varies with the wavelength*

*Mutations are induced by the photons absorbed in DNA*

## Reciprocity?

$$J_{(\lambda)}\ [J / s\ m^2]\ \times t\ [s] = D_{(\lambda)}\ [J / m^2]$$

The results depends only on the incident dose ( $D_{(\lambda)}$ )
or
on $J$ and on $t$ separately

Reciprocity is valid for photochemical reactions but not for photobiological results.

# Examples for the photobiolgical effects of light

## Beneficial vs detrimental effects

examples

Vision
Vitamin-D production
Pigmentation
Daily and annual rhythms
Terapeutic applications

examples

Sunburn
Wrinkles
Age related pigmentation
Skin cancer
Immuno-suppression

## Spatial distribution of alterations

*Local effects*

in the skin

in the eye

target regions of therapies

*Systemic effects*

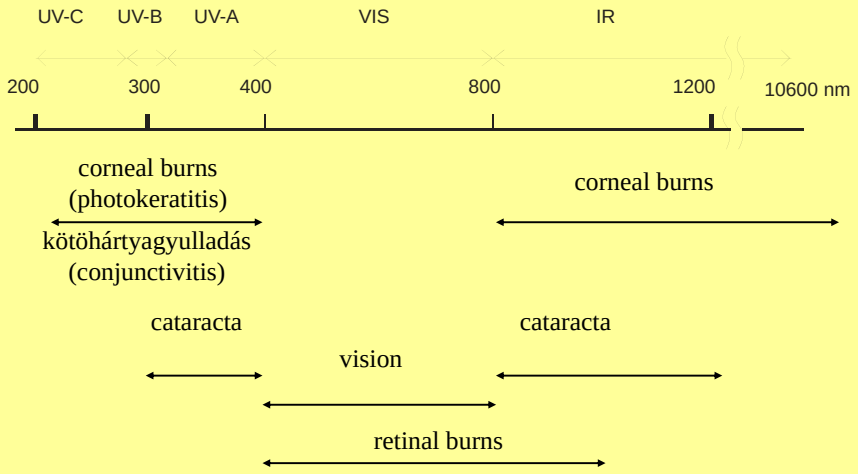
## Temporal distribution of alterations

*Short term*: sunburn
immuno-suppression

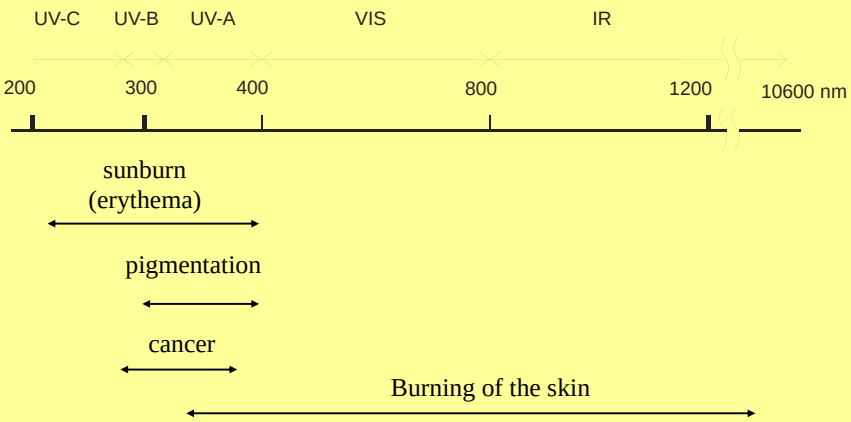
*Long terme*: age related wrinkles
age related pigmentation
skin Cancer


## Penetration distance and localization of damages

in the eye



## in the skin




## *Question of the week*

Absorption of UV-C and UV-B radiation leads to photobiological damages in living organisms. Wich macromolecule is responsible for these processes? Why?

## *Damjanovich, Fidy, Szöllősi: Medical Biophysics*

II. 2.3.3

II. 2. 3.4.

IX.2.