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THE INFLUENCE OF LIGHT ON THE GROWTH OF HUMAN SKIN FIBROBLASTS

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The objective of this work was to investigate the growth changes of human skin-cells (fibroblasts) after irradiation by visible light with different wavelengths.

According to experiments performed with a He-Ne laser this radiation is considered to have an antiinflammatory and analgesic action and to stimulate the regenerative mechanisms of tissues. Good clinical results have been reported from patients with trophic ulcers, indolent wounds, severe burns, polyarthritis undergoing such laser treatment. This method was pioneered by Prof. Mester, Hungary (1). The question arises if one can get similar effects by irradiation with ordinary non-coherent light sources. Such an indication was given by Karu et al. (2) showing that the DNA synthesis is stimulated similarly after irradiation both by He-Ne laser and by red light with $\lambda = 633$ nm of a filament lamp with light filters. Nevertheless, the mechanism of the stimulating action of red light is not clear.

In this work human skin fibroblasts were grown as monolayer in a 8×12 well microplate with bovine serum supplemented medium, applying conventional cell culture techniques. The first column was left empty in order to adjust the instrument; all subsequent readings were related to these values. In order to prohibit infections the plate was covered with a transparent strech-foil. Above each plate two different interference glass filters were placed in such a way that 25 wells were covered by each filter and the rest of 38 wells was left uncovered serving as control. The cells were cultivated in an incubator at constant temperature of 37 °C and irradiated with an ordinary neon tube. (Power output: 8 W; Philips, type: TL 8W/33 D7.) All irradiation experiments were carried out during the log-phase growth of the cell cultures. After reaching the beginning of the plateau phase the cells in monolayer were stained with neutral red in order to measure the cell proliferation with a photometer using a wavelenght of 492 nm. The degree of light absorption is proportional to the cell concentration which is easier to determine as compared to time-consuming cel counting using a hemocytometer.

In a series of experiments the alteration of growth of skin fibroblasts beneath different filters was shown to be highly significant at the 0.01 significance level compared to the uncovered cells. The comparison of the different absorption values was carried out with the distribution free two-sides U-test. Figure 1 shows an increased proliferation of cells over the whole range of wavelengths of the visible light. Especially in the range between 530 and 790 nm a significant increase

of growth occured with a maximum around 630 nm, while in the range between 400 and 500 nm a minimum could be observed.

The performed experiments show that the effect of increased proliferation seem to be unrelated to the property of coherence of the light as it is sometimes emphasized in the literature. Therefore, one can assume that the effect depends mostly on the wavelenght and perhaps on the intensity of the light. The question is if molecules exist also in human cells cabable of absorbtion of light of specific wavelength as it is known from plants. In the latter case the molecule phytochrome is a receptor for light (660 and 730 nm) and operates as a switch providing regulation of metabolic reactions and physiological functions (3). At the present time one only can hypothesize that similar mechanisms may also be established in animals and that specific enzymes could be associated with control mechanisms of cell growth.

References:

1 Mester, E. et al., Laser+Elektro-Optik, **1**, 1974, S. 28.
2 Karu, T. I. et al., Nuovo Cimento, **1**, 1982, S. 828.
3 Mandolini, D. F./Briggs, W. R., Spektrum d. Wiss., 10, 1984, S. 120.

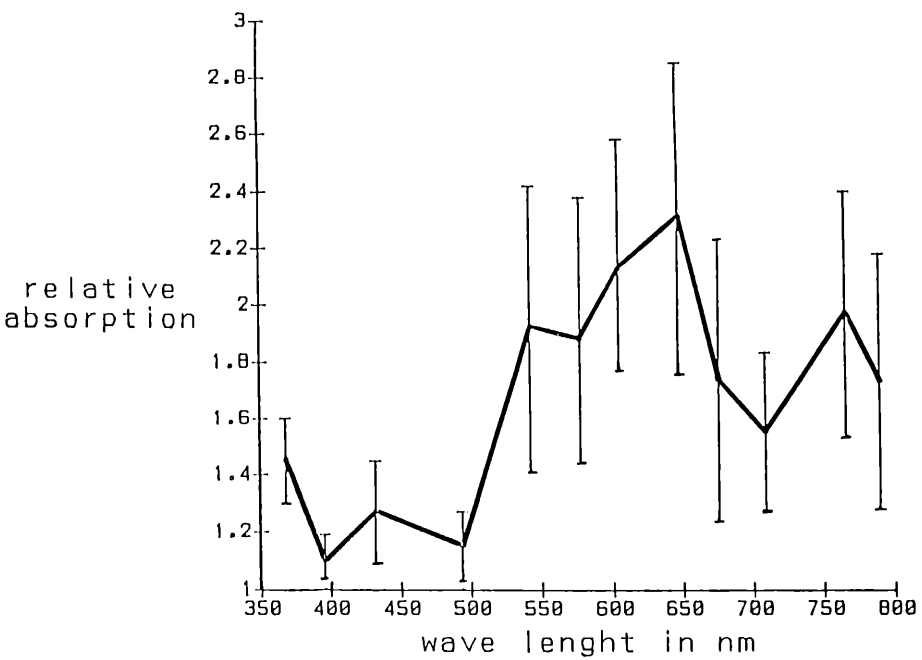

Fig. 1: Growth ratio of human fibroblasts measured as relative absorption after irradiation with visible light of different wavelengths.