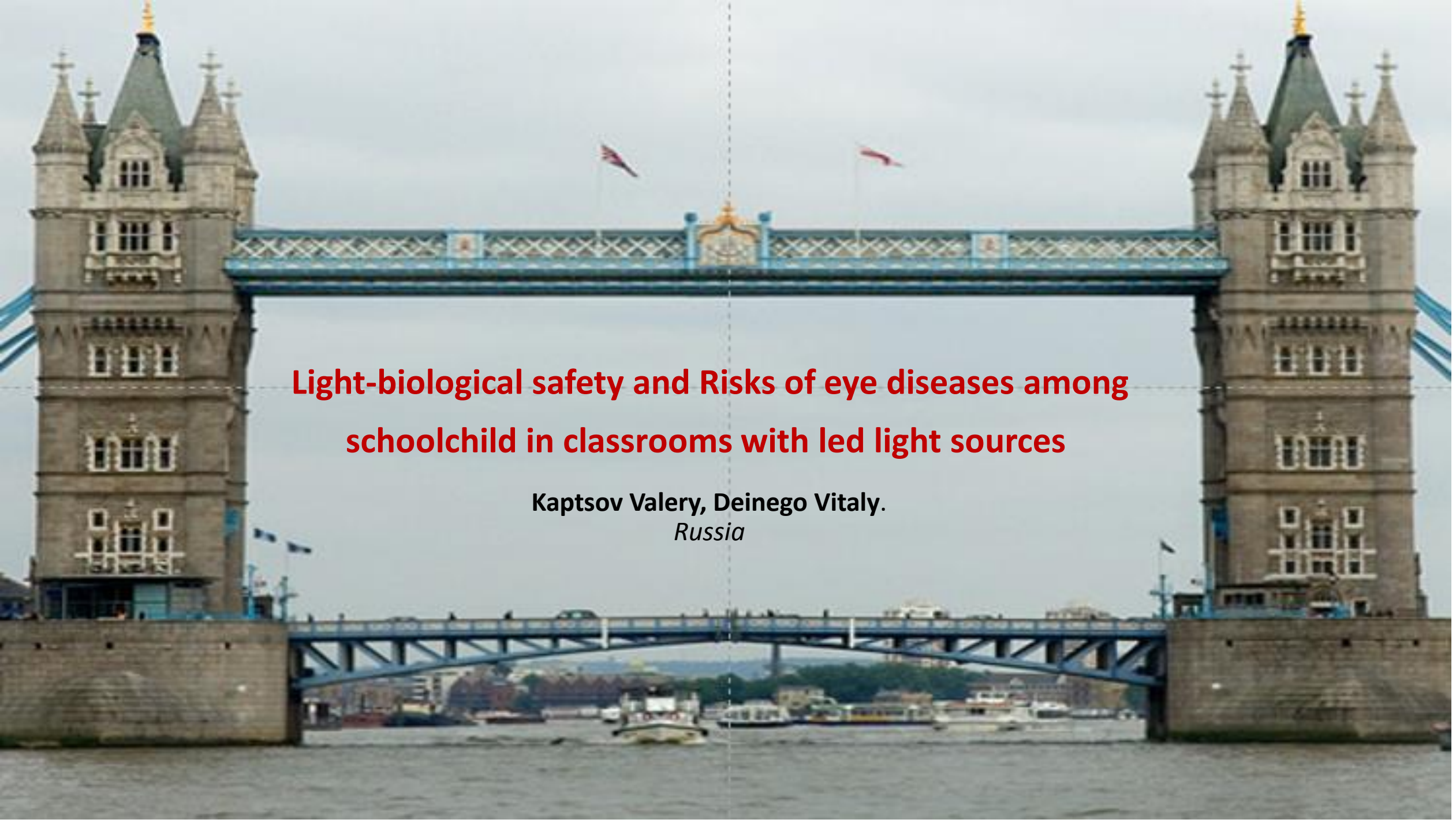
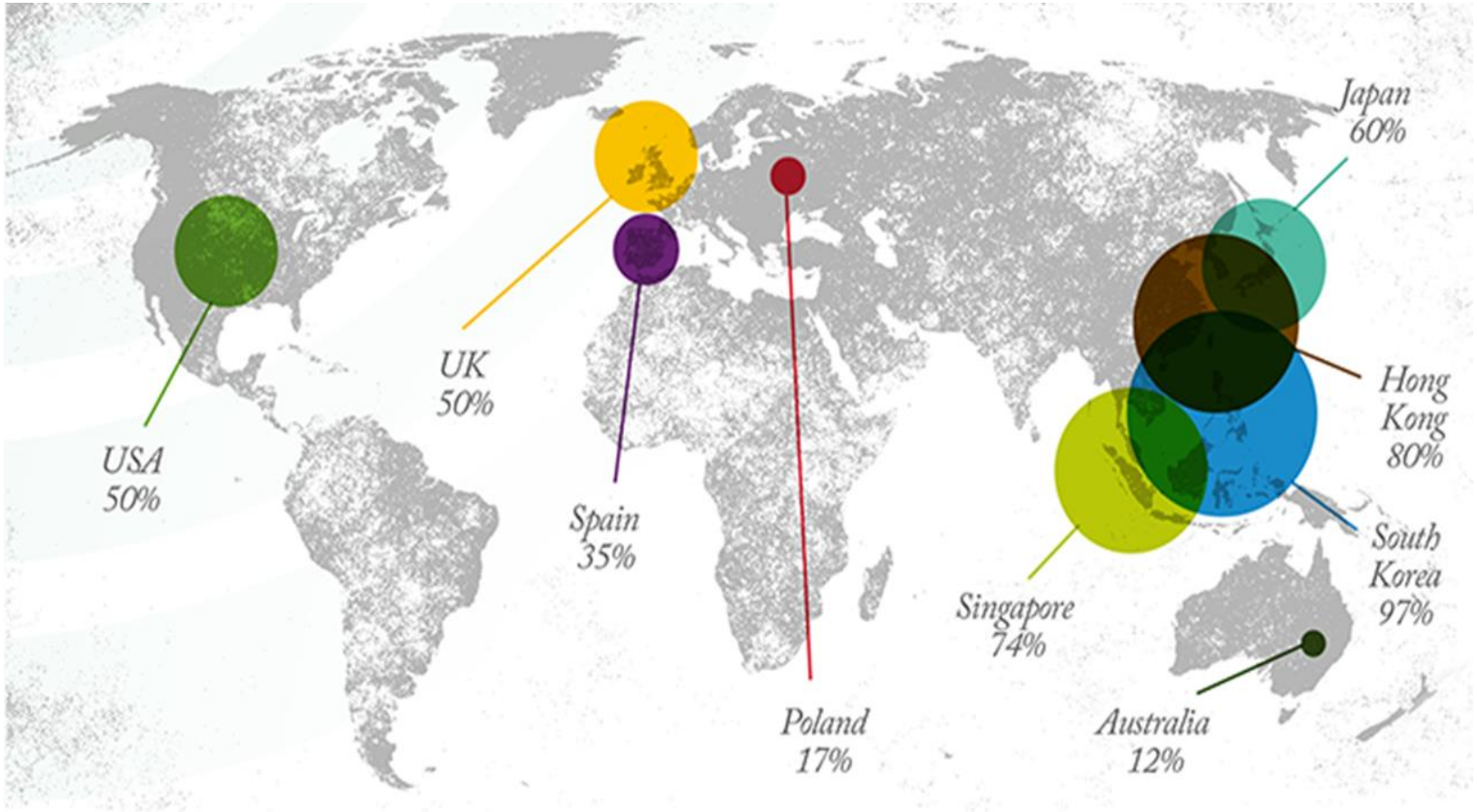


Light-biological safety and Risks of eye diseases among schoolchild in classrooms with led light sources

Kaptsov Valery, Deinego Vitaly.
Russia

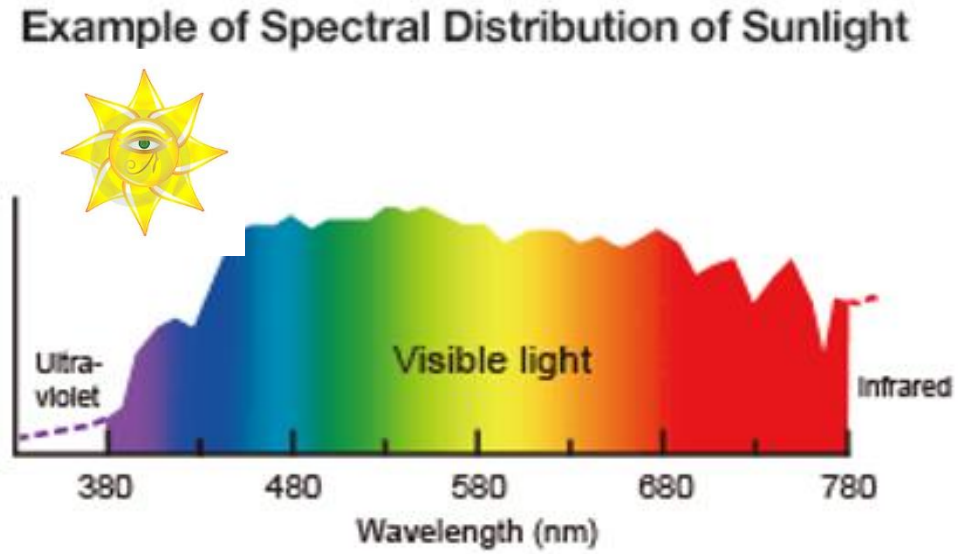
1.Myopia-Light environment
2.Hygienic safe spectrum of sunlight
3.Optimal illumination and the spectrum of the light source
4.Spectrum of led light and detected effects:
- melanopsin cross;
- melanopsin retention of pupil ;
- the marginal effect of the yellow spot;
- accumulation **lipofuscin** of which at low doses irradiation with blue light ;
- fatigue of the accommodation mechanism of the visual organ with the pupil open.
5.Evaluation of the manifestation of the effects according to the criterion of CFMF. (critical frequency of merge of flashings)
6. LEDs with sun-like spectrum of light
7.Biologically adequate emission spectrum

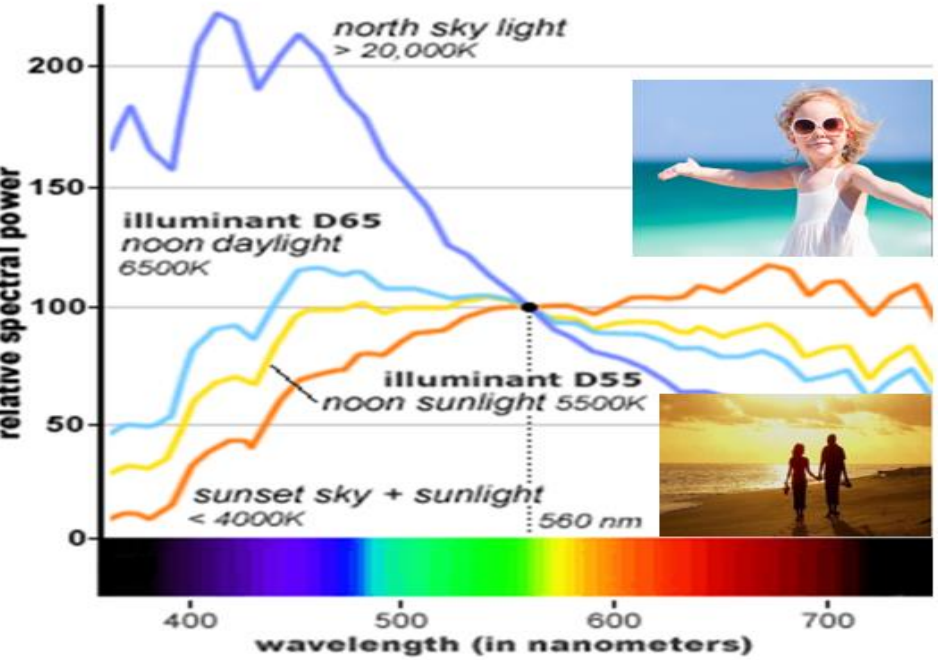
Myopia is a global problem



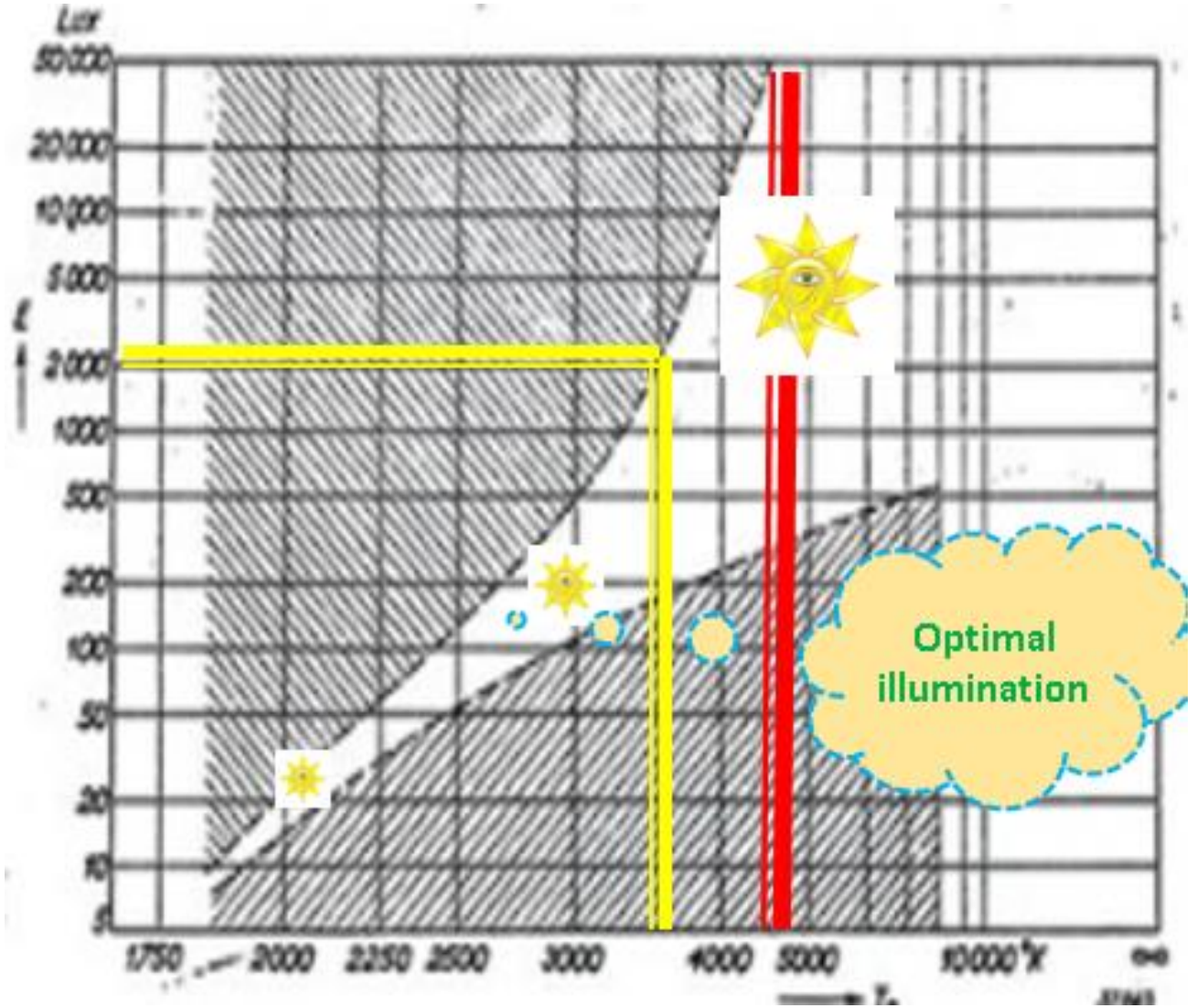
A recent study conducted in South Korea showed an almost surreal fact that virtually all 19-year-old men have short-sighted. Their military had a compulsory military service at that age, and 96.5 per cent of the conscripts were myopes.

Hygienic safe sunlight spectrum and optimal light levels





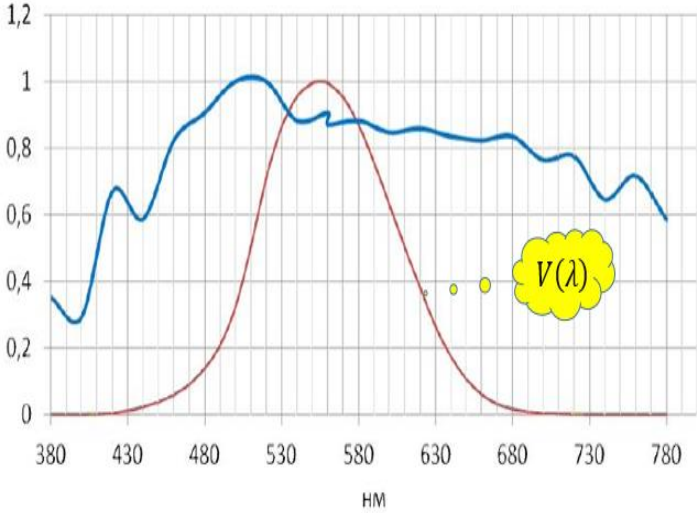
Kruithjf A/A/ Tubular Luminescence Lamps for General Illumination, Philips Technical Review 6, pp. 65-96 (1941).



Optimal illumination

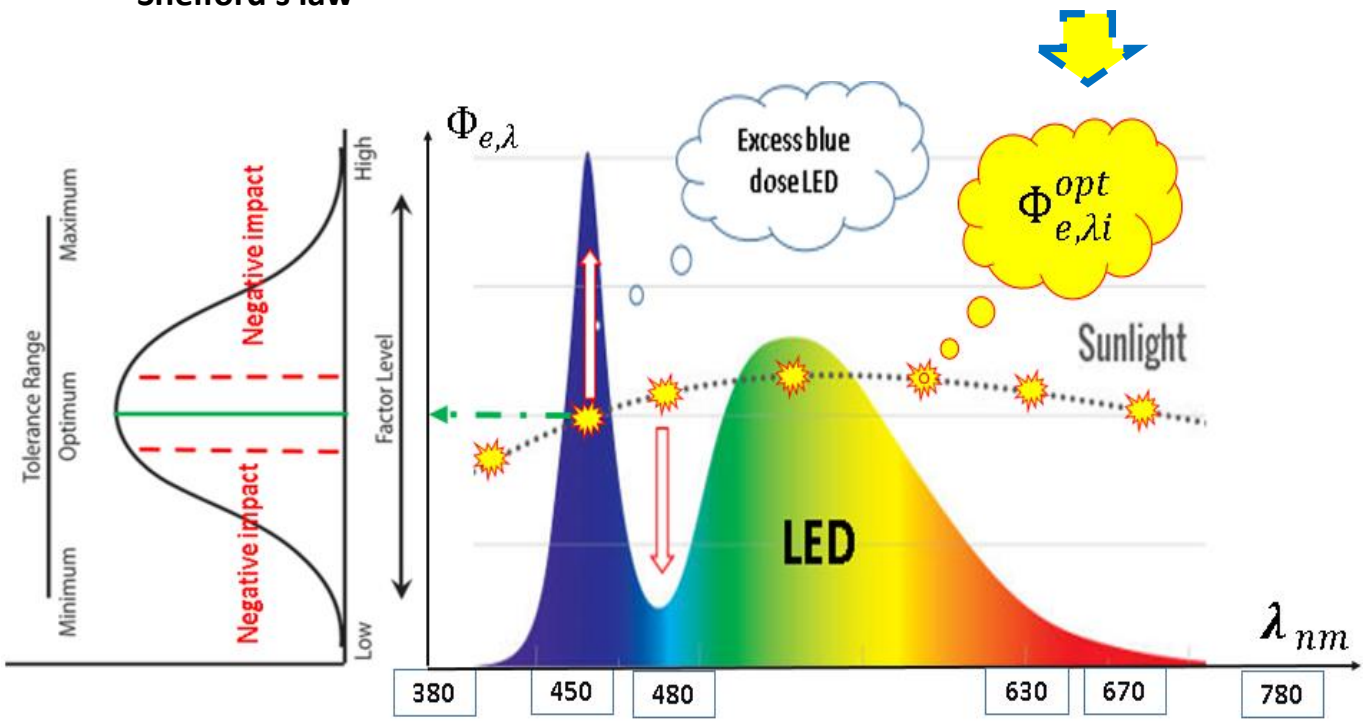
Luminous flux

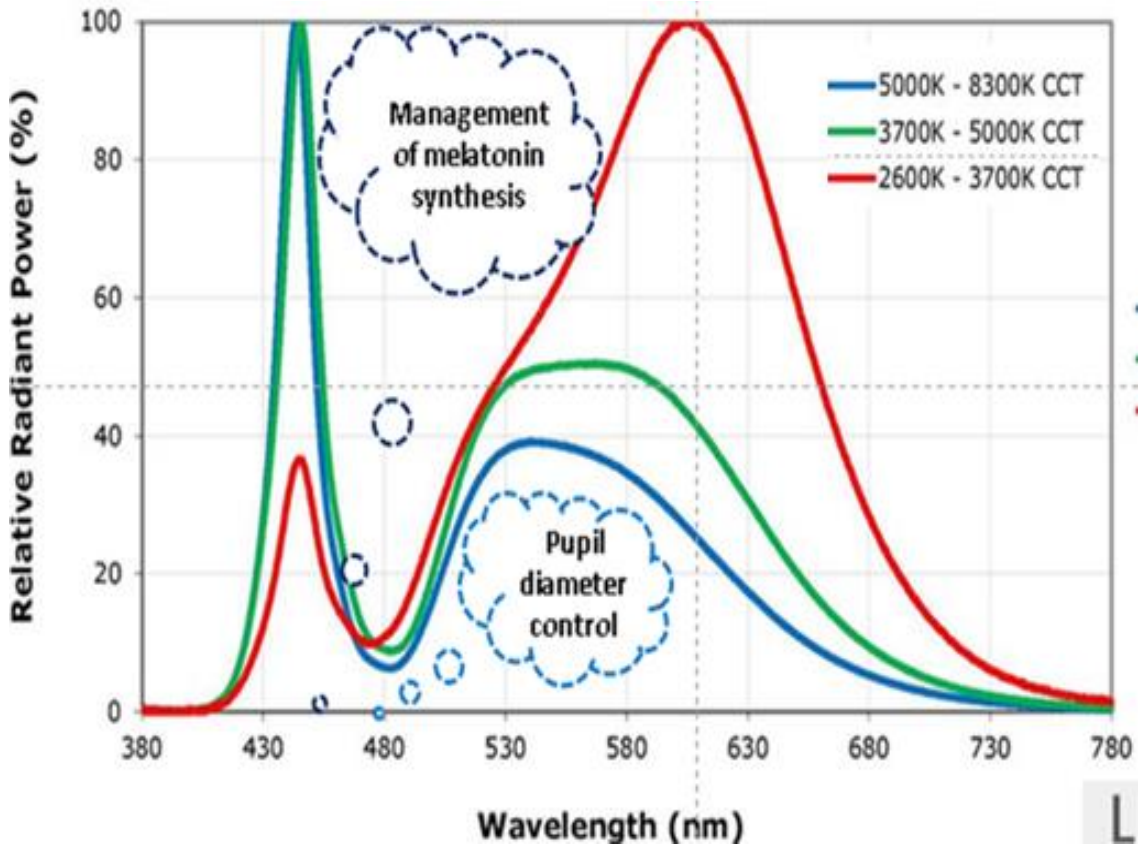
$$\Phi_v = K_m \cdot \int_{380\ nm}^{780\ nm} V(\lambda) \cdot \Phi_{e,\lambda} \cdot d\lambda.$$



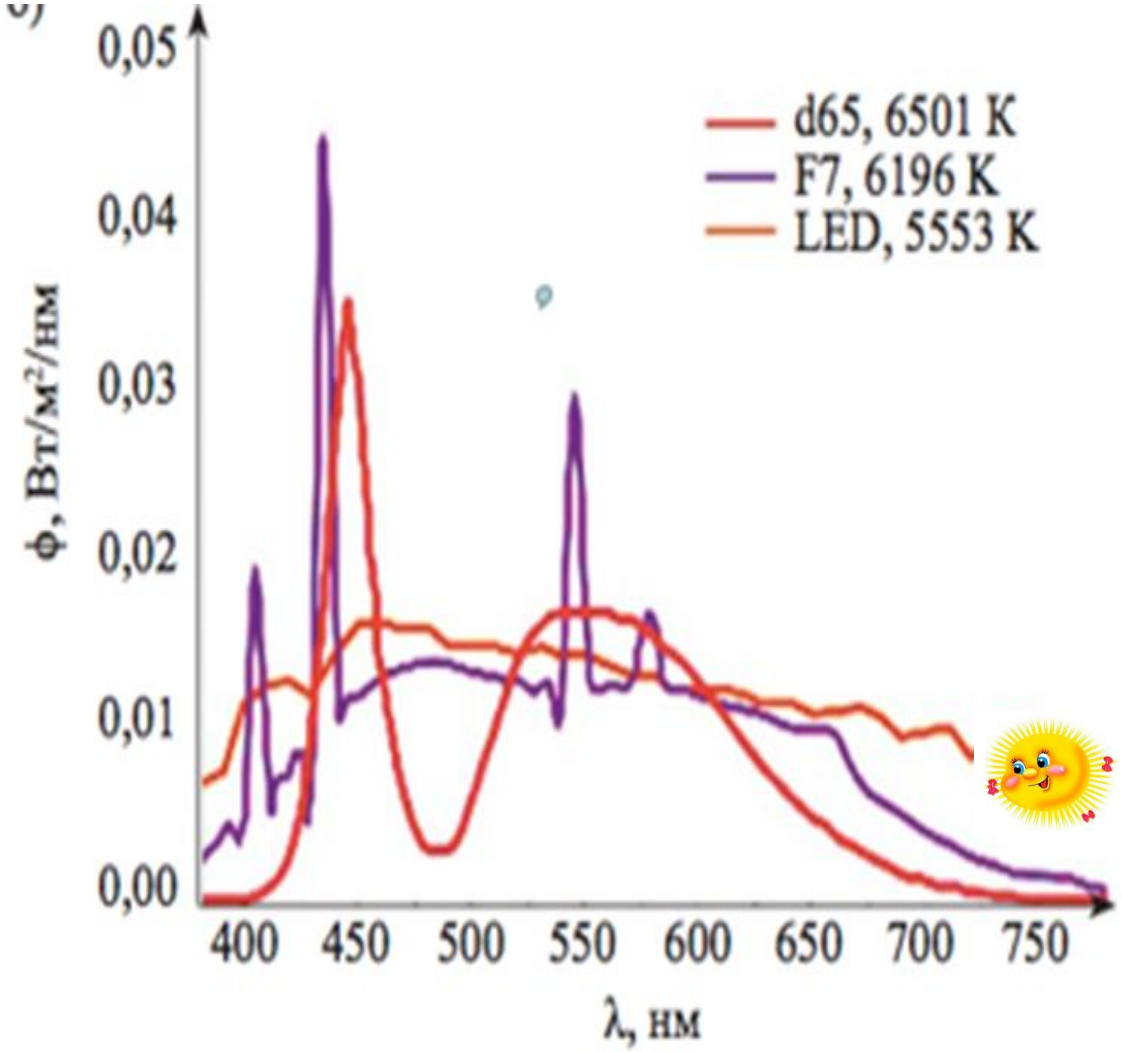
Law of optimum
or
Shelford's law

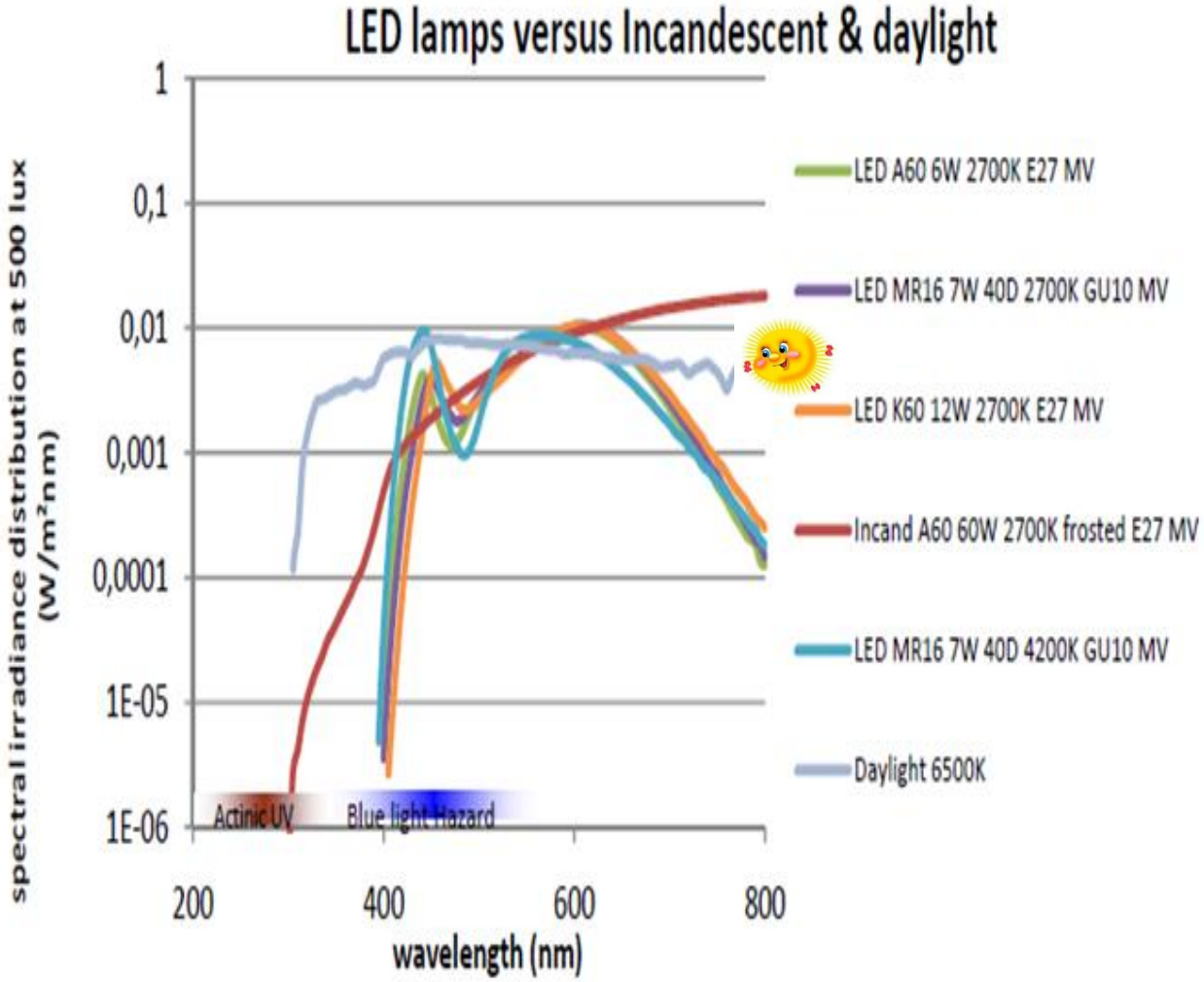
Spectral density radiation flux



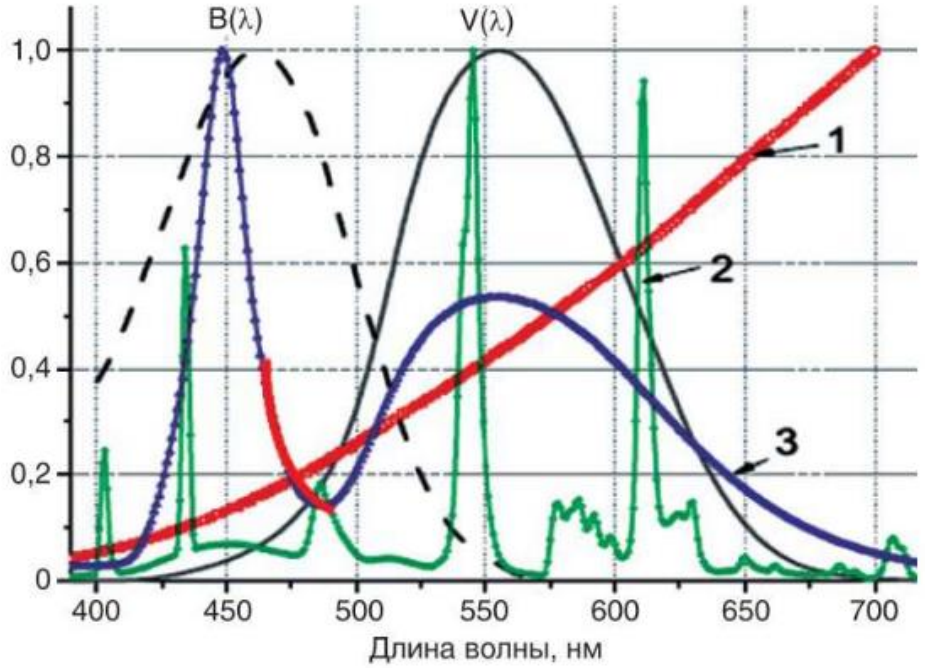


Excess dose of blue light in relation to hygienic safe sunlight



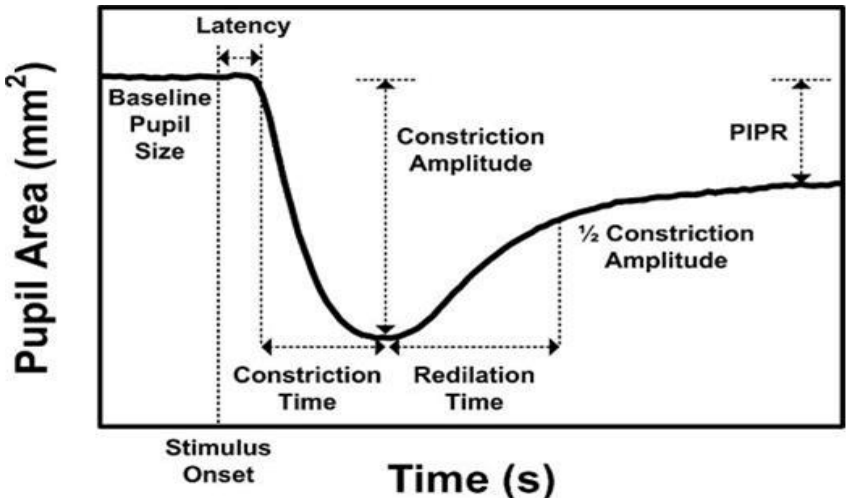


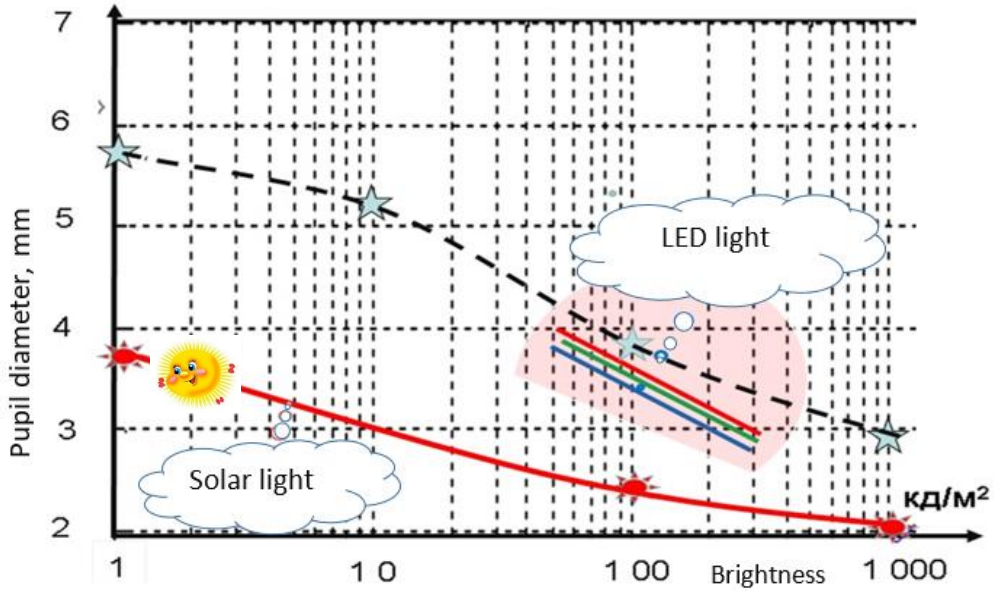
Melanopsin cross



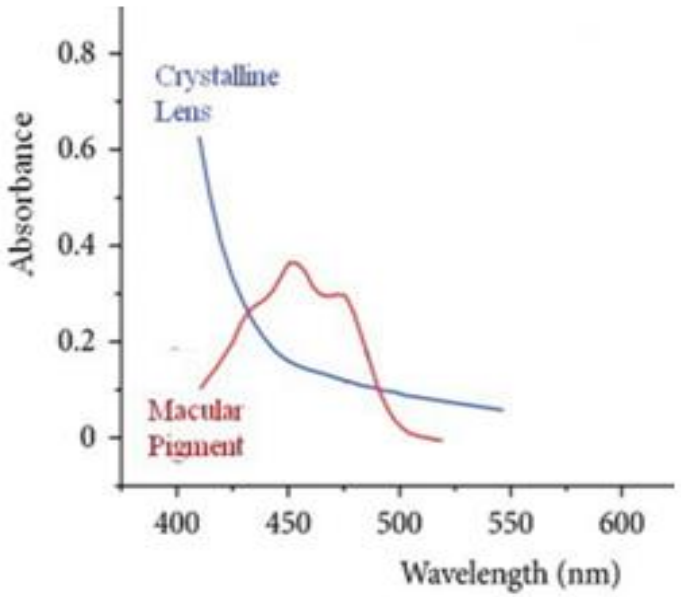
Melanopsin cross at the intersection of the spectrum curves of incandescent lamps and LEDs in the range from 460 to 480 nm

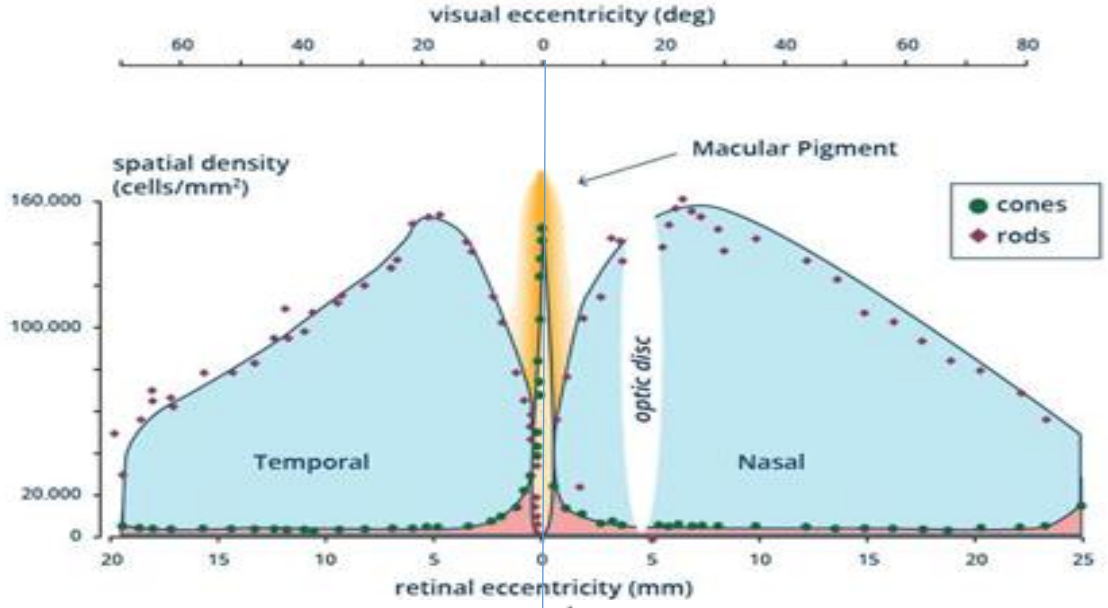
Effect of melanopsin retention of pupil

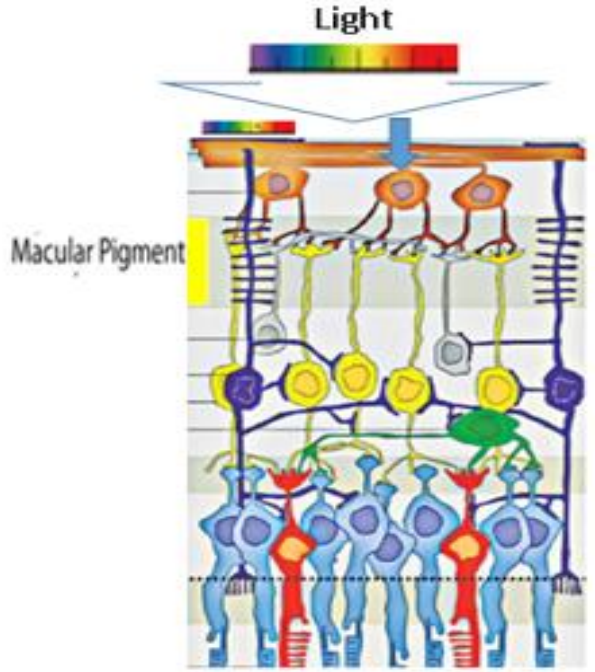




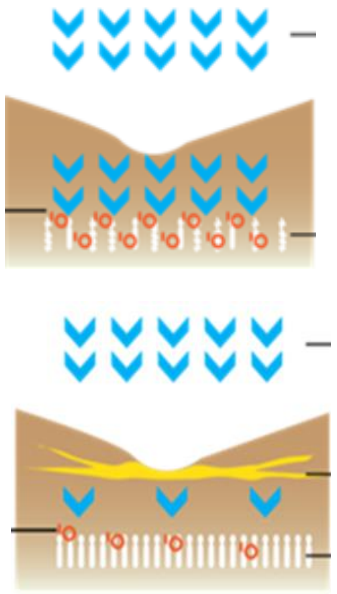
Marginal yellow spot effect

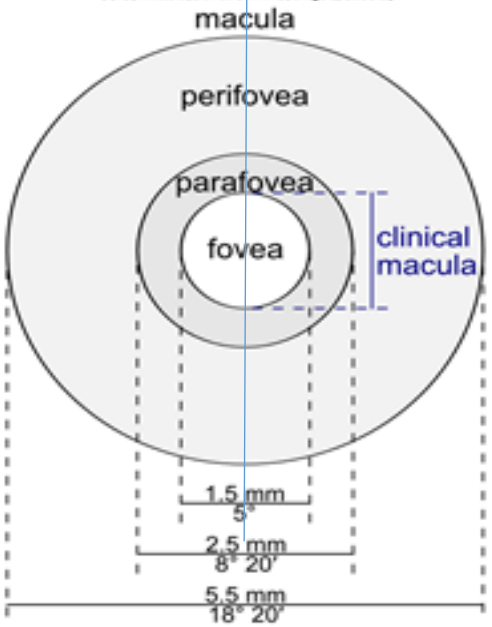


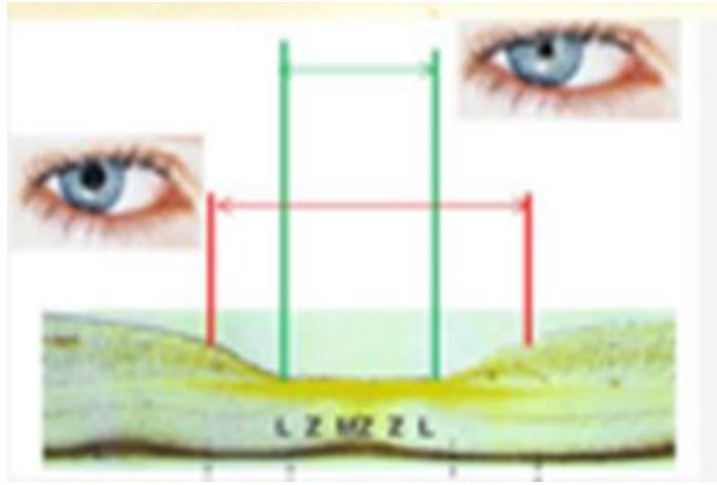




In newborns, the area of the yellow spot is light yellow with fuzzy contours. From three months of age, a macular reflex appears and the intensity of the yellow color decreases. One year is defined foveolar reflex, the center becomes darker. By the age of three or five, the yellowish tone of the macular region almost merges with the pink or red tone of the Central retina zone. The area of the yellow spot in children 7-10 years of age and older, as in adults, is determined by the vascular Central area of the retina and light reflexes.



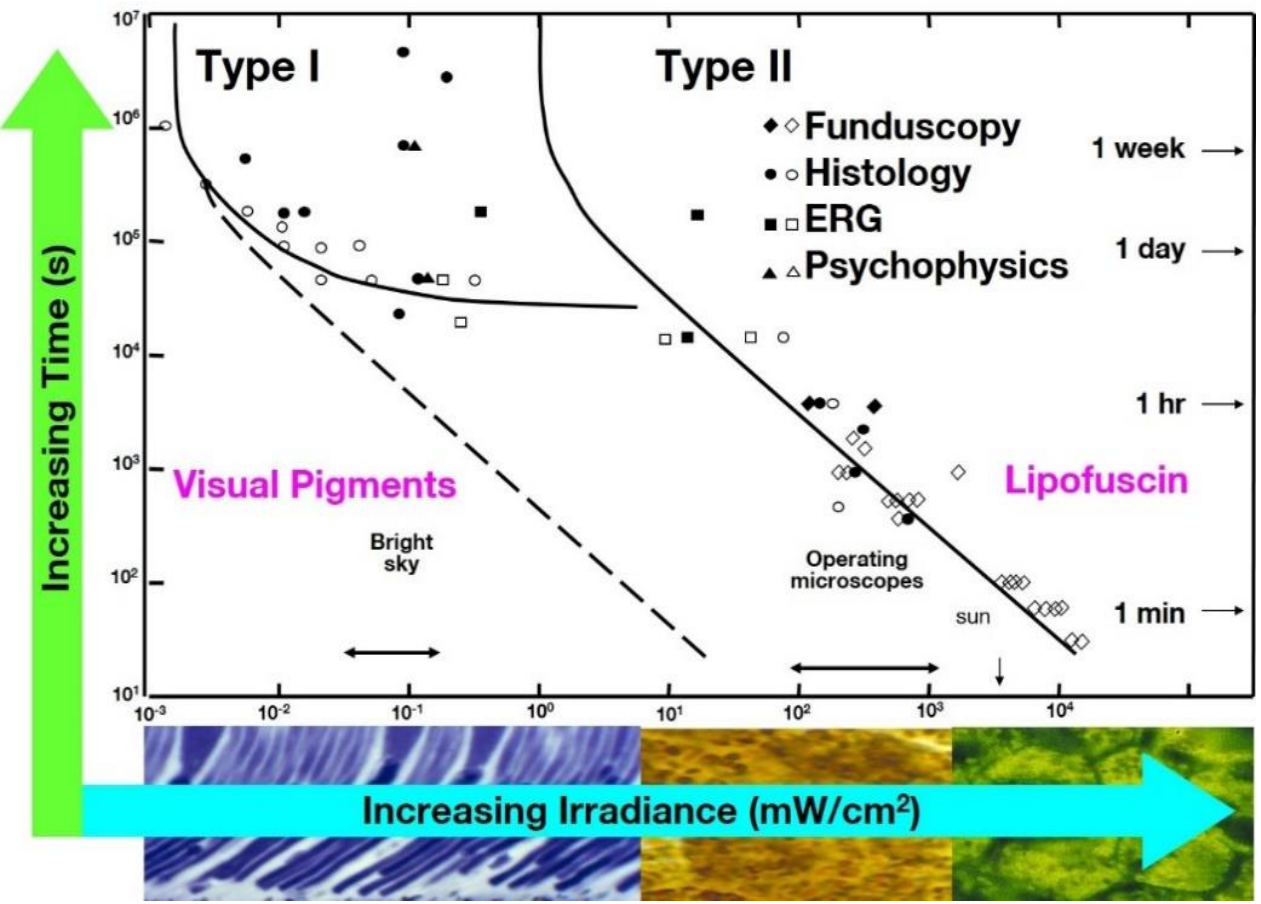


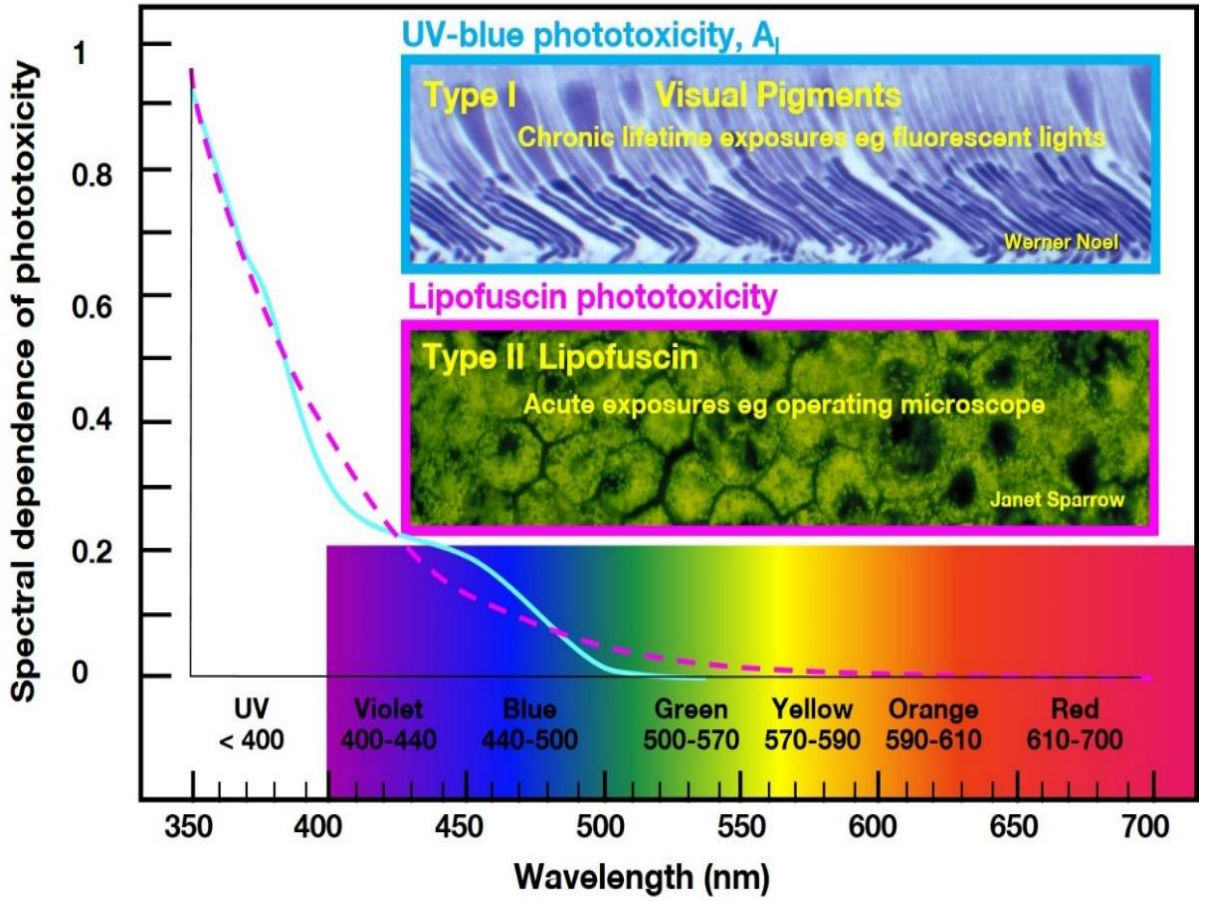


The blue light paradox: problem or panacea lipofuscin

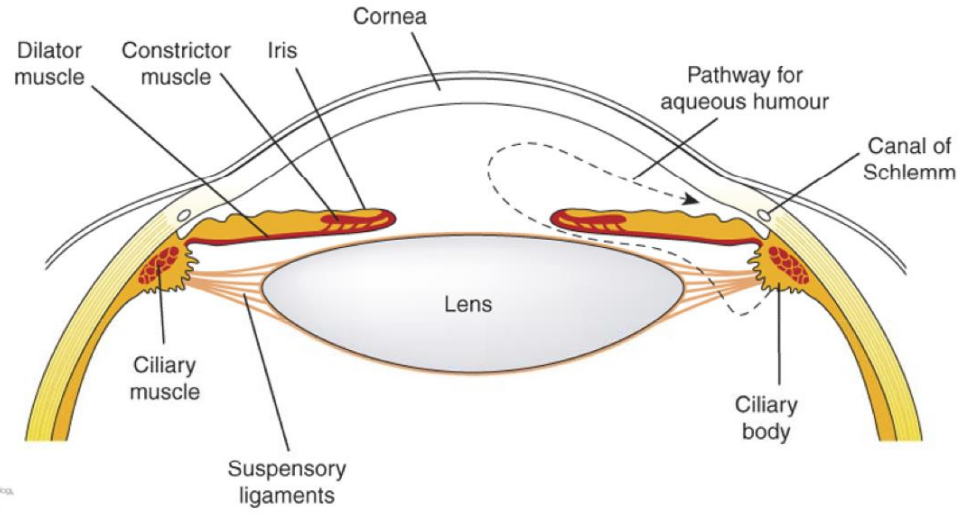
By Professor John Marshall The Blue Light Paradox: Problem or Panacea

2 CPD in Australia | 0.5G in New Zealand | 27 July 2017



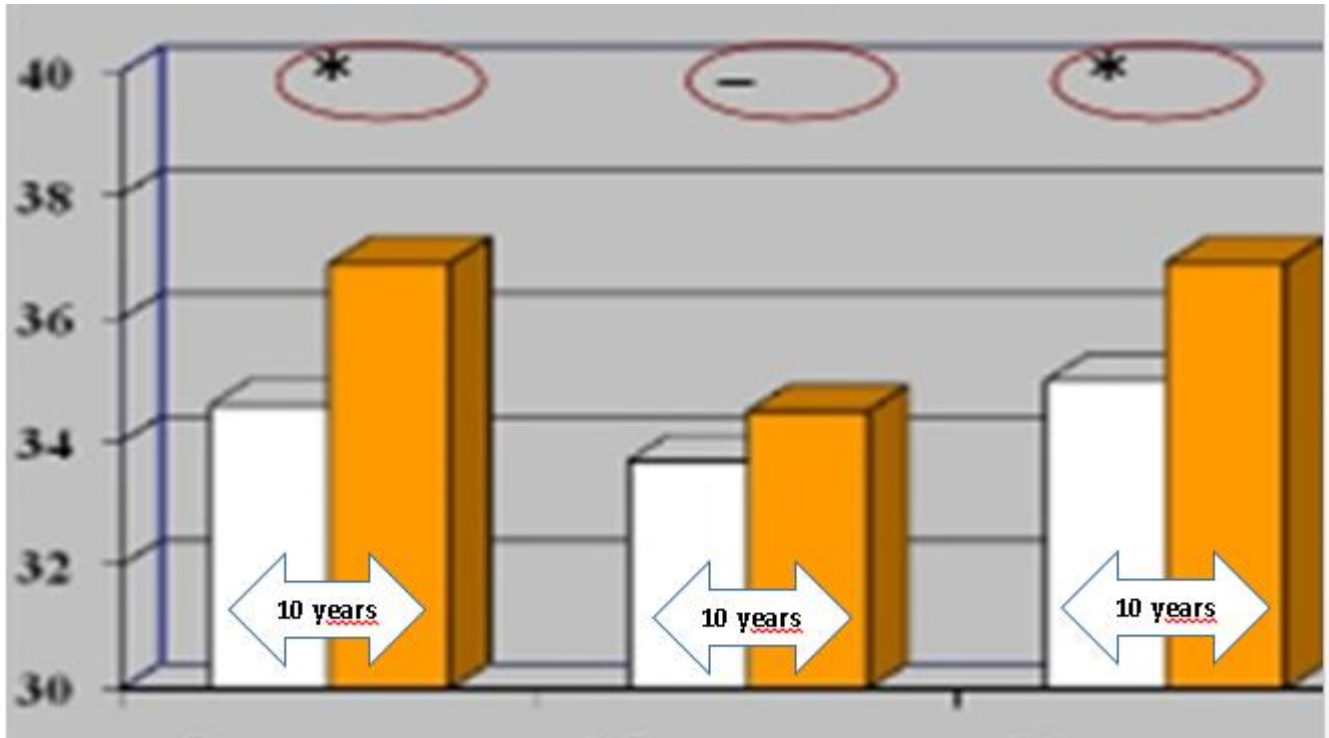


The accommodation mechanism of the visual organ is formed during all age periods and reaches the optimal level of development at the age of 17.



Pupil dilation in the conditions of led lighting (the dip in the spectrum of light in the 480nm region), the accumulation of fatigue in the muscles Brücke, Ivanova, Muller, Calasans that ensure adherence to the equality of inflow and outflow of the aqueous humor and interaction with the mechanism of accommodation

Evaluation of the manifestation of the effects on the criterion CFMF



One of the reasons for the 10-year difference in the indicators of the critical frequency of merge of flashings (CFMF) is the widespread introduction into modern life of students of information and communication tools that contribute to the development of cognitive functions and psychomotor, but lead to great fatigue of the nervous system.

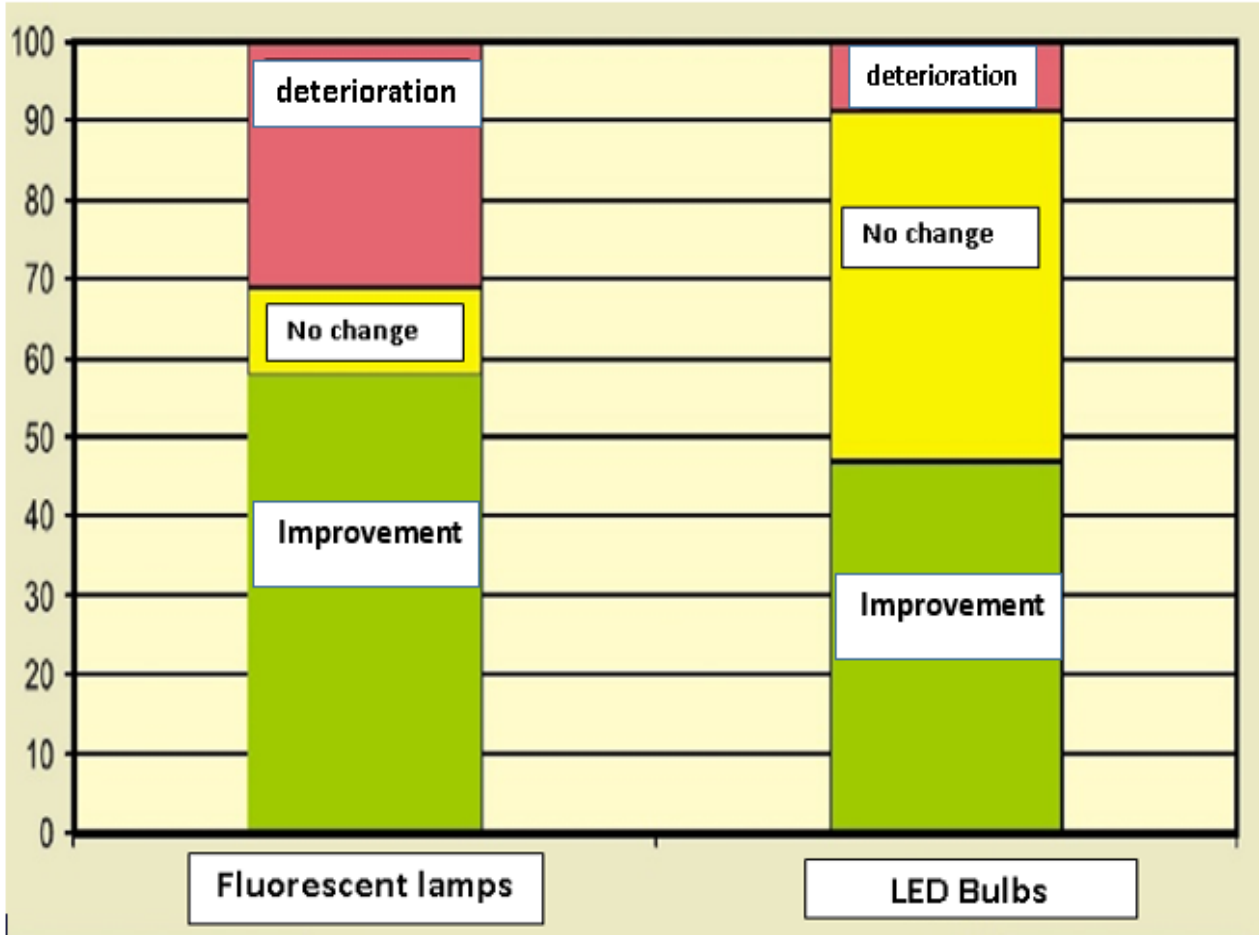
Over the past 10 years, the average level of the indicator CFMF sharply decreased

Institute of hygiene and health of children and adolescents of the Russian Academy of medical Sciences

The decline in the proportion of students of the 4th class with the "better" indicators CFMF
Pupils of 1,2 and 3 classes were not examined

Class	Indicators	Fluorescent lamps	LED Bulbs
4	Speed of work	-	+
	Precise operation	-	-
	Strong and vypazhtnnoe fatigue	-	+
	Integrated health indicator	-	-

(minus) - negative trend

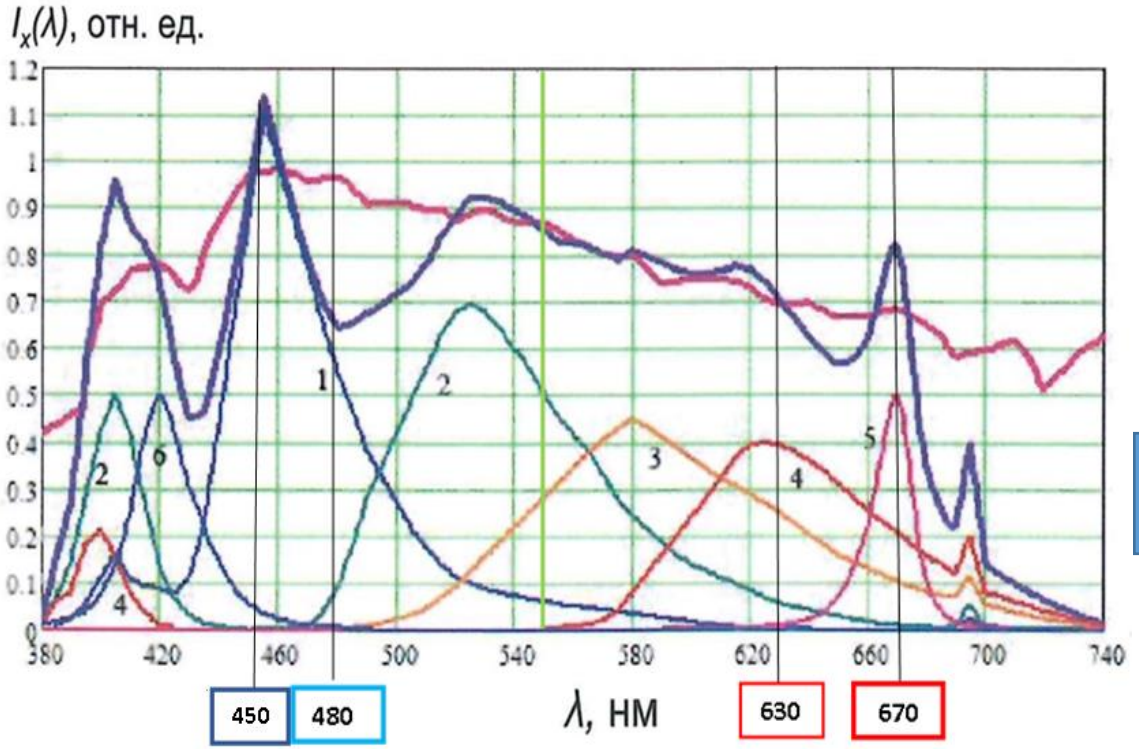


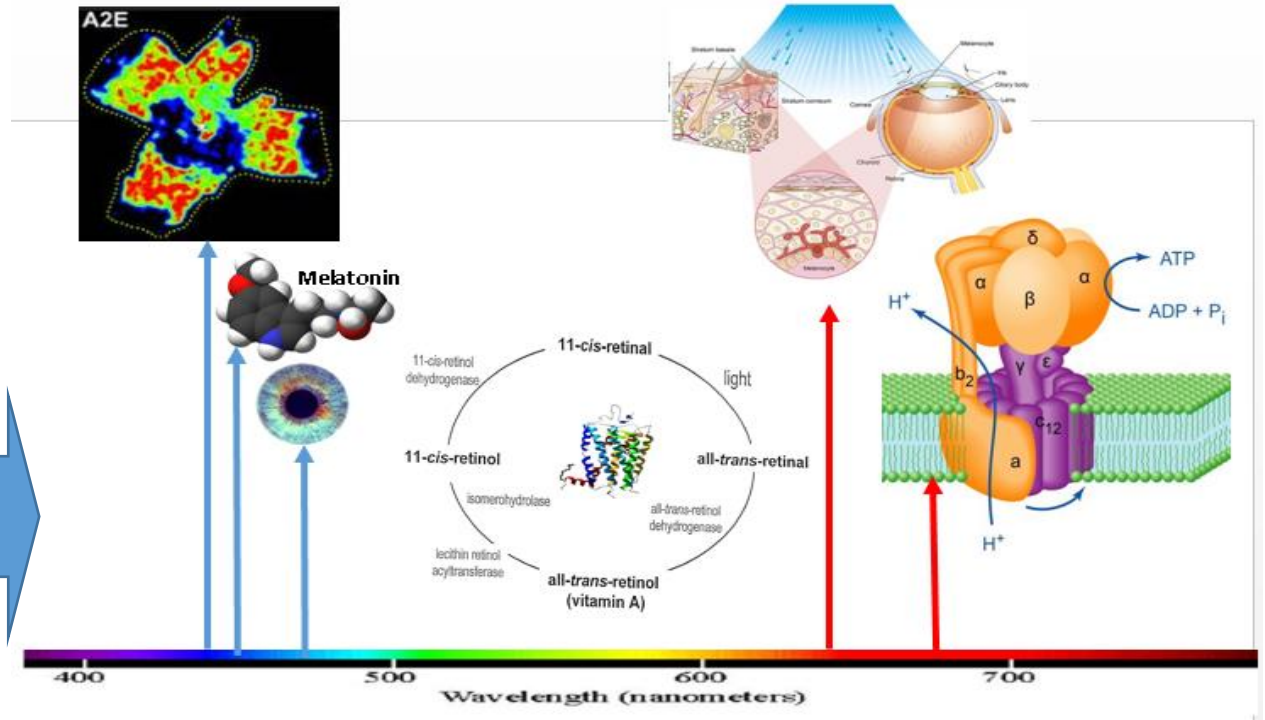
Institute of hygiene and health of children and adolescents of the Russian Academy of medical Sciences

=

F. X. Grothus in Russia (1817) and Draper in the United States (1839), independently from each other formulated the law, according to which the chemically active, only those rays which are absorbed by the reaction mixture .

The synthesis of sun-like spectrum of LEDs and phosphors



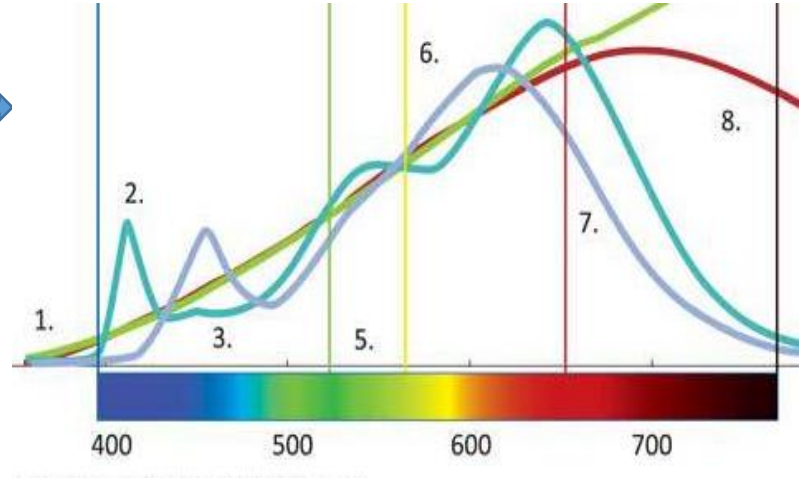


Biologically adequate spectrum of light is an energy spectrum of white light photon streams, which form a matrix of control signals, ensuring the harmonious operation of the functional elements (cells) of the visual analyzer and the hormonal human system.

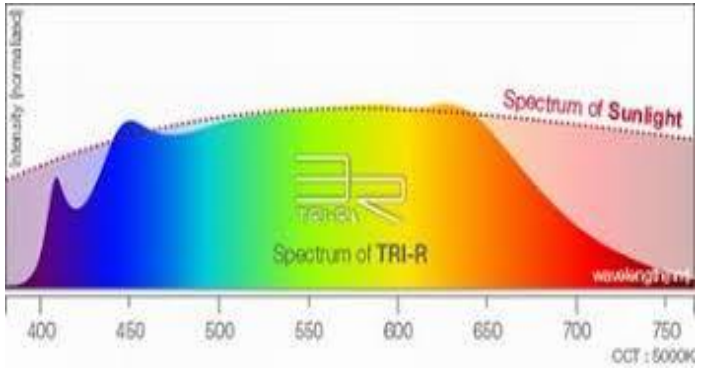
The concept of sun-like light is gaining supporters around the world today

The concept of sun-like light is gaining supporters around the world today

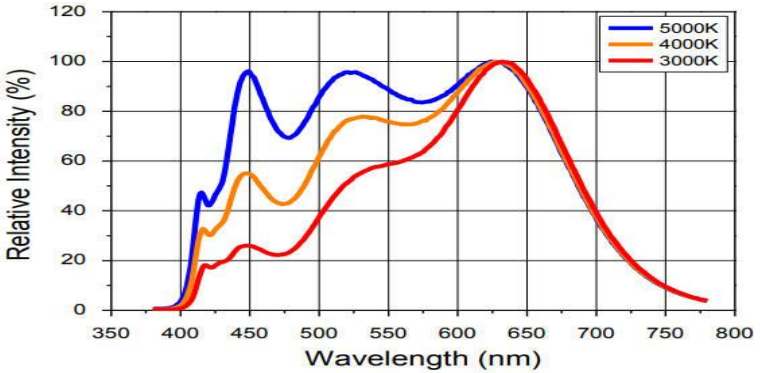
SORAA



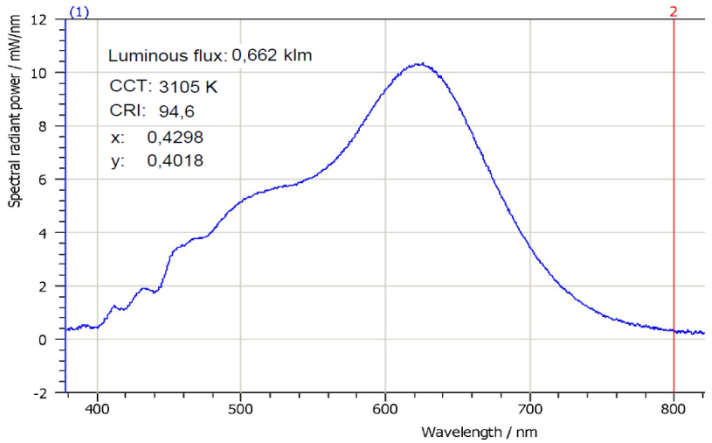
Toshiba Material Co., LTD



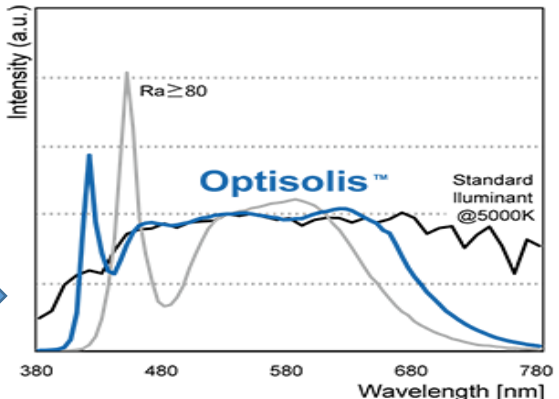
SEOULSEMICONDUCTOR



ZAO ELTAN and REMILICHT



NICHIA



LED Lighting in schools

LED Lighting in hospitals





Thank You for your attention！