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## Illumination in educational institutions and the vision of students

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In 2014, the World Health Organization (WHO) published statistics according to which about 285 million people suffer from visual impairment; 246 million of them have low vision. The most common cause of disease (43%) is uncorrected refractive errors, including myopia. F. F. Erisman pointed out "I must add that myopia is not an inevitable evil that must be associated with school education; on the contrary, progressive myopia is an evil that arises only from the inappropriate device of schools, and this evil would, of course, be eliminated if the device of schools would be drawn to the attention of society." In schools in China to combat myopia modified Erisman's desks limiters that would head students did not fall less than 30cm. At the same time, a stochastic relationship was established between the growth of myopia and the introduction of energy-saving light sources with biologically inadequate radiation spectrum. The researchers believe that the fact of long stay inside the premises is the main cause of the problem, which after the elimination of other factors, is reduced to the effect of light on the development of myopia. Sergey Vavilov noted that from the biological point of view, "optimal illumination" should be the result of evolutionary adaptation of the eye to the average illumination created by the Sun. The eye in relation to energy is not adapted to the Sun itself, but to the sunlight scattered from the surrounding bodies. Modern people began to spend much less time on the street, and this provokes the appearance of myopia, since under the influence of bright daylight the retina of the eye produces dopamine and controls the diameter of the pupil of the eye, and its lack and causes the elongation of the eyeball. When assessing the productivity and fatigue in the light of an incandescent lamp, mercury and fluorescent lamp, the following is established.

To create equal levels of productivity and fatigue need lighting:

- incandescent lamps 300 lux;
- fluorescent lamps – 500 lux (above 1.66 times than that of incandescent lamps).

In the evaluation of visual performance when natural and artificial lighting is set as follows.

At equal levels of visual performance for :

- natural light desired illuminance 300 lux;
- artificial lighting - 500 lux (1.66 times higher than for natural lighting).

Schools generally use combined lighting (sunlight plus energy-saving lamps).

The spectrum of combined lighting is characterized by high unevenness, increased dose of red light in comparison with the spectrum of sunlight and violated the law of optimal control of the pupil diameter of the eye and ATP synthesis, which increases the risk of myopia and ADM.

### Summary

1. The study of the biological effects of light on humans is an urgent problem of lighting hygiene. Biological inadequacy of natural and artificial light of equal intensity, experimentally proved at cellular, biological and psychophysiological levels, is maintained even with increasing light level from artificial sources.
2. The hygienic value of natural light must be taken into account when developing lighting standards and new artificial light sources for long-stay rooms.
3. The increase in the level of illumination of artificial light sources by 1.6-2 times compared to natural light contributes to the preservation of a high level of productivity and visual performance, but does not solve the problem of reducing myopia during prolonged work in artificial lighting.

4. When combined natural and artificial light occurs uneven spectrum of radiation, different from the spectrum of sunlight, which increases the risk of myopia.

**Recommendations:**

1. For the optimal functioning of the visual analyzer and the human hormonal system, it is necessary to introduce semiconductor light sources with biologically adequate radiation spectrum.
2. Implement the recommendations of the 3<sup>rd</sup> Global Pediatric Congress, held in March 2018 in London to improve the coverage of educational and medical institutions.

**Biography**

Valery A. Kaptsov. In 1987 defended the doctoral dissertation and in 1988 was appointed deputy director of the Russian Academy of medical sciences (RAMS) institute of occupational health. From 1993 to 2005 worked as the director of the All-Russian Research Institute of Railway Hygiene. In 2004 was elected associated member of RAMS, in 2014 - associated member of Russian Academy of sciences. From 2005 to 2013 - Deputy Director of the Institute. From 2013 - Head of the Department of Occupational Health the same Institute. He has published more than 500 papers in journals and has been serving as an editorial board member.

**Notes:**