



# Blue light and living things

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**For billions of years, life has evolved to exploit the absence of blue light at night. Introducing it via high colour-temperature LED lighting results in damaging biological effects.**

1. There is widespread concern about blue light in a very broad community covering studies of the majority of animal life. For example, optometrists have long suspected that exposure to blue light can be damaging to eyes. However, the mechanisms by which this occurs are not yet widely known outside a small research community.
2. It is known that light has a direct effect on the performance of the mitochondria that are the sources of chemical energy production in cells (oxygenic respiration). Mapping the nature of these interactions as functions of colour, intensity and time of irradiation (i.e. when during the day/night cycle) is a complex process but is a very active field of research. It had been learned that the effects can be very critically dependent of the colour (wavelength spectrum) of the illumination in that there are 'resonances' between particular wavelengths and fundamental bio-chemical/physical processes.
3. This understanding is particularly relevant to so-called Photodynamic Therapy (PDT) as a treatment for a growing number of types of cancer. This therapy works by using very specific light wavelengths to activate molecules within tumours in a way that triggers the cell to commit suicide (apoptosis), thus removing the tumour.

4. I use the example of PDT since, although clearly of benefit in this case, the illumination of mitochondria in normal cells can be dangerous. Even a rather modest amount of blue light can disable or even kill fruit flies.

5. The powerful blue component of the very 'white' (high colour temperature) LED lamps used in modern interior and exterior lighting has a wavelength that overlaps the colour that will kill flies. Such damage is not restricted to fruit flies but applies to essentially all lifeforms.

6. Recent research shows that the susceptibility of cells to such damage depends on the state of the mitochondria at particular times of day/night. Life has adapted during the last two to three billions of years to protect itself from the extremely toxic effects of oxygen. One of these adaptations seems to be to ensure that the mitochondria only perform certain functions in the absence of the light that can damage them. The fact that street-lamps are less bright than the Sun is therefore not the point. Illuminating the planet at night without considering this damage is stripping away billions of years of evolutionary adaptation and exposing us all to harm.

The single point I would make based on the above is that we (i.e. the population of the entire planet) should be very careful about the way we illuminate ourselves, especially at night. The modern, bright, high colour temperature LED lamps could be considered to be amongst the worst of all possible choices.

**There is no need to shine blue light on life at night.**