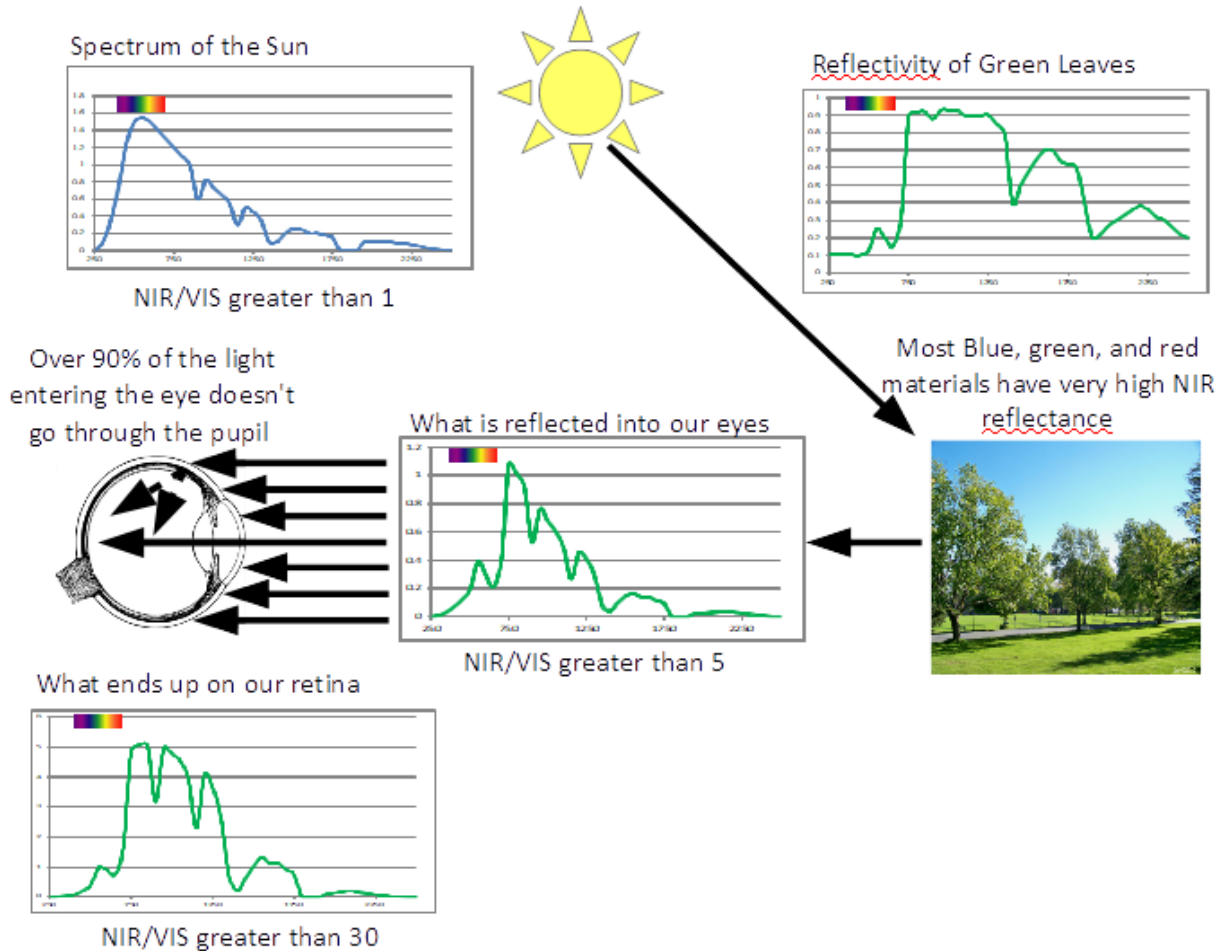


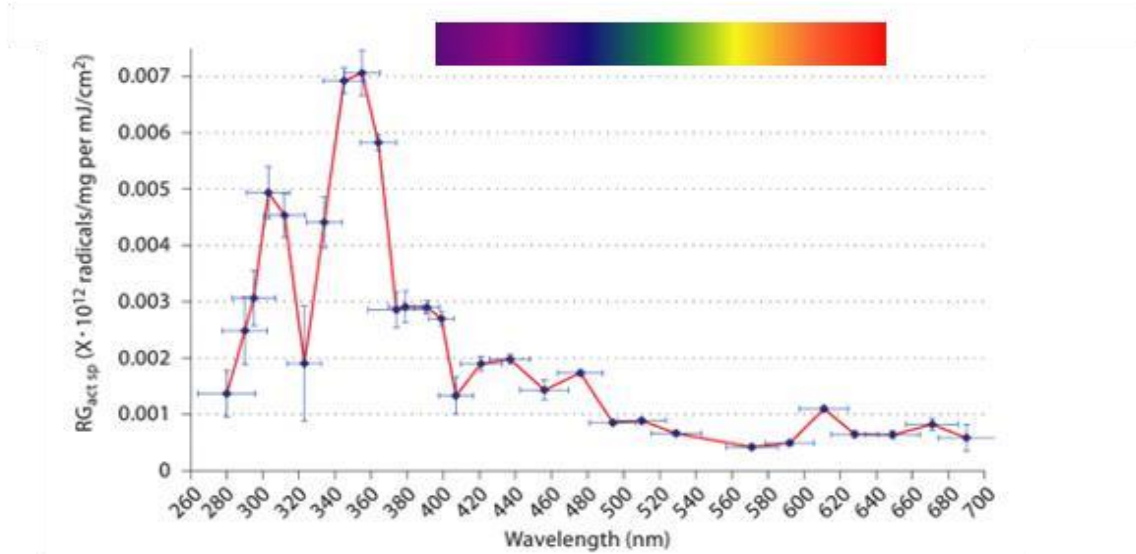
## Melatonin and the Optics of the Human Body

### Supplementary Materials



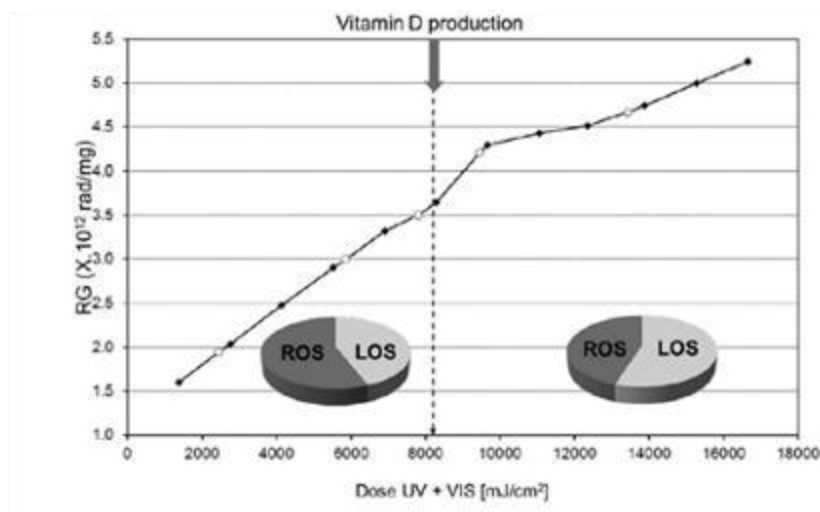
**Fig. S1 How our surroundings modify the spectrum of Sunlight.**

*Our surroundings absorb UV/visible photons but strongly reflect NIR photons. This coupled with the optical properties of the human body increases the ratio of NIR photons to Visible photons our cells are exposed to.*



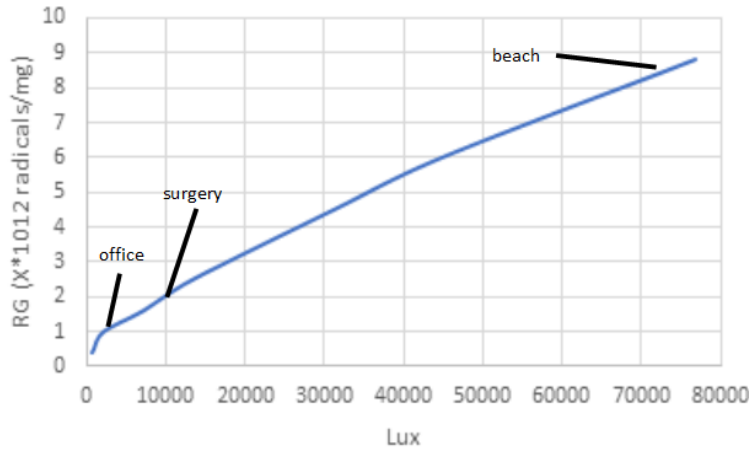
**Fig. S2 Free radical generation rate as a function of wavelength.**

*Electron Spin Resonance of the Human skin is used to generate an action spectrum in the UV and Visible spectrum every 10 nm. UV photons are 4 to 8 times more effective at generating free radicals than visible photons but all wavelengths measured generate a significant number of free radicals, especially if it is realized that the number of visible photons our body is exposed are typically 10 times higher than UV photons. As an example, in natural sunlight equal amounts of free radicals are generated by the UV and Visible photons.*



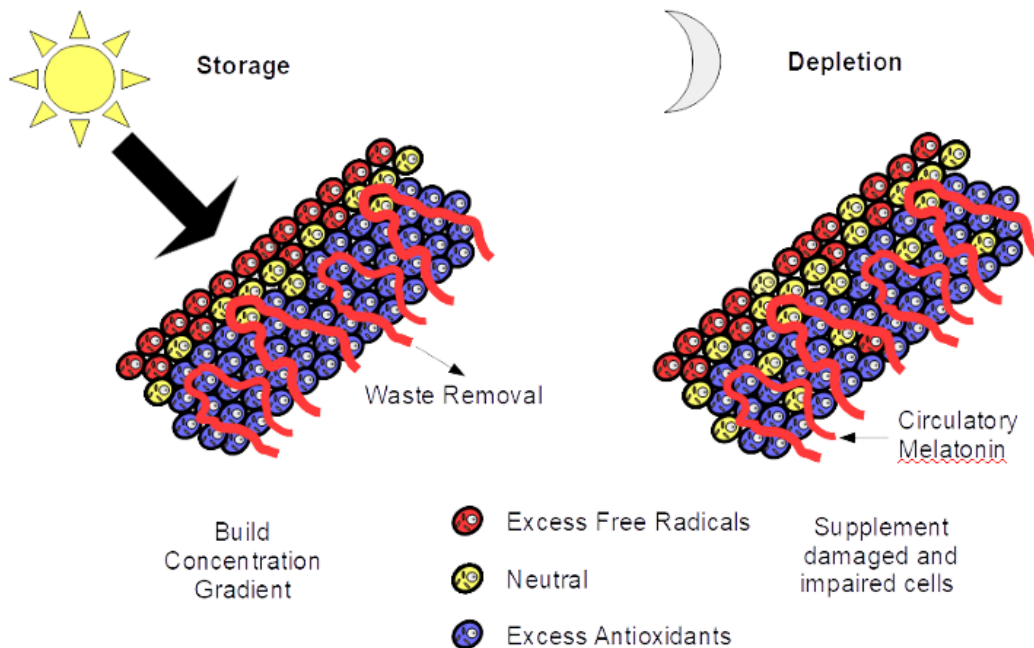
**Fig. S3 Ratio of LOS to ROS as a function of Dose in human skin.**

*As the dose increases the ratio of lipid free radicals increases due to their longer half-lives compared to other free radicals.*



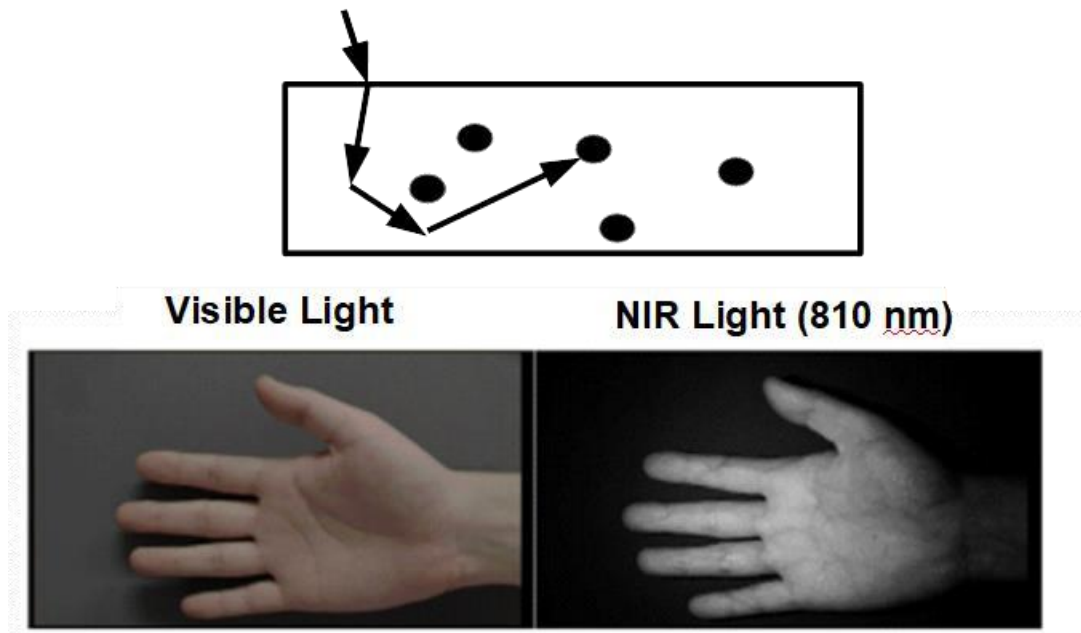
**Fig. S4 linearity of free radical generation rates versus lux levels.**

*Reciprocity holds for free radical generation over a wide range of illumination levels. As such prolonged exposure to even low-level light sources is generating a significant level of free radicals. The relative harm generated becomes a function of the antioxidant health of the particular cells being exposed.*



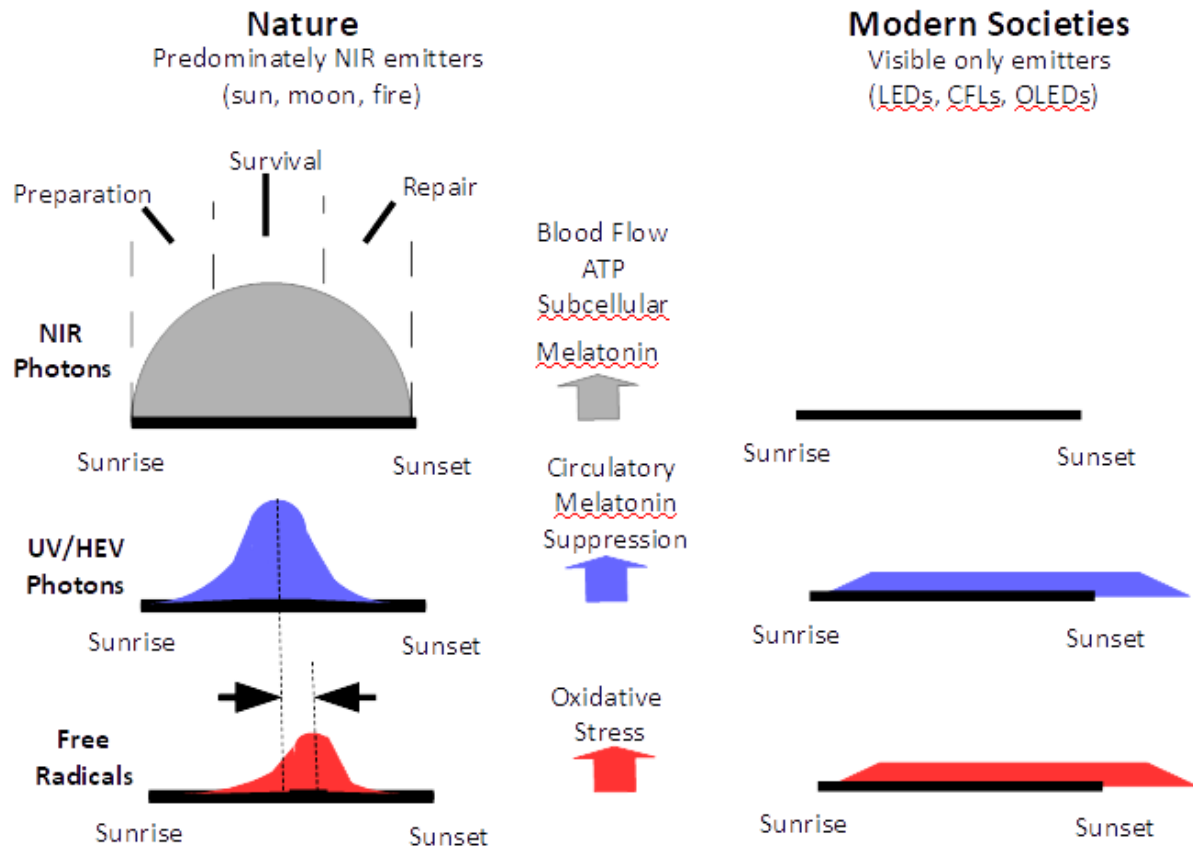
**Fig. S5 Illustration of the supplemental role of circulatory melatonin.**

*It is proposed that circulatory melatonin is provided as an antioxidant supplement/control during periods of low cellular activity. The cell membrane has been shown to maintain a chemical concentration gradient to melatonin in the blood. As such in this hypothesis only cells with low melatonin levels would receive supplemental melatonin from the blood.*



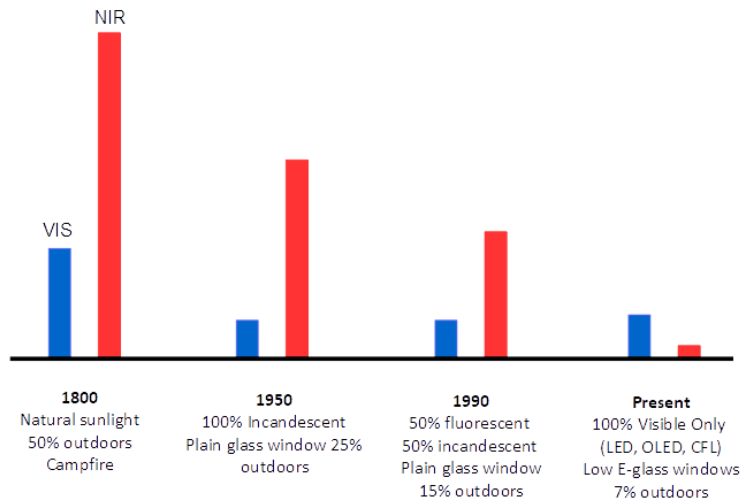
**Fig. S6 optical scattering in the non-homogenous skin localizes absorption in blood vessels.**

*Optically, the human body is extreme complex. Even the skin is non-homogenous with low optical absorption in most cellular matter and high optical absorption in blood vessels, blood, chromophores in the mitochondria, etc. As the image shows the strong optical absorption in the visible masks the underlying structure of the hand. But in the NIR blood vessels are readily observable. Optically low loss scatter localizes photons in regions of high optical absorption.*



**Fig. S7 Typical NIR versus UV/HEV exposures during at typical day and its associated free radical profiles.**

*We are in the process of dramatically altering our exposure levels via artificial lighting. This alters not only how many free radicals are formed but also when they are formed. The elimination of NIR from modern societies would appear to be increasing oxidative stress in the human body.*



**Fig. S8 Comparison of NIR to Visible exposure levels from 1800 to Present**

*As we move inside and increase our exposure to artificial light sources we are altering both the dose and spectrum of light our bodies are exposed to.*



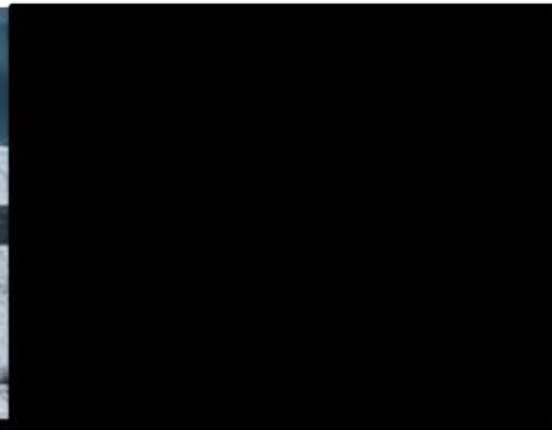
Visible picture of campfire



Visible picture of Times Square



NIR picture of a summer day  
in a wheat field



NIR picture of our homes, schools, and offices  
if we don't change course

**Fig. S9 how night is becoming day in the visible spectrum and day is becoming night in the NIR.**

*There is agreement that visible photons at night disrupt sleep leading to a host of negative health effects. We are now in the process of eliminating the majority of the solar spectrum (NIR) with little understanding as to the long-term health and wellness consequences.*



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