

The Effect of Light on Hormones, Brain and Behavior by George Brainard, Ph.D.

Dr. Brainard earned his Masters of Arts in psychology at Goddard College in 1978 and graduated from the University of Texas Health Science Center with a Ph.D. in anatomy in 1982. Today he holds joint appointments to Jefferson Medical College of Thomas Jefferson University of Philadelphia, Pennsylvania as Associate Professor of Pharmacology and as Associate Professor of Neurology. He is Director of the Graduate and Medical Neuroscience Course. He has developed a specialty in the study of light's effects on animals and humans. Dr. Brainard's presentation was diverse and far-ranging. A summary follows.

All life on earth evolved under a rising and setting sun on a twenty-four hour cycle: i.e., a circadian system. All species have had to develop mechanisms to cope with the presence or absence of light on a daily basis and the changes that occur seasonally. There are four characteristics of light: *brightness (irradiance), wavelength, duration and circadian time of exposure*. By controlling three, the fourth may be studied.

Studies done with the Syrian hamster were presented. A study of the inhibition of pineal melatonin production by light revealed a dose-response relationship, indicating that *light behaves as if a drug*. Further, other studies showed that red and yellow wavelengths caused reproductive inactivity, while green, blue and ultraviolet had the opposite effect, indicating that *light drives the reproductive system*. This was predicted by Spitzer in *The Syntonic Principle*. Dr. Brainard listed many organs and endocrine substances in various animals which are influenced by light.

Dr. Brainard demonstrated how brunescence, as a function of aging in the human crystalline lens, causes a gradual decrease in near-ultraviolet, blue and green light transmission in the eye (and possibly influencing effectiveness of syntonic prescriptions?).

Seasonal Affective Disorder (SAD) was discussed. The signs and symptoms were reviewed. There may be an underlying homology in the evolutionary mechanism within the human brain which allows some to respond in a more severe way to seasonal change. About one-quarter to one-third of the population are aware of SAD symptoms but are not compromised. Since 1981 the treatment of choice for SAD has been bright white light. Studies indicate that certain wavelengths (green) may be more effective than others in treatment. This was predicted by Spitzer as to light and the restoration of health.

The next topic was shift work. There may be 25 million shift workers, i.e., those working outside "nine to five". It seems that accidents involving "operator error" occur more frequently during hours when the operator should normally be asleep, e.g., Three Mile Island (4:08 AM), Chernobyl (1:23 AM) and Exxon Valdez (12:04 AM). The problem is asking a normal human body that is diurnal to stay awake and function at a time when it wants to be asleep. Some examples are combat situations and air traffic control. Numerous factors associated with shift work are under research and might be improved through improved scheduling, education as to diet and sleep hygiene and the *lighting environment* to produce sustained performance. *Biologically necessary light levels* must be considered.

From a more humanistic viewpoint Dr. Brainard concluded by sharing that we can only know about light by virtue of darkness. Considering the human condition, we must recognize the darkness in ourselves as well as the light, and choose on which side we will stand. With continued research we can find the light for the external environment that will give us the best vision, the best biology and the best behavior; and individually we can all reach inside ourselves and find the light that is best for all of us.

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