SCIENTIFIC FINDINGS ABOUT LIGHT'S IMPACT ON BIOLOGY

By Ray Gottlieb, O.D., Ph.D., Dean CSO

Only recently have scientists begun to pay attention to light's impact on biology. The quantity of articles and quality of basic and clinical research is booming. Measuring light's biological effects is a complex business because outcomes are dependent on wavelength, intensity, time, timing and number of repetitions. There are short-term effects, measured a few seconds or minutes after irradiation, as well as long-term effects observed after hours, days and weeks. The effects also depend on the type of organism studied, its growth phase and the parameter being measured.

At this time energy medicine is not a final or unified model. There is a dynamic rhythmic matrix of energies including mechanical, electric, magnetic, gravitational, thermal, acoustic, and photonic. Different theraputic approaches focus on one or more phenomena. Our living matrix can extract information needed to pilot our biological systems. There is not one but many pathways through which this may occur.

LIGHT ON THE SKIN

Healing work with lasers started with Endre Mester in Budapest, Hungry in 1966 as an investigation to determine whether ruby lasers could help cancer victims. He found that these lasers increased the growth of monocellular organisms and of fur on a shaved rat. At a certain range of dose intensities, the hair grew faster. At doses below and just above, the laser had no effect; but at even higher intensities fur growth was inhibited. The next experiment, rates of wound healing, had similar results - only at a certain level did the light increase wound healing. Too much light reversed the effect. The finding was published in Hungarian in 1967. Since then nearly 2000 articles have been published about the effects of Low Level Laser Therapy (LLLT).[1]

Until recently most LLLT research has taken place in the former Soviet Union and Eastern Block countries. For twenty years Russian biophysicist Tiina Karu and her group at the Laser Technology Research Center in Troitzk, Russia, has been conducting a systematic study of LLLT. Their research shows that laser light is not required for healing to take place. Non laser (incoherent) light was as effective in healing peptic ulcers as coherent laser light of the same wavelength. Karu says that lasers are used only because lasers are easier to control. Her data proves that comparatively low doses (102 -103 J/M2) and short periods (10 - 100 s) of irradiation stimulate lasting changes in cellular respiration chains as well as in RNA and DNA synthesis. Even seven days after stimulation, the number of cells, cell size, and respiratory activity were increasing more than in unirradiated tissue. Research on various organisms and cell types consistently showed light alters cell metabolism, causing synthetic cell processes to dominate catabolic ones.[2] In a recent paper Karu described it this way: "The primary changes induced by light are followed by a cascade of biochemical reactions in the cell that do not need further light activation. These dark reactions are connected with changes in cellular homeostatis parameters due to an alternation of the cellular redox state"[3]

Which wavelengths of the spectrum stimulate these changes? She finds maximum effectiveness in almost every visible-light band. Cells stimulated first with red light, then with blue showed much greater increases than with just red or blue alone. Red followed by wide-band (white) visible light stimulated no acceleration of growth.[2]

Karu's research gives another phototherapy hint. How does light find the right places to work to heal the body? Normal tissue is much less effected by light than out-of-balance tissue. Starving cells are more sensitive than well-fed ones. Cells already reproducing at an exponential rate are least changed by light stimulation. In stagnant colonies, on the other hand, light triggered huge increases in rates of reproduction or cell mass growth. Wounded, chronically inflamed, and ischemic cells are characterized by their acidic, hypoxic and inhibited state. Light increases the pH and drives them toward oxidation, balance, vitality and healing. [2]

Karu's papers and books provide undeniable proof that light stimulates biological transformation and healing. Her work has encouraged clinicians worldwide to use low-intensity laser light therapy for healing a variety of human ailments. For an impressive experience of her research and influence visit her web site at: http://www.isan.troitsk.ru/dls/karu.htm and books: "Scientifics of Low-Power Laser-Therarpy," Dec. 1998, ISBN, 9056991086 and "Photobiology of Low-Power Laser Therapy Laser Science and Technology," Vol 8 , Paperback (October 1989) Harwood Academic Pub; ISBN: 3718649705 visit amazon.com for a review.

Other Russian researchers are using red and far-red lasers to reduce eye strain in workers. In a controlled study of myopia and accommodation, myopic children stimulated for 12 minutes per day with a 2mm spot of red or far-red light on the limbal sclera. Children measured one month after just ten consecutive days of light treatment had great increases in accommodation and three years after the light therapy had one-sixth the myopic increase of matched controls.[4]

This approach to light and color therapy has been successfully applied in laboratory experiments and in clinics for relieving pain, resolving inflammation, enhancing tissue repair mechanisms, stimulating immune function, defeating infection, and improving damaged neurological tissue. Laser therapy has also been used for preventing dental caries and stress-related heart and cerebrovascular disease and for healing cancer, asthma, herpes simplex, rheumatoid arthritis, intractable wounds (ulcers), damaged nerves, tendons, muscles and bones, and for reducing infection, inflammation, and tennitis.

A growing number of Western clinicians have gotten on the beam. One organization, the North American Laser Therapy Association (NALTA), held The First NALTA Conference near Washington DC, in October, 1999. The meeting was convened collaboratively with the FDA to clarify regulations concerning laser photostimulation and laser acupuncture and to educate leaders of government organizations about clinical application of low-level laser therapy.

For a more complete list and details see these web sites: http://www.laser.nu/lllt/therapylink.htm and, especially for cancer, http://www.spie.org/web/abstracts/2700/2728.html

LIGHT EFFECTS VIA BLOOD

Other research indicates that light-sensitive blood constituents carry light information and energy to affect far-off places in the body. Blue light delivered to an area behind the knees, for example, resulted in significant alterations in human circadian rhythms.[5] Oren and Therman postulate that the blood constituents hemoglobin and bilirubin in animals may be counterparts to chlorophyll and phytochrome the light-sensitive pigments in plants. Hemoglobin is similar to chlorophyll in structure. Both are reversibly altered by light.[6]

Other research has found that the heme oxygenases are reversibly altered by specific wavelengths of visual light.[7] The heme oxygenases, HO-1 and HO-2, are enzymes controlling oxygen-carbon dioxide exchange and also regulate vasodilatation, neurotransmission, anti-oxidation, anti-inflammatory, anti-viral, gene expression and other basic physiological functions.[8] HO-1, like the sympathetic nervous system, acts to protect the organism from acute environmental stress, while HO-2 acts more like the parasympathetic nervous system.

Nitric Oxide (NO) is another important blood constituent that works to control bodily stress reactions. Russian researchers confirmed that low-power He-Cd (441.6 nm) and He-Ne (632.8 nm) lasers NO-hemoglobin can reversibly dissociate and release free NO. Relaxation of blood vessel walls due to NO is one of the physiological effects induced by visible radiation. [9]

LIGHT DIRECTLY STIMULATING THE BRAIN

In another study, low levels of visible light directed onto slices of rat cerebral cortical tissue enhanced release of the neurotransmitter gamma-aminobutyric acid (GABA) from these brain slices. At higher light intensity this was suppressed. The effective amount of light for neurotransmitter release is approximately equal to the amount of light that can penetrate the head and reach the brain at the intensities of sunlight. This points to pathways of light transduction not considered in modern times. [10]

Since the beginning of this century evidence has accumulated demonstrating that nonmammalian vertebrates possess photoreceptors situated deep within the brain. These photoreceptors have been implicated in several different areas of physiology that play a critical role in the regulation of circadian and reproductive responses to light in all species examined. Published data raise the possibility of several types of encephalic photoreceptor photopigments (cone-like, rod-like or different from both) and, depending on species, at least two types of photoreceptor cells: CSF-contacting neurons (larval lamprey, reptiles and birds) and classical neurosecretory neurons within the nucleus magnocellularis preopticus (fish and amphibians). [11]

Can this also exist in mammals? Until 1999 mammalian opsins have been described as specifically expressed only in the retina and the pineal. But now scientists at NIH have discovered what appears to be the first opsin, called encephalopsin, expressed specifically in the mammalian brain. Because the major function of opsins involves light detection, these scientists are invesigating the possibility that encephalopsin does too. [12]

Other data suggest that low-energy

infrared laser irradiation has certain neuroprotective activity in various types of oxidative stress such as ischemia, reperfusion, and acute edema of the brain. Infrared laser irradiation lowered the increased levels of hydroperoxides and malonic dialdehyde and elevated superoxide dismutase activity in the brain during ischemia, reperfusion, and acute edema of the brain. [13] These findings have vast implications for the fields of immunology and rehabilitative medicine and also suggest scientific support for syntonic therapy for brain injury.

BIOPHOTONS

Other research has established a hitherto-overlooked information channel within living systems. All emit leak levels of visible and ultraviolet light. This biophoton emission has been correlated with many biological functions. Biophotons may trigger chemical reactivity in cells, growth control, differentiation and intercellular communication. Biophotonic communication may prove electromagnetic fields are more primary to biology than is chemistry.[14]

NEW INFORMATION ON CIRCADIAN CONTROL SYSTEMS

For billions of years, a dependable aspect of living on Earth has been the daily light-dark cycle. The circadian rhythmicity in organisms may have arisen directly as a response. Indeed, in free living cells and in tissues of multicellular organisms, there is a correlation between photoresponsiveness and circadian rhythmicity. Even nonphotoreceptive tissues such as the mammalian suprachiasmatic nucleus have close connections to photoreceptors in the eye.[15]

"Circadian rhythms and the cellular oscillators that underlie them are ubiquitous--and for good reason. For most organisms, dawn means food, predation, and changes in all the geophysical variables that accompany the sun—warmth, winds, and so on. It's a big deal when the sun comes up, and most living things time their days with an internal clock that is synchronized by external cues. Given this common and ancient evolutionary pressure, circadian clocks probably evolved early, and common elements are present up and down the evolutionary tree. Circadian systems will almost certainly be made up of more than one interconnected feedback loop. Of these, one may be dominant and take the lead in determining phase (the time of day indicated by the clock) and others may be more like slaves. This interconnected ensemble will ultimately determine all the exact characteristics of classical circadian properties--period length, temperature compensation, and resetting by light or temperature..."(Jay Dunlap, Dartmouth Medical School) [16]

"In mammals the retina contains photoactive molecules responsible for both vision and circadian photoresponse systems. Opsins, which are located in rods and cones, are the pigments for vision, but it is not known whether they play a role in circadian regulation. A subset of retinal ganglion cells with direct projections to the suprachiasmatic nucleus (SCN) are at the origin of the retinohypothalamic tract that transmits the light signal to the master circadian clock in the SCN.[17] The SCN responds to light/dark neural signals, which are converted in the pineal gland to hormonal secretions. Different wavelengths have varying entrainment abilities relative to hormone output. The pineal also responds to the earth's electromagnetic fields. Pineal secretions (primarily melatonin) regulate reproduction functions, growth, body temperature, blood pressure, motor activity, sleep, and immune function. Hormonal interactions with the pineal suggest it is the master gland. Pineal regulation plays a role in such conditions as diabetes, osteoporosis, heart disease, cancer, Parkinson's, Alzheimer's , and aging in general. [18] What latent abilities does the pineal possess that can be promoted by light activation?

Circadian clocks exist throughout the body. To understand the tissue clocks, chronobiologists will need to figure out how they sense light. For the brain clock, this job is performed by the retina, although not by the light-sensitive cells responsible for vision. The optic nerve then transmits the information to the brain. But cells outside the retina lack the photosensitive pigments found in the eye. Instead, there are hints that these tissues may use recently discovered proteins that are sensitive to visible light. Human photoreceptor flavin molecules are not limited to the retina but are virtually in all tissues.[19]

Research suggests that multiple biological clocks may exist throughout the body in the form of photosensitive proteins. Genetic research has already mapped sites expressing the potential for biological clocks in the heart, lung, liver, kidney, and testes. Each clock may be set individually by light and follow a schedule independent of the brain's master clock. Individual cells may undergo daily cycles of activity and rest just like whole organisms do. These cycles may be sensitive to direct light reception, to blood elements altered by specific frequency bands of visible light entering the eye, or to light stimulation directly at the retina.

CONCLUSION

These examples of research demonstrate the broad array of light pathways being investigated today. Applications in healing can be found in optometry, medicine, psychiatry, psychotherapy, color acupunture (now termed colorpuncture), rehabilitative medicine, and a vast assortment of body centered therapies. Syntonic phototherapy is at the core of a rapidly growing interest in and shift toward energy medicine in our quantum age. In syntonics it may be the retinal-hypothalmic-pituitary-pineal axis, the retinal vasculature, several accupunture meridians, or by a yet undiscovered means. These applications are the future of medicine and healing. Syntonics is a time honored and clinically proven modality of treatment and is in a unique position to provide the leadership in light therapy.

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