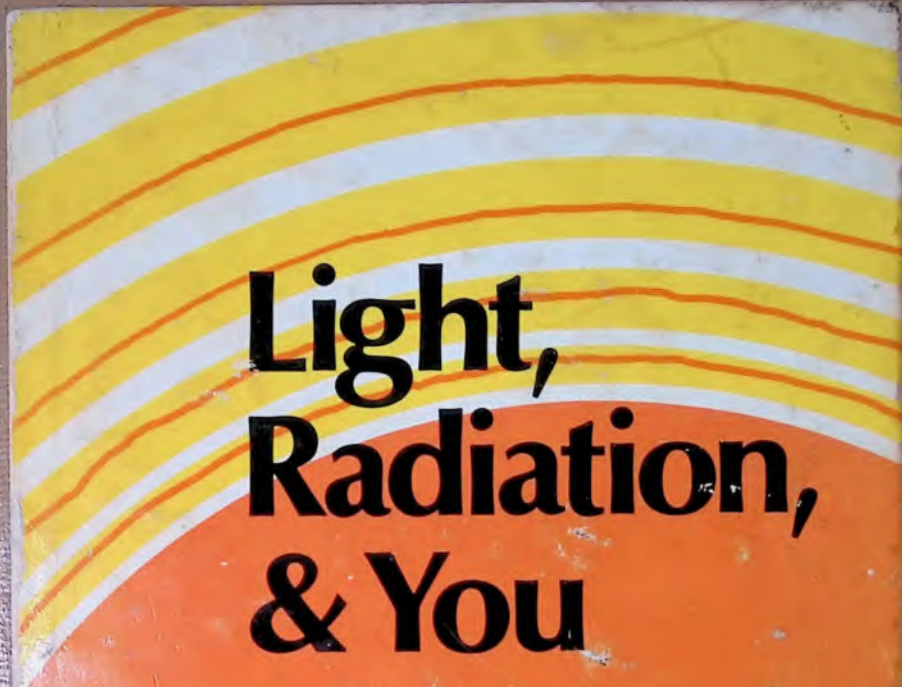


A stylized graphic of a rainbow with multiple bands of yellow and white, arching over a solid orange background that resembles a rising sun.

Light, Radiation, & You

How to Stay Healthy

John N. Ott

LIGHT, RADIATION, AND YOU



Also by John N. Ott

My Ivory Cellar: The Story of

Time-Lapse Photography

*Health and Light: The Effects of Natural
and Artificial Light on Man and Other
Living Things*

LIGHT, RADIATION, AND YOU

How to Stay Healthy

by JOHN N. OTT

Preface by Philip S. Callahan, Ph.D.

Introduction by Fritz Hollwich, M.D.

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To my wife's patience and encouragement

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AUTHOR'S FOREWORD

At the back of this book is a bibliography listing articles I have written that have appeared over the past thirty-three years on the biological effects of light and low levels of radiation on plants, laboratory animals, and, more recently, school children and prison inmates. Admittedly, some of the first interesting results I reported were no more than serendipitous observations. However, most of the latter studies reported were carried out at leading university-affiliated medical research centers by qualified scientists and medical doctors.

I have tried to report these findings in a serious scientific way in scholarly journals, and in a humorous way in unscientific journals; some I have coauthored with qualified scientists. In some articles I have stressed the scientific results, in others I have stressed the legal, moral, and religious approaches.

Some of these articles are readily available in scientific libraries, but some might be difficult to locate. However, my two previous books, *My Ivory Cellar* (1958) and *Health and Light* (1973), both published by the Devin-Adair Company,

contain the basic information of all the articles up to the publication date of each book. *Health and Light* was also published in paperback (1976) by Pocket Books, with an updating chapter (Afterword).

This present book includes a few brief references from both *My Ivory Cellar* and *Health and Light*, but mainly carries on with the more recent developments that have occurred since the first two were published. Therefore, both books—*Health and Light* in particular—are requisites for reading to obtain the complete story.

Today the lighting in virtually all research laboratories is still the responsibility of the janitor and is classified as ordinary building maintenance. Those in charge of most research laboratories continue to refuse to acknowledge that light has any biological effect on laboratory animals or people, and they criticize and ridicule the few scientists who do recognize its importance.

This book is another attempt to emphasize the need to bring light under scientific control. It will approach the subject from a still different point of view, one with possibly more personal interest: the diminishing sex drive. Such subjects as cancer research and human behavioral studies will be treated as related problems.

JOHN N. OTT
Sarasota, Florida

PREFACE

This book is a delightful recounting, in an easy-to-read, conversational manner, of many years of pioneering research by John Ott on the effects of color and light on living creatures. His persistent and ingenious experimentation has been directed at such diverse creatures as pumpkin seeds, the tails of rats, mink, and, of course, human beings. It is the latter "experimental animal" that we are most concerned with in this book.

The effect of color on life should be as obvious as the blue sky and green leaves of the forest—but apparently it is not. John Ott's genius for designing elegant experiments demonstrates the *power of light and color* in physiological processes.

The central message of this book is what I have called "a little is a lot." It is the process labeled *doping* by scientists in the electronic fields. Solid state physicists dope various crystals with trace minerals to make transistors and lasers. The process Dr. Ott describes is doping the organic body with color wavelengths in the UV and visible region. It is a process that leads to some very subtle and significant effects in the human body.

The power of "doping" with color is best illustrated by Dr. Ott's technique of using kinesiology to measure the effect of blue and various reds on muscle tone. Another unusual experiment is his use of beeswax, delightfully called "hear wax," to dope his own ear and increase his hearing threshold. Because of my own interest in the *electret effect* in plants and insects described in my book, *Tuning in to Nature*, I was particularly intrigued by this significant experiment.

Eastern mystics have for centuries been aware of the effect of color on the human body. The word "chakras," of Hindu origin, means "wheel" and refers to a disk representing the sun. The sun, of course, is the source of all earthly color. In the mystic and holistic medical literature, the chakras are the points of the body where *prana*, the energy of the universe, interacts with the worldly body. Concentric rings of color are presumed to emanate from the seven bodily chakras. Apparently, the Eastern mystics understood more about the subtle, low energy effects of colored light in the body than do we moderns.

John Ott, through many years of experimentation, is slowly changing our *high energy-inorganic* distorted Western view of light and color to a *low energy-organic* view. It takes a rare and unique genius to swim against the tide of conventional scientific dogma—especially in this age of specialization.

In a chapter of my own forthcoming book, *Exploring the Spectrum*, I point out that almost all significant scientific discovery begins with a process called "serendipity." The word is defined as the special gift of finding valuable or agreeable things not sought for. It comes about quite naturally, for the very good reason that the experimenter is usually manipulating some biological, chemical or physical phenomenon when something happens that is unexpected and cannot be explained. A scientist who is intellectually prepared recognizes the new phenomenon as something significant and redirects

his experimental effort toward discovering its place in nature. Roentgen discovered X-rays in just this manner. Dr. Ott tells how he began his research career with an unexpected occurrence of serendipity. Fortunately, he had the vision to take advantage of that occurrence.

The reason that scientific discovery by serendipity is so rare in today's research atmosphere is that scientists are trained in such a way as to discourage taking advantage of the phenomenon. Most researchers are trained as specialists and thus develop a tunnel vision that directs their intellectual processes along fixed lines. They have a locked-in fix on what the specialized scientific literature says must be so, and are not likely to change the direction of their thinking.

John Ott's real strength lies in the fact that he is never a specialist, but, rather, in the tradition of the nineteenth century, a natural philosopher. That is the true measure of all really great scientists.

As you read this book, bear in mind that, although it is written for the layman, the work it describes is of such a nature that it may well lead to revolutionary cures, or even, more importantly, new insights into how that cosmic energy we call "color" affects our life and even our behavior. For that, John Ott, we thank you from the bottom of our hearts.

PHILIP S. CALLAHAN, PH. D.
Gainesville, Florida
1981

INTRODUCTION

John Nash Ott, who has won worldwide acclaim for his time-lapse films, was awarded an Sc.D.(Hon.) by Loyola University in Chicago, Ill., for his decades of research work on the influence of light on plants, animals, and man. It was the fascinating effects of different wavelengths of light energy on plant life that first inspired the author to extend his investigations to animal and human life. In his new book, *Light, Radiation, and You: How to Stay Healthy*, Dr. Ott summarizes his observations in a clear, simple, and most readable style.

One area of his investigation is concerned with the electrical field, or dimension, of the human body. He demonstrates this electrical field in a simple way by showing that holding a lightning rod, for example, causes loss of muscle strength. Dr. Ott's working hypothesis is that negative ions are believed to give the body energy, while positive ions bring on fatigue and even depression.

In short, it can be said that the first part of his book deals with the influence of various everyday electromagnetic stimuli on human muscles. In this connection, Dr. Ott has

investigated the negative effects of digital watches, certain man-made fibers such as polyester and vinyl, ionizing-type smoke detectors, certain kinds of fluorescent lighting, electronic fetal monitoring equipment in hospitals, and others. His detailed observations merit more than interest alone; they should inspire specialists, first and foremost those in electrophysiology, to undertake further scientific studies in this area.

The latter part of the book deals with various related subjects, the central chapter being: "Light—the Missing Link?" Here, on the basis of numerous observations, the author establishes that light influences the size, number, and rate of growth of tumors in laboratory animals being used for cancer research. Since the results of experiments vary under different types of lighting, Dr. Ott stresses the need for including light as a variable which, in all research laboratories, should be under scientific control.

Dr. Ott's observations further include the stunted growth of plants that had been placed near the ends of some fluorescent tubes. He notes that old fluorescent tubes seem to emit more radiation than new ones.

Thus, he has been led to study the behavior of pupils in windowless schoolrooms under different lighting conditions. Aided by hidden cameras taking time-lapse films, Dr. Ott has reached the conclusion that some standard fluorescent lights emit certain kinds of radiation that may trigger hyperactivity and irritability in particularly sensitive children.

Moreover, the author is concerned about the possible harmful effects of radiation from color television sets, and is of the opinion that the present safety level needs to be substantially lowered even further.

In his last chapter, "What the Average Person Can Do," Dr. Ott summarizes his most personal experiences in handling (or avoiding!) the various objects mentioned in the

foregoing chapters. His suggestions, based directly on the conclusions drawn from his observations, will aid the reader in obtaining maximum benefit from the advantages of industrial progress, and in avoiding the disadvantages inevitably connected with it.

In summing up, it should be stressed that Dr. Ott's many-sided studies are the result of a lifetime of investigations. These are grounded in an empiric, subtle observation of various environmental phenomena which are an integral part of our present-day high standard of civilization, and which seem to exert a negative influence on human health. Some of Dr. Ott's conclusions have already achieved scientific recognition, and I personally believe that others will be confirmed by subsequent research. A "Rousseau" of our day, Dr. Ott and his most deserving work merit the full attention of the public in general.

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I A FUNNY THING HAPPENED AT THE LUNCHEON TABLE

IT WAS LATE for luncheon, and I thought the main dining room in the hotel was empty. I was explaining to an elderly lady how fluorescent lights and things like an ordinary ionizing type of smoke detector weakened one's muscular strength. Her husband had just given a substantial grant to the Center for Light Research to study the effect of color and light on the behavior of prison inmates, but he was not feeling well enough to have lunch with us. My wife was there, and was patiently listening to the story she had heard me tell many times before.

To my surprise, a stranger sitting at a table behind me broke into our conversation and said, "Pardon me, but did I understand you to say smoke detectors weaken all your muscles like that?" I nodded, and then he said, "Gee, thanks. Now I know what's the matter with me. I have one in the bedroom right over the bed." He got up and left the dining room. It took me several minutes to realize the far-reaching implications of his more or less joking comment. I had hesitated to ask him more details at the luncheon table, so I excused myself and chased after him, but I could not locate him anywhere.

Since then several uncontrolled studies and a great deal of discussion and conversations with a number of people interested in the subject have strengthened my belief that an ionizing type of smoke detector anywhere within fifty feet of the bed diminishes both the male and female sex drive and can cause complete impotence. This distance, depending on the type of construction, may include floors above or below, in fact, anywhere in an average-size house. Some polyester nightclothes and bed sheets can have the same effect. So does holding a lead pencil in the ordinary writing position, or wearing a battery-operated wrist watch. Holding a lightning rod against your chest also weakens all your muscles, including the heart muscle, but since most people don't take lightning rods to bed, we won't worry about them—at least for the time being.

I mentioned uncontrolled studies. Perhaps I should just say that some serendipitous observations have suggested these crazy things, since my background is banking. I became interested in the biological effects of light and low levels of radiation through taking time-lapse pictures of flowers growing.

Sex counseling is quite outside my general area of activities (frankly, I should think the psychological impact of trying to obtain scientific data during love-making would be quite disconcerting). However, I do read the newspapers and have noticed an increasing number of articles about greatly increased sexual activity during the 1960s, and a complete reversal during the 1970s. The problem of impotence in men and failure to obtain full satisfaction in women, including otherwise happily married couples, has become an area of major concern for marriage counselors.

Most explanations attribute the cause solely to psychological problems. One New York psychiatrist, for example, believes that the present generation represents the babies who first received prepared formulas on a wide scale in lieu of breast feeding. This resulted in failure to establish a close contact and

affection between mother and baby, which, in turn, has resulted in the loss of interest in sex today. Well, maybe, but when you get rid of that smoke detector and polyester bedclothes and sheets, I can tell you that interest in sex comes right back—even in the older generation.

As soon as I returned to my office after the late luncheon, I called the doctor at the Central Clinic Research Center of the National Institutes of Health in Bethesda, Maryland, with whom I had just spent two days doing muscle testing under different types of lights and wearing different colored sunglasses. I had met this doctor under somewhat unusual circumstances a few days earlier at a national meeting of the Clinical Ecology Society, to which I had been invited to give the banquet speech. (Incidentally, I was also honored by the Society with the Jonathan Forman Gold Medal.)

During my speech I demonstrated how looking at a pink card, or being under ordinary fluorescent lights, or wearing certain types of sunglasses would grossly weaken the shoulder deltoid muscle. The doctor didn't believe it possible, and came forward and held his arm straight out so that I could try the experiment on him. It worked perfectly. His arm went down like limp spaghetti when I pressed on his wrist. He still could not believe that just looking at a pink card, or being under fluorescent lights, or wearing sunglasses could so quickly and completely weaken his shoulder muscle. He was insistent that I come right up to Bethesda, where we could repeat the experiments again under more controlled conditions with muscle-testing equipment. I spent two days with him at Central Clinic headquarters, doing all kinds of muscle testing under various circumstances. He used special, very modern equipment that showed that the heart muscle was also weakened. He thought this was quite alarming, but that was as far as we went in testing at the time.

When I called him on the phone about the late luncheon affair, he thought for a moment and replied slowly, "Well, we

know that light affects the muscle that controls the opening and closing of the pupil. Our tests showed that light directly affected muscle strength in the shoulder, and also the heart muscle. So, what would you expect?"

Shortly thereafter I was invited to speak at a medical meeting at a hospital in New Jersey, not far from New York City. Again I demonstrated the loss of strength in the deltoid muscle as the result of looking at a pink card, turning on ordinary fluorescent lights, or wearing different types of sunglasses. This time I also showed that turning on a small hand-held, battery-operated calculator had the same effect. I also mentioned the late luncheon affair.

Following my presentation, the doctor in charge of the meeting came up to me and said that this demonstration seemed to explain a major problem recently encountered by his hospital and many others across the country since the new-type fetal monitoring equipment had been installed in their maternity wards. He added that the same basic type of electronic monitoring equipment is also used in the cardiac wards. His main concern at the moment, though, was with the alarming increase in the rate of Caesarean births in the hospital that had been definitely associated with the installation of the new-type monitoring equipment. The increase in the rate of Caesarean births, he said, was definitely related to an unexplained gross loss of uterine muscle strength: the mother was just not able to deliver the baby. The rate of Caesarean births at this hospital had increased from less than 2 percent to over 25 percent, which we both thought was alarmingly high. Since then, I have found one hospital where the rate is 36 percent, and another where it is over 50 percent of all the babies born.

Recently, I have noticed articles in the press, and in several scientific journals, with reference to doctors complaining about the unnecessary routine use of fetal monitoring equipment in hospitals and the alarming increasing rate of Caesarean births.

None of the articles I have read so far directly relates uterine muscle weakness with the electronic monitoring equipment, fluorescent lights, or polyester sheets, but the doctors with whom I have talked—and who have seen the simple arm muscle test—agree that it is a serious problem and that something should be done about it. More on this in later chapters.

I have said that my background is banking, that my hobby is taking time-lapse pictures of flowers growing, and that sex counseling and such matters are not exactly my line. So, before getting any deeper into the subject, perhaps I had better explain briefly how taking pictures of flowers got me so involved in the subject matter of this book.

2 HOW IT ALL STARTED

AFTER I SPENT my whole week's allowance of ten cents for a small box camera at the dime store, I began to wonder if my action had been prudent or possibly a bit hasty. I was horrified to find that a film cost twenty cents more, and then I had to pay to have it processed. Little did I realize what I was getting into.

During the 1918 flu epidemic at the end of World War I the family went to California so that my father could recuperate from an attack. I toured a studio and saw a movie being made with real actors. I guess I got the bug right there and then—not the flu bug, but the camera bug.

Christmas 1924 brought me my first 16-mm movie camera, and one dark night early in 1927 I borrowed the works from the kitchen clock to make my first automatic timer. I made a time-lapse picture of an apple blossom opening. The same bug was still biting.

By the time of the 1929 stock market crash I was working in a bank and could not always get home at the right time to make certain necessary adjustments on the two additional cameras I had accumulated secondhand. This made it necessary to build

more automatic equipment, but even so, by 1948 I realized that banking was interfering too much with taking time-lapse pictures, so I retired from banking.

During the early days of television, when some of the big city TV stations were expanding their broadcast time from approximately three to five hours a day, the manager of one of the Chicago stations telephoned me one Saturday afternoon. He was desperate. Something had gone wrong, and he had a half-hour period the following day and nothing to fill it with. He understood that I had some old films about flowers and asked me to come in and help him out. I did so, and he asked if I had any more that I could show the following week. Again I helped him out, and, in fact, kept on showing flower films every week for over ten years. I wanted to do a show on photography, since that was a subject I thought I knew something about. But the station manager insisted on a gardening show, so that is what it turned out to be.

Before each show I asked my wife how to grow the flowers I was going to talk about and show in my time-lapse pictures, and soon I was an authority on gardening.

As time went on, I had over fifty cameras taking time-lapse pictures of all sorts of things. I made many of the time-lapse sequences for Walt Disney's Nature Series, including *Nature's Half Acre*, *Secrets of Life*, and others. More recently, I did the flower sequences for Paramount's *On A Clear Day*, which featured Barbra Streisand. The film opens with her planting bulbs in pots on the rooftop, and as she sings they grow like mad on the screen, giving the impression that they are responding to her sweet voice. Actually, while they were really growing I sang to them, but she gets the credit, and that's how it goes.

Other time-lapse projects include making pictures of building the floats for several of the Macy's Thanksgiving Day Parades, as well as of the parades themselves, and the inflating and assembling of the balloon for Malcolm Forbes's attempted flight across

the United States and the Atlantic Ocean. A time-lapse camera was also mounted inside the gondola to record the entire trip, but the gondola did not go very far because of a malfunction of the harness equipment.

Perhaps my most gratifying time-lapse project was an educational film that showed the farmers of India how to increase the yield of their rice crops. My wife and I had recently returned from a lecture trip that took us around the world, including several stops in India. One day there was a knock on the door, and a representative of the Fertilizer Division of Amoco International and the Indian Department of Agriculture came in and said that he had had a hard time tracking us down. He explained that because the Suez Canal was closed by the Seven Day Middle East War, less grain from the United States would reach India, since shipping would have to take the much longer route around the Cape of Good Hope. India would have to increase its agricultural output. Would I, he asked, make an educational film for farmers?

I said I thought the canal would certainly be opened again before I could possibly produce the film, and farmers could be shown how to improve their methods to increase the rice crop yield on a national basis. He said that in India it was thought the canal would be closed for a long time, and, as it turned out, he was absolutely right.

He explained that they wanted to show time-lapse pictures of rice growing with and without fertilizer, as I had previously done with corn, wheat, oats, cotton, and other crops for various fertilizer and farm machinery companies here in the United States. Planting had already started, he said, and harvesting of the previous crop would soon be completed, so if I could start shooting within ten days I would be able to cover both operations at the same time—and time was all important.

I asked my wife if she would go back to India with me. She nodded approval, so back we went, and all went very well. The

sound track was done in three Indian dialects and the film was soon being shown from mobile truck units all over southern India (the rice-producing area). The yield of the rice crop, I am happy to say, showed significant improvement.

I have enjoyed every minute spent making time-lapse pictures. There were times, though, when all was not roses and honey. Some plants didn't cooperate and refused to bloom. At first, I would just discard them and try something else. But, as time went on, when a flower refused to bloom I had to try to figure out what was wrong so that I could follow the script. The first problem of any possible scientific significance came in trying to photograph the growth of a pumpkin from the emergence of the first shoot to maturity for the Walt Disney film *Secrets of Life*.

I didn't get any pumpkins, but I did learn that a pumpkin is a monoecious plant, that is, it produces both staminate (male) and pistillate (female) blossoms on the same vine. Down in my ivory cellar (basement studio) I found that all the staminate blossoms developed into large, healthy specimens, but all the pistillate blossoms (with the little embryo of the pumpkin right under the blossom) would dry up, turn black, and drop off the vine.

I had good pictures of a tomato turning bright red, but this particular sequence had to tie into the story of Cinderella's chariot, and Walt Disney insisted that a tomato simply would not do. It had to be a pumpkin.

I consulted a number of horticulturists, botanists, and just plain farmers who grew pumpkins, but since no one had ever seen this kind of situation before, I received no real suggestions as to what might be wrong. The soil tested out all right. The plants looked perfectly healthy, but at an early stage of growth all the pistillate blossoms would fail.

The situation was getting desperate. Walt Disney needed this sequence badly, so I agreed to try it again the next year. I was doing the project under a skylight in my ivory cellar and supple-

menting the restricted daylight with two large fluorescent fixtures. The lights were old and beginning to flicker, so I bought some new fluorescent tubes at the local hardware store and started over. To my amazement, this time all the pistillate buds developed fully and the staminate buds dropped off. This was just the opposite of what had occurred the previous year.

Thus, for the second time, after having photographed a vine every five minutes over a period of months from the time the seed was planted until it had grown to over fifteen feet, I was confronted with the problem of having all flowers of only one sex. This time I had a perfect female, or pumpkin-producing, flower, which I figured would open the next day, and nothing but year-old pictures of the male flower.

The next day the flower was open and would have to be pollinated before closing that night if it was to produce a pumpkin. In this delicate situation I decided to call my friend, Dr. Harold Tukey, head of the Department of Horticulture at Michigan State University. I asked him if he had any pumpkins growing at that time of year in the department's experimental greenhouses, and also if it might be possible to use any kind of artificial hormones. The answer to both questions was "no." Dr. Tukey had no pumpkins and advised that real pumpkin pollen would be necessary under these circumstances.

Next I called Dr. Dorsey at the University of Illinois, who said he was sorry, but he had no pumpkin pollen at the moment either.

Then I called Dr. Julian Miller at Louisiana State University. Dr. Miller had been very helpful on a previous occasion in settling a dispute about which end of a sweet potato should be "up" when it was planted in a jar of water on the kitchen window sill. I had demonstrated this on my televised, gardening show, and a lady called in to the station to say I had planted it upside down! This was very embarrassing and certainly a challenge to my authority as a TV gardening expert. Dr. Miller advised that

sometimes the big end should be down and sometimes it should be up. The procedure differs with various varieties, and the problem can be avoided by planting the potato on its side, the way the farmers in Louisiana do it.

I thought that possibly pumpkins might be blooming in Louisiana, but Dr. Miller told me there would be none for a week or ten days. This would be much too late for my beautiful pumpkin flower, which was now in full bloom.

Maybe the pumpkins would be in bloom a little farther south, so I called Dr. Deatrick of the Flagler Hydroponic Gardens in Miami. I asked him if he could look around Florida to see if there were any male pumpkin flowers in bloom. After I explained the urgency of the situation, he said he would see what he could do. He called me back a little later that morning, saying that he had spread the word. By noon an urgent appeal for pumpkin pollen had been published on the front page of the early edition of the Miami paper and broadcast on the radio, so that my beautiful little lady flower wouldn't die a spinster before dark. By two o'clock that afternoon a lady living in Miami called in to say that she had a pumpkin vine with male flowers in bloom and would offer it in the emergency. While I was sitting at my desk, wondering how I could get a male flower or at least some pollen up to Chicago before dark, the telephone rang. It was the vice president of Eastern Airlines. He had heard of the plight of my lady pumpkin flower and offered their facilities. He arranged to have the whole pumpkin vine dug up and placed aboard a nonstop plane to Chicago with an extra stewardess to take care of it.

I dashed out to the airport and waited for the plane. Soon it was announced, and I was escorted out onto the field. Newspaper photographers and reporters had gathered, but no one really knew who the important celebrity was. From all the commotion, it obviously had to be a movie star or foreign

royalty. No one would believe me when I told them it was King Pumpkin, or perhaps they just didn't understand. The passengers were all held on the plane until the pumpkin was unloaded and delivered to me. I rushed it out to my time-lapse studio, where I introduced it to the lady-in-waiting. Now I am being called Uncle John by a lot of little pumpkins, particularly by the one that starred in Walt Disney's *Secrets of Life*.

In checking everything I could think of, I found that the first year I happened to be using cool-white fluorescent tubes, which are strong in the yellow-orange part of the spectrum, and the second year, without asking for any particular kind of tube, I just happened to get daylight-white. This tube has more blue in it. After completing the pictures for Walt Disney, I continued to experiment with different fluorescent tubes and found I could obtain 100 percent staminate or pistillate blossoms on a pumpkin vine simply by supplementing the somewhat restricted daylight with either cool-white or daylight-white fluorescent.

Actually, there may not be too many people interested in the sex life of a pumpkin, but the fact that either male or female flowers can be brought forth by controlling slight variations in color or wavelength of light opened up some interesting possibilities for investigation.

Soon thereafter, I was asked to assist in taking time-lapse pictures of the development of fish egg embryos in the Department of Biology at Loyola University in Chicago. After the project was well under way, I suggested placing some guppies, which bear their young alive, under cool-white and other guppies under daylight-white fluorescent. The sex of the guppies can readily be determined by the development of certain coloration in the males as the fish mature.

The results of this experiment were quite significant. The professor in charge advised me that all of the guppies under

cool-white appeared to be females; that is, they had not developed any male coloring long after the time when male coloring should normally have appeared. However, at a later date he told me that approximately 20 percent of the guppies showed faint male coloring that never did fully develop. They appeared to be males, but the development of their secondary sex characteristics had been materially retarded. It was not feasible to do any autopsies at the time to see what had caused this mixed-up sex situation, although light certainly seemed to be a factor. However, there may be a clue here for future investigation with regard to the problem of homosexuality and the increasing number of transsexual operations.

A story about the effect of light on the sex of the pumpkin blossoms and the guppies appeared in the press, and I received a letter from a chinchilla breeder in New Jersey advising me that this growing industry was having a major problem obtaining enough female chinchillas for breeding purposes. Chinchillas kept outdoors produce approximately 50 percent males and 50 percent females. However, when chinchillas were moved indoors, the sex ratio in the litters changed to about 95 percent or more males.

Generally speaking, the chinchilla breeders were using the same procedures established for breeding mink. It was widely believed at first that chinchillas were cold weather animals and could tolerate extremely cold winter temperatures. It was also thought that cold temperatures would produce better pelts, earlier in the season, than would be the case with animals kept indoors.

Experience soon indicated, however, that temperature did not control the development of heavier winter fur and that chinchillas, being native to a more temperate climate, could not stand the extreme cold. It is now known that the seasonal changes in the length of daylight and darkness trigger the onset of the heavy winter fur, just as they also time the migra-

tion of birds, the hibernation of certain animals, and the mating season of almost all animals except primates. The poultry industry routinely uses artificial light to lengthen the daylight periods, especially during the winter, to increase egg production.

The chinchilla breeder advised me that since the chinchillas had of necessity been moved indoors, it was no longer possible to maintain the necessary number of females for breeding purposes. The cost of changing the incandescent fixtures to fluorescent, such as I had used on both the pumpkins and guppies, was more than the chinchilla breeder wanted to pay, so I suggested trying daylight incandescent bulbs in the breeding rooms in place of the regular incandescent. Daylight incandescent uses a blue glass to cut down on the high ratio of red and infrared found in the regular incandescent.

The lights were not installed until ten days after mating had occurred, and the same parent animals that had been consistently producing approximately 95 percent males in the litters under the regular incandescent bulbs now produced 95 percent females, which is contrary to the long-established X-Y chromosome theory. Daylight incandescent bulbs are now in worldwide commercial use by chinchilla breeders to increase the number of females in the litters.

All went well with the New Jersey chinchilla breeders for about two years. Then I received a special delivery letter advising me that the blue lights were no longer achieving the same results: the sex ratio was back to about 90 percent males again. The breeder had thought from the beginning that it was a silly idea, and she was now convinced it had been just a fluke that it had seemed to work for awhile.

But why, I thought, did it work for almost two years? Could it be that the filaments in the bulbs give off more red and less blue as they get older? I called the research director at the

Lamp Division of General Electric Company and asked if they had a wavelength chart of an old, almost-burned-out daylight incandescent bulb. He said they did not; all their wavelength charts were made using new bulbs. He thought there would be very little, if any, change in the spectral characteristics during the burning life of the bulb. I then asked if he would make a spectral wavelength chart of an old daylight incandescent if I sent one to him. He agreed reluctantly, although he thought it would be a waste of time.

I called the chinchilla breeder in New Jersey and asked if she had any more of the blue bulbs that had not burned out. She said she still had some, and I asked her to send several directly to the research director at General Electric. Soon I received a call from him saying they had come in. Then, with great guffaws, he advised me to learn the difference between one kind of blue bulb and another if I was going to continue giving people advice on lighting! He pointed out that I had told him he would be sent some daylight incandescent bulbs, but what he actually received from the chinchilla breeder was a sky-blue coloramic incandescent bulb. Well, I knew what I had sent the chinchilla breeder, so I called and asked what had happened. What did happen was that the original daylight incandescent bulbs I had sent burned out, so the chinchilla breeder bought some new blue bulbs that looked the same but happened to be sky-blue coloramic. The daylight incandescent has cobalt actually mixed in the glass that colors it blue, whereas the sky-blue coloramic is an ordinary incandescent bulb with a coat of blue paint on the outside of the glass. While they look about the same shade of blue to the human eye, the spectral wavelength charts show that the sky-blue coloramic does have much more red in it than the daylight incandescent.

I explained all this to the chinchilla breeder and she put daylight incandescent bulbs back in the breeding room. The

sex ratio reverted right back to approximately 95 percent females and, as far as I know, that's where it is today.

While this episode could not be considered a controlled experiment, it did nevertheless indicate a very important point: such biological responses are linked to certain wavelengths—just any old blue light will not necessarily do. This has also proven to be the case in many controlled experiments using different types of fluorescent tubes. Several years ago, however, an article appeared in the *Illuminating Engineering Society Journal* about the variations in the wavelength output of different batches of supposedly the same type of fluorescent tube manufactured by the same manufacturer, and even greater differences in supposedly the same type of fluorescent tube made by different manufacturers.

Finally, I decided to build a small animal laboratory out in the backyard and experiment with keeping various laboratory animals under different colors or wavelengths of light on a more controlled basis. This was an entirely new experience for me, but through several doctor friends I was able to get some qualified animal laboratory technicians to help set up the necessary scientific controls and generally supervise the experiments.

In our studies, as reported in detail in *Health and Light*, the most significant abnormal conditions were found in laboratory animals under pink fluorescent, which represents a concentration of the wavelength energy in a narrow part of the spectrum toward the red end of the visible spectrum. The animals used in these particular experiments were mice and rats, which are nocturnal and do not see into the far red end of the spectrum. This is why red lights are used in the so-called night rooms of many zoos; since red light does not disturb nocturnal animals, they are more active and not asleep in a corner of their cages while the zoo is open to the public during the daytime.

The abnormal responses in the animals under the pink fluorescent consisted of excessive calcium deposits in the heart tissue, smaller numbers of young in the litters, with lower survival rates, significantly greater tumor development or cancer (which has now been confirmed by six major medical centers), and a strong tendency toward becoming irritable, aggressive—constantly fighting with one another—and cannibalistic.

Another experiment with time-lapse pictures of bean plants and white rats placed in front of a TV set was given credit for leading to the passage of the 1968 Radiation Hazards Bill, which set safer levels for exposure to X-rays. The abnormal growth responses of the geranium plants under the ends of fluorescent tubes, shown in Paramount's *On a Clear Day*, has led to the development of new lighting fixtures for school-rooms that make hyperactive kids calm down and learn to read (while they also show one-third fewer cavities in their teeth).

I know this all sounds incredible, but keep on reading and I shall try to explain more in the next chapter.

3 BIOLOGICAL COMBUSTION

FIFTY-FOUR YEARS ago, when I began taking time-lapse pictures of flowers growing and blooming, it became apparent to me right from the start that light was a very important factor controlling growth and development. All further studies with laboratory animals, school children, and now the inmates of several U.S. Navy Correctional Centers and Federal penitentiaries indicate that light is an important factor in influencing human health and behavior.

During this time it has been my privilege to show some of my time-lapse pictures and speak to many groups representing quite a few disciplines.

As a result, I firmly believe there exists a great lack of interdisciplinary communication which is holding back progress in research dealing with various basic life processes. The living cell and the fundamental metabolic process involve so many overlapping disciplines that perhaps it is now time to stand back and take a good look at the overall picture.

To do this, it might be helpful to use less technical terms or phrases so that we may bring certain concepts into a closer understanding within a greater number of disciplines.

For example, metabolism might be thought of as biological combustion. When we speak of combustion, we think at once of the need for some sort of combustible material; that is, fuel or food—in other words, nutrition.

Oxygen is definitely a requisite. The proper adjustment of the carburetor in your automobile engine is done with a very delicate needle valve. Some automobiles now sold in cities at higher altitudes, where the air is a little thinner, have new, more delicate methods to adjust for the lesser amount of oxygen.

The under sides of leaves have countless numbers of small openings called "stomata," the Latin word for "mouth." The brighter the sunlight, the wider they open, in order to supply more air for a higher rate of photosynthesis.

When too much oxygen is given to premature babies in their incubators, it causes blindness, deafness, and brain tissue damage. Fortunately, this has not resulted in any recommendation that we should try to get along without oxygen. Such a notion is obviously preposterous. Yet that is exactly what is happening in prevalent views about ultraviolet light. Without doubt, too much ultraviolet is harmful—particularly the short-wavelength or germicidal ultraviolet that is mostly filtered out of sunlight by the atmosphere, and especially the upper ozone layer. That is why there is concern about the exhaust from SST airplanes and the fluorocarbon gas in aerosol spray cans destroying the ozone layer. The fear of too much ultraviolet is causing many people to overprotect themselves from sunlight, to the point of creating a deficiency in a very essential environmental life-supporting energy. Two very good recent books on this subject are *Sunlight Could Save Your Life* by Zane R. Kime, M. D., M. S. (Penryn, Calif.: World Health Publications, 1980) and *The Influence of Ocular Light Perception on Metabolism in Man and in Animals* by Fritz Hollwich, M. D., Professor Emeritus of Ophthalmology, University of Münster, West Germany (New York: Springer-Verlag, 1980). The following is quoted from the preface of Dr. Hollwich's book:

This book was written to show that light is a primal element of life. All life originates and develops under the influence of the light of the sun, that "superterrestrial natural force" (Goethe).

Sunlight influences the vital processes not only of the plant (e.g., heliotropism, photosynthesis) and the animal (e.g., color change, maturation of the gonads) but of man as well. The human organism too reacts "heliotropically," as the 24-hour rhythm of the sleep-waking cycle demonstrates. . . .

It is the purpose of this book to demonstrate to architects as well as teachers, physicians, and lighting experts that the source of the light rays entering the eye is of great importance. Artificial light may be an optic substitute but it is by no means equivalent to natural light in physiological terms. Too much artificial fluorescent light interferes with the natural development of the child and subjects the nervous system of the adult to inordinate stress. The health of our organism is dependent to a large degree upon the environmental factor of light, i.e., upon the entry of natural light into the eye. . . .

Many of today's large buildings are without windows and are completely air-conditioned. Man, who, like all living creatures, evolved under the light of the sun, is thereby cut off not only from visible light but also from the interaction between invisible electromagnetic rays and the earth's electric field. . . .

In conclusion, to define the crucial issue of today, such an important environmental factor as light must once again be correlated with the needs of man as a creature of nature. Man, in his daily routine, requires the influence of natural environmental factors to a certain degree. Among these are daylight, with its visible and invisible electromagnetic radiation, as well as the unfiltered pure air of the atmosphere and the changing temperature of the external world. Since places of work to a large extent exclude contact with nature, dining and recreation rooms on the premises should be designed to offer a certain compensation. Finally, our homes should also be planned with this purpose in mind. Man, "the Unknown" (Alexis Carrel), has already reached a remarkably high level of civilization in the last decades due to the introduction of many technological options; he should now devote a portion of his energies to the study of those life factors which are indispensable for the maintenance of his health and thus of his existence.

In experiments performed over a period of almost three decades (1948-1975), the author [Dr. Hollwich] and co-workers were the first to demonstrate conclusively that the eye is the channel for light's stimulatory effect. In order to elucidate this effect and separate it clearly from the visual process, in 1948 the author [Dr. Hollwich] designated the neural pathway

conducting the photostimulus to the pituitary gland (hypophysis) as the "energetic portion" of the optic pathway. Vision itself proceeds independently via the "optic portion" of the optic pathway.

We take for granted that a combustion engine also needs an ignition system, and that if the spark plugs are dirty it is a waste of time to work all day adjusting the carburetor or adding "nutritional" additives to gasoline. But we totally ignore the biological combustion, or metabolic ignition, system—that is, the interaction of light or electromagnetic energy.

Light is generally thought of as something other than such electrical energy as radio waves, but it is just as much a part of the total electromagnetic spectrum and, therefore, actually does come within the technical classification of being electric energy.

We know that every chemical, mineral, vitamin, or substance of any kind that we take into our bodies as food has a maximum wavelength absorption characteristic of electromagnetic energy. We also know that this wavelength energy penetrates the skin and interacts directly at the molecular level with the chemicals and minerals in the blood supply.

One of the more interesting developments in medicine during the past few years has been the introduction of light therapy for the treatment of neonatal hyperbilirubinemia, or jaundice, in premature babies. The use of light in the treatment of jaundice may have been practiced originally in India by midwives, who placed unclothed, jaundiced infants in the sunlight to cure them. In 1958, Dr. Richard J. Cremer of Harefield Hospital in Middlesex, England, did significant work in the use of artificial light to treat jaundice. Dr. Cremer showed that the serum bilirubin levels that cause jaundice could be lowered in infants by exposing them either to sun-

light or to artificial blue light. The accepted alternative treatment for severe cases is to perform a complete blood transfer, which in itself carries considerable risk.

In this country, Dr. Jerold F. Lucey, professor of pediatrics at the University of Vermont College of Medicine and a past president of the American Academy of Pediatrics, has carried on extensive work in studying light therapy for the treatment of jaundice in premature babies. When the premature babies are exposed to the light treatment, their eyes are covered with a blindfold as a precautionary measure. The treatment is usually for eight hours a day for five or six days.

The condition, bilirubinemia, results from high concentrations of a toxic waste in the blood, which the infant is unable to dispose of through its liver and kidneys. The blue light (with its shorter visible wavelengths) passing through the tissues interacts with the bilirubin serum and converts it into a nontoxic substance that can be easily excreted.

Dr. Lucey and his coworkers have experimented with different types of fluorescent lights. He is now using full-spectrum fluorescent light containing the normal amount of blue to approximate the spectrum of natural sunlight.

It seems logical that while the use of a strong blue light might hasten the breakdown of the bilirubin serum, the absence of all the other wavelengths of the total spectrum might create other deficiencies or side effects, especially in newborn infants receiving their first direct exposure to light.

Westinghouse makes a special blue fluorescent tube which they recommend for the phototherapeutic treatment of hyperbilirubinemia. In their current Lamp Sales Engineering Bulletin, the use of these special blue lamps is discussed and the following statement appears:

Note: Some personnel who view infants under the special blue lamps for extended periods may experience a slight nausea. This is caused by the

extremely saturated blue light. This nauseous condition can be corrected or improved considerably without appreciably reducing the effectiveness of the bilirubin treatment. Where an individual complains of nausea, we suggest the following:

1. One of the special blue lamps in the bilirubin hood can be replaced with a Gold (GO) Fluorescent Lamp of the same electrical characteristics. (F20T12/GO to replace F20T12/BB or F40GO to replace F40BB). This approach tends to dilute the saturation of the blue light.
2. Yellow or amber tinted transparent plastic curtains may be fastened to the treatment hood so that the infant being treated is viewed through the tinted curtain.

As previously stated, many biological responses are not to any light (as compared with darkness), but, rather, to narrow bands of specific wavelengths. When these are missing in an artificial light source, the biological receptor responds as if it were in total darkness, even though other wavelengths are present. For example, cool-white fluorescent as well as ordinary incandescent bulbs lack the shorter wavelengths that we see as blue.

If a particular ailment can be treated with certain wavelengths of light, we might logically assume that living under an artificial light source that lacks these wavelengths can contribute to causing the ailment in the first place.

It is worth noting that all the acceptable applications of phototherapy so far use the blue or ultraviolet wavelengths that are grossly missing in the artificial light sources under which modern civilization exists. Pink tinted lenses especially stop these beneficial wavelengths from entering the eyes, thus causing an endocrine deficiency. The recent rapid swing toward the new, more efficient but grossly distorted pink and orange spectrum of the new type sodium vapor lighting further raises very serious questions concerning their effect on human health and behavior.

In a similar way, the buildup of toxic levels in the blood of factory workers from exposure to industrial chemicals could be influenced by the type of artificial lights used in the working area. A buildup or accumulation of chemical pesticides, food preservatives, or artificial coloring materials and other chemicals could reach higher toxic levels if the wavelengths to which they interact are weak or missing. In an article entitled "Blue Light and Bilirubin Excretion" (*Science* April 11, 1980) by Antony F. McDonagh et al. emphasis is placed on the effect of blue light enhancing normal bilirubin metabolism so that it can be excreted by the liver. We are probably being optimistic if we assume that serum bilirubin is the only chemical in the blood that reacts to specific wavelengths of light or electromagnetic energy in this way.

In the May 9, 1980, issue of the *Journal of the American Medical Association* an article entitled "Uremic Pruritus Treated with Ultraviolet Light" mentions that "The response to UVB may indicate the deposition of some [toxic] substance in the skin that is being degraded or inactivated by ultraviolet light." It seems to me that referring to a toxic substance in the skin being degraded or inactivated by any kind of light comes pretty close to talking about the metabolic process, or biological combustion.

I further quote from an article entitled "Phototoxicity: The Neglected Factor," *J.A.M.A.*, August 3, 1979:

Ignorance of phototoxicity by the general biomedical community constitutes a health hazard. Certain food colorants and dyes proposed for use in angiography produce lethal effects in cells and whole organisms on light exposure but not in the dark. Yet light-relatedness is usually neglected in toxicity studies. We urge that the specific involvement of light be considered whenever the toxicity of a light-absorbing substance is assessed.

The European Society for the Study of Drug Toxicity has reported that the lethal dose rate for most drugs is higher

when administered during the daytime than during the night. We also know that light received through the eyes stimulates the pineal and pituitary glands. These glands control the endocrine system that regulates the production and release of hormones controlling body chemistry. This would then seem to me to be a carry-over of the basic principles of photosynthesis in plants—sometimes referred to as a conversion of light energy into chemical energy—to animal life, a phenomenon not heretofore recognized. Thus the wavelengths that are missing in various types of artificial light or that are filtered from the spectrum of natural light by window glass, windshields, eyeglasses (particularly tinted contact lenses or deeper shades of sunglasses), smog, and even suntan lotions, are causing a condition of malillumination, similar to the malnutrition that occurs when there is a lack of a proper nutritional diet.

Those minerals and chemicals in the individual cells of our bodies that would normally be metabolized by the wavelengths that are missing remain in the equivalent of darkness, even though other wavelengths are present. The end result is an incomplete metabolic or biological combustion process.

Viruses are sometimes described as abnormal chemicals or chemical compounds within the cell. Quite possibly, there may be a relationship between an incomplete, or unbalanced, light spectrum and the abnormal cell chemistry associated with viruses responding through the process of biological combustion. A direct relationship may even exist between viruses and electromagnetic energy, including light. Needless to say, such possibilities should be further studied.

Many doctors refer to cancer as a disease of endocrine imbalance. They treat the master endocrine gland, the pituitary, with drugs or perform surgery without realizing the important role that light plays in controlling this gland that acts as the

balance wheel of the endocrine system. Cancer is also often described as being a growth that has gone wild. Such a condition would certainly seem to be directly related to a mixed-up metabolic or biological combustion process.

In addition to a generally distorted spectrum, all fluorescent lights contain mercury vapor lines that are customarily shown on wavelength charts as only one one-hundredth of their true intensity and one hundred times their true width, in order to represent the same relative energy and show them on an ordinary-size sheet of paper. This gives a grossly distorted impression of the intensity of these wavelengths. Other types of gaseous discharge lights, including mercury vapor, sodium vapor, and multivapor, also contain very narrow lines or wavelength peaks.

Like the automobile combustion engine, all systems in biological combination must be "go" for smooth operation. It is not possible to say whether fuel, oxygen, or ignition is the most important. All we know is that, in order to function, an engine must have all three.

4 KINESIOLOGY

WHAT'S THAT?" I asked. "How do you spell it? No, I've never heard of it." The connection isn't very good. "Can you speak a little louder? What did you say your name was?" That was my introduction to kinesiology back in 1977.

Dr. Charles R. Schultheiss had called me from the Salisbury (Maryland) State College to tell me that he and Brian White had just completed a study utilizing standard kinesiological muscle test procedures indicating that photochromic lenses, the kind that turn darker outdoors, substantially weakened the shoulder deltoid muscle. He further stated that full-spectrum, neutral gray lenses did not produce this effect. I was particularly pleased when he added that reading my book, *Health and Light*, had prompted the experiments.

Dr. Schultheiss sent me a copy of his paper, which also included a brief outline on the development of kinesiological muscle testing methods and their use. He pointed out that Dr. George J. Goodheart of Detroit was generally considered the originator of the muscle test method to determine when an environmental stimulus can be harmful to the body.

This idea has since been expanded by other researchers in the field. Goodheart's original work dealt with the senses of touch and taste; Schultheiss expanded the technique to include olfaction. Dr. John Diamond, author of *Behavioral Kinesiology*, expanded it to include hearing. These researchers and others have noted that when a stimulus is harmful to the body, it somehow will produce an immediate diminution of muscle strength, as determined by the standard muscle testing techniques of Kendall, Kendall, and Wadsworth.

Recent findings now indicate that the electromagnetic environment also significantly affects the strength of all muscles, including the heart muscle. It is not as yet clear just how and why this happens, but the end result is very positive.

One obvious direct response of the eye to light is the muscle-mechanism that opens and closes the iris. Like other biological responses, it appears to react to certain wavelengths and not just to light, per se, as compared with darkness. An experiment involving the placing of an ultraviolet transmitting contact lens in one eye of a patient and an ultraviolet absorbing contact lens in the other eye showed the pupils were both the same size indoors without any ultraviolet light. However, outdoors, in sunlight, the pupil receiving the ultraviolet was significantly smaller than the pupil in the eye that received no ultraviolet.

This indicates that the muscle-mechanism controlling the iris responds to both the visible wavelengths, plus the part of the spectrum that continues into the near ultraviolet. Accordingly, this may explain why people wearing ordinary clear eyeglasses or looking through an automobile windshield that blocks out the ultraviolet have to squint and suffer eyestrain from too much light entering the eye. They then feel the need for dark glasses. Their pupils remain larger than they normally would under the same intensity of natural daylight containing the normal amount of the near ultraviolet.

A major problem with fluorescent lights, as well as with all

the other types of gaseous discharge tubes or bulbs, is that they emit RF radiation beyond the range of visible wavelengths. This is known to cause computers and scanning equipment used in hospitals to give erroneous or erratic readout results, which is why plastic diffusers with a grounded wire grid are recommended for the fluorescent light fixtures. This RF radiation has now been found to cause muscle weakness and other physiological and psychological problems as well.

Loss of muscle strength can easily be demonstrated by having a person stand under ordinary fluorescent light fixtures with his or her arm held straight forward, palm facing downward. Press down on the wrist while the person resists, in order to establish the strength of the shoulder muscle. This should be done first with the fluorescent lights turned off and then repeated with the lights turned on. Radiation from fluorescent tubes also weakens the muscles of the person administering the test. However, the person pushing downward has a big advantage over the person resisting upward. Usually, there will be a very noticeable difference in the muscle strength.

However, this test does not always work, as there are other factors grossly affecting muscle strength that must be eliminated. These include not only such items as ordinary eyeglasses (especially tinted contact lenses and deeper-colored sunglasses if the test is done outdoors in natural daylight), but also ionizing-type smoke detectors within a distance of fifty feet, including floors above or below test area location. Any wrist watch or nearby clock with a luminous dial or a battery-operated mechanism, calculators, video display terminals, microwave ovens, high-voltage electric transmission lines, certain types of synthetic clothing (especially vinyl imitation leather, imitation rubber, and some polyester fabrics), and what the person may have eaten during the previous three or four hours—refined sugar or white bleached flour, for example—will also weaken muscle strength to the point that there is little left to test.

The wavelength characteristics of light reflected from different colored walls is similar to that passing through filters of similar colors and must also be considered. For some unknown reason, pink and orange produce the greatest loss of strength and blue the least loss when compared to full-spectrum outdoor natural daylight. I repeat that the recent swing toward the new, more efficient, but at the same time grossly distorted pink and orange spectrum range of sodium vapor lighting raises very serious questions about its effect on human health and behavior.

Certain single items that weaken muscle strength will complement each other when combined and produce a synergistic effect, while other combinations may counteract each other and end up producing no effect.

Many abnormal biological effects in both plants and laboratory animals (especially tissue-culture studies) have been shown to be caused by fluorescent lights. Too often, it seems to me, these abnormal responses are almost automatically attributed to ultraviolet wavelengths from the fluorescent tubes.

While the basic principle that makes the fluorescent tubes work is the mercury arc giving off strong shortwave ultraviolet, which causes the phosphor coating inside the glass tube to fluoresce visible wavelengths of light, the glass, as the earth's atmosphere, effectively stops the shortwave ultraviolet. Only the longer wavelengths of the ultraviolet and visible light penetrate through both the glass and the earth's atmosphere. Standard fluorescent tubes such as cool white, warm white, and daylight do give off trace amounts of the long-wavelength ultraviolet, but not enough to have any of the beneficial effects of natural outdoor daylight.

The very thin glass used in fluorescent tubes allows some long-wavelength ultraviolet to pass through. The thicker glass used in windows does not. It is similar to placing tissue paper over a flashlight or a piece of thicker cardboard.

The radiation from the ends of fluorescent tubes will pene-

trate aluminum foil but not lead foil, which indicates a "trace" amount of X-rays although at too low a level to be picked up with existing X-ray measuring equipment. It was while I was trying to grow geranium plants for *On A Clear Day* that I noticed the stunted growth on the plants near the ends of the fluorescent tubes. Remember, it was not long ago that canary birds had to be used to detect coal gas in mines.

The cathodes at each end of the tube are the same sort of device as is used in TV picture tubes and X-ray tubes. However, fluorescent tubes operate at a much lower voltage and theoretically should not give off any X-rays. In the G.E. publication "Techni Talks," there was an article not long ago stressing their quality control in manufacturing the filaments for high voltage rectifier tubes so that they would be perfectly smooth, since any rough spot could act as a little point emitter and give off electrons that could produce X-rays if they happened to hit a metal target.

One of my time-lapse pictures of a light bulb filament over the full life of the bulb clearly shows the filament starting out new, shiny, and smooth. But as it gets older, the heat of the filament is so great that the metal coils of tungsten soon start to shrivel and get rough, so there are many little bumps and points that can only be seen with a microscope, like some of those microscopic antennae on very small insects. In many of the papers I have published, I have mentioned that old fluorescent tubes and TV sets seem to give off more radiation than new ones, as evidenced by the stunted growth of plants. Many filaments, especially those in fluorescent tubes, are coated with an electron-emissive material that further compounds the problem.

Standing under these regular types of fluorescent tubes, either with or without special additional plastic shielding designed to filter out absolutely all of the trace amounts of any ultraviolet, results in gross loss of muscle strength. When the

normal proportionate amount of long-wave ultraviolet found in natural daylight is added and radiation shields are used to stop the radio frequency and X-ray radiation, then there is no loss of muscle strength.

This supports my belief that in addition to the distorted visible spectrum, some abnormal biological effects caused by ordinary fluorescent lights are from the radio frequency and X-ray emissions that are being totally ignored in supposedly controlled research studies, and not from the virtually nonexistent ultraviolet in standard types of fluorescent tubes.

I repeat that hospitals that have installed electronic fetal monitoring equipment in their maternity wards are experiencing an alarming increase in the rate of Caesarian section births, due to the loss of uterine muscle strength of the mother. Ionizing-type smoke detectors, digital wrist watches and polyester sheets and nightclothing, in addition to ordinary fluorescent lights, are also especially high on the list of items that weaken muscle strength, diminish the sex drive, and/or cause impotency.

Cotton sheets and underclothing may help some, but they are not thick enough to insulate completely the effects of a polyester mattress, quilt, or outer garment.

All these recent findings are helping to make it possible to understand more clearly the results of previously reported studies of the effects of different colors or wavelengths of light on laboratory animals. Until just recently, such effects could not be fully explained and were therefore ignored.

5 THE ELECTRICAL DIMENSION OF LIVING CELLS

THERE IS A LOT to be learned about how light and radiation affect not only human muscle strength but also general health and behavior. Nevertheless, the fact that they do have an effect is now indisputable. What is more difficult to understand is the electrical field associated with each living cell. This has been shown to exist through Kirlian photography, but what it means is extremely vague. Psychics claim to be able to see an aura around the human body, and I am myself now absolutely convinced that they do, even though I see nothing, however hard I try. Unfortunately, but understandably, such unscientific observations have in the past been placed in the category of the mysterious—and, perhaps, highly suspect—supernatural.

But there is something there that can now be demonstrated through kinesiological testing of human muscle strength using an ordinary lightning rod. The most common belief as to how a lightning rod works is that it is put up on the roof and grounded with a heavy copper wire so that if lightning happens to strike in that general area, it will be attracted to the lightning rod and grounded without causing any damage to the building. How-

ever, this is not what the people who make them say. Their explanation is that if lightning hits a lightning rod it is an indication it was not properly installed and grounded. The makers further say that the lightning rod must be pointed so that it will be more efficient in acting as a point emitter, and grounded so that it will draw the opposite electrical charge from that of a cloud approaching overhead. It then discharges this opposite electric charge from the ground into the air and neutralizes the charge in the cloud fast enough so that there will be no bolt of lightning at all.

The existence of an electrical field or dimension in the human body may be demonstrated by placing a lightning rod against the chest and pointing it away from the body. It appears to act as a point emitter and discharges the body's electrical energy into the air. The result is a gross loss of muscle strength. If the lightning rod is turned around and pointed toward the chest, the muscle strength immediately returns and in some cases is actually enhanced.

A lightning rod placed against the back has a reverse effect. When pointed away from the body, the muscle strength is strong, and when pointed toward the back, it is weak.

This reverse response is in keeping with the ancient Chinese Yin Yang theory dealing with body energy. According to the Yin Yang theory, the front part of the human body possesses a negative electrical charge and the back possesses a positive charge.

Negative ions are thought to give the body energy and positive ions are thought to bring on fatigue and even depression. Accordingly, the loss of negative ions from the front of the body through the lightning rod could explain the muscle-weakening effect. However, when the lightning rod is turned around and pointed toward the front of the body, it would increase its electrical charge, which is negative, and thus increase muscle strength. By placing the lightning rod against the back, the

positive ions would be emitted from the point, thus increasing the overall ratio of negative ions in the body. If we turn it around again, so that the point is against the back, then the electrical charge or dimension of the back would be increased. This would build up the overall ratio of positive ions so as to cause muscle weakness, depression, and so on. The Yin Yang theory also relates other specific parts of the body to positive or negative electrical charges.

Interestingly, this effect of a lightning rod on human muscle strength frequently occurs only during the period from sunrise until sunset, and has no effect during the dark nighttime period. The phenomenon becomes even more interesting when we compare this daytime response with the fact that commercial radio stations are required to reduce their broadcast power at sundown because of a change that takes place in the ionosphere, which directly affects radio broadcasting conditions during the nighttime period. Many radio stations are required to go off the air completely until sunrise the following day.

The lightning rod-muscle test experiment is influenced by the level of negative ions in the air and will not work if a negative ion generator is operating nearby. However, this may be caused by the unshielded high-voltage electric circuit of the generator and not by the negative ions that are generated.

Nor does the lightning rod test work in a large building of steel construction, where a portable radio is also inoperative. Other electronic equipment or devices, including fluorescent lights, ionizing-type smoke detectors, black-and-white, but not color, TV sets, video display terminals, calculators, and clothing made of synthetic material (especially vinyl imitation leather, and polyester), will also prevent the lightning rod test from working.

In this connection I might mention that the results of acupuncture treatments vary between day and night and even at different times of day. Also interesting is the fact that acupunc-

ture needles are always made of metal, as are antennae for either receiving or broadcasting radio, TV, or microwaves. Obviously, a piece of grocery string or a wooden rod would not work as an antenna. Nevertheless, insect antennae are a non-metal biological material—and they work.

Dr. Philip Callahan of the Insect Attractants, Behavior and Basic Biology Research Laboratory, U. S. Department of Agriculture, and the University of Florida, Gainesville, has done some remarkable work in developing methods of insect control alternative to chemical pesticides. He has measured the frequencies that various plants and insects radiate and has made miniature transmitters, utilizing a wax candle to duplicate the frequencies. He has attracted moths and ants to the frequencies that mimic moth sex scents (pheromones) and certain plant attractant scents. The wavelengths emit in the far infrared portion of the spectrum.

He demonstrated that the insect antenna is made of non-metallic biological material and can receive the long-wavelength infrared radiation. His further studies revealed that the insect antennae contained many minute wax glands that keep the antennae coated with wax. Wax is known to be a material capable of guiding electromagnetic waves along a surface without actually conducting them the way metal does. Dr. Callahan states that wax acts as a wave guide not only for electromagnetic waves, but also for acoustical sound waves.

With this in mind, and mindful of the fact that animals have wax only in the ear canal, I decided to try a little experiment. I coated the ear canal of both my ears with beeswax. The result was a significant improvement in my hearing.

However, there were complications. Beeswax is normally quite a hard substance, and to soften it, I tried heating it. To make it soft enough to apply with a cotton Q-tip applicator, it was necessary to heat it to the point where it was uncomfortably hot. I checked the contents of several liquid wax furniture polishes and found the thinner generally used is turpentine or

other solvents that would be very harsh if applied to the ear canal.

I then tried thinning the beeswax with glycerine, which has long been used as ear drops, especially with children. However, glycerine will not mix with beeswax, even when heated to high temperatures.

I asked my local pharmacist if he knew what could be used as a thinner for beeswax other than turpentine. He looked the matter up in a large reference book and advised me that natural vegetable oils would mix with beeswax. Accordingly, I tried pure olive oil and found that this worked fine, but when I applied it to my ears, it caused severe itching. I next tried using castor oil, which also worked fine in thinning the beeswax, and caused only very minor itching. I added lanolin to the mixture and found that this not only eliminated the itching problem, but also seemed to improve my hearing even more. I have tried mixing various amounts of these ingredients and find that one-third beeswax, one-third castor oil, and one-third lanolin by volume seem to give the most satisfactory results. I call this mixture "Hear Wax."

At the age of seventy-two, I am well aware that my hearing ability has been deteriorating for several years, and is not as good as it used to be. An examination by my otolaryngologist indicates a hearing loss of approximately 50 percent from normal. Audiograms made with and without the use of "Hear Wax" show no significant difference. However, this may be due to the normally very close position of the ear phones and the sound being directed right at the ear drum. Furthermore, the words spoken on the audio records are clearly enunciated and there is no background noise.

The benefit of using "Hear Wax" is noticed most when a number of people are all talking at the same time in a room or when one is in an open space with a high background noise level.

Also, during these past years, I have been aware of a very

noticeable decrease in the amount of wax discharged from my ears. On the other hand, too much wax, especially if it is dry and hard, can plug up the ear canal and block the sound waves, and should be removed. Remember—too much of anything can be bad.

I got in touch with my patent attorney, and he had a search made of the records in the Patent Office. The searcher reported all kinds of patents issued on various methods of getting rid of the wax from the ear, but nothing about trying to put wax in. He also wanted to double check to see if he understood correctly that I really wanted to put more wax into the ear.

While synthetic materials such as vinyl imitation leather and polyester do not actually conduct electricity, they apparently act as a wave guide material that negates the lightning rod experiment and also weakens the human muscle strength.

A metal wire rod pyramid with a base approximately ten inches square can be used in place of the lightning rod and will produce the same results affecting muscle strength. This clearly demonstrates that there is something to the very controversial claim for some sort of pyramid power. As an experiment, I made a similar-sized pyramid out of wooden dowel rod and it would not work, but when I coated it with beeswax it did.

Holding an ordinary lead pencil in the normal writing position also grossly weakens muscle strength. The graphite lead down the middle of the wooden pencil acts as a wave guide-point emitter, the same as the wax coating on the wooden pyramid. But the pencil must be sharpened to act as a point emitter. If it is flat across the writing end, it does not cause any muscle weakness. It makes no difference whether or not there is a standard type of rubber eraser on the other end. A wax or "grease" pencil also has the same muscle-weakening effect.

However, if either the lead or the wax pencil is pointed at both ends, the energy point emitter action is equalized or cancelled so that there is no weakening of the muscle strength. Also, if the metal sleeve that holds the rubber eraser is cut or

notched to make one or more triangle shapes pointing away from the end of the pencil, the points so created will also act as energy equalizers and there will be no loss of muscle strength.

Ordinary metal eyeglass frames also cause muscle weakness when worn in the usual position across the bridge of the nose with the temples extending back along each side of the head to the ears. However, if a piece of metal wire is used to connect the end of each temple around the back of the head, thus circling the head completely with the metal, the effect is equalized and normal muscle strength results.

The following simple and somewhat unscientific muscle test procedure has done more to convince skeptical people that light and low-level radiation really do have a direct effect on the human system than all the articles that have been published.

I call this procedure "simple and somewhat unscientific" because that is just what it is—simple and somewhat unscientific. As mentioned in Chapter 4, it consists of pressing down on someone's wrist (with the arm extended and the palm facing down) to test the shoulder muscle strength while the person being tested tries to resist. This test works providing the muscles of the person being tested are not already weakened by any of the many items previously mentioned, including digital wrist watches, nearby smoke detectors, contact with anything made of polyester or vinyl material, and others. The difference in a person's muscle strength is usually gross and unmistakable. In most cases, it is so obvious that a pressure-measuring device is not necessary. However, it is surprising how much difference there is in the muscle strength of the individuals of any group selected at random. Some people, both male and female, have surprisingly weak muscles; others have exceptionally strong ones. Naturally, the test works best on people with reasonably strong muscles, as there is a much more noticeable difference between their strong and weak conditions than is the case with someone who has very little strength to begin with.

One drawback to the test is that it is difficult to be absolutely

sure that the person has had no contact with muscle-weakening items. For example, even if you ask the person being tested all the questions about digital watches, polyester clothing, and whether or not he had anything to eat or drink containing refined white sugar during the past four to six hours, he may not be certain or may have forgotten about sucking a sugar-coated gumdrop or hard candy or cough drops an hour before.

Several medical equipment companies have started making a very sensitive meter to measure more accurately and scientifically the exact pressure required to push a person's arm down. However, this can be self-defeating, since the pounds-pressure reading is shown by a digital read-out that weakens the muscles of both the person being tested and the tester, just as muscles are weakened by the new-type monitoring equipment used in the maternity and cardiac wards of many hospitals. One such scientifically designed pressure-measuring device that I witnessed being used also had a padded pressure sensor that was placed on the person's wrist, and the padding material used was made of vinyl.

Another published report mentioned having the person being tested either sit on a padded wooden chair or lie down on a padded wooden table in order to test arm and leg muscles in different positions. The test results showed very little difference in muscle strength from the results obtained when looking at either a blue or pink card. The padding material was later found to be made of vinyl.

Another researcher reported significant differences in shoulder muscle strength when the colored cards were placed on a wooden rack on top of a wooden table. However, the distance from the cards to the eyes could vary considerably, depending on just where the person being tested might stand. Accordingly, to gain a better control of such possible variables—and before any significant number of tests was completed—a special aluminum tubular frame was designed to hold the colored cards in exactly the same position and distance from the eyes for each

test. It was so made as to go over the head of the person being tested and rest on the shoulders, with supports down both the front and back to hold it firmly in place. It did hold the different colored cards in exactly the same position in relation to the person's eyes for each test, but after a statistically significant number of tests had been completed and run through the computer, it was evident that the magnitude of color effect differences was very small.

To satisfy my own curiosity, I constructed a similar metal frame out of heavy solid wire and discovered that when such a frame made of either solid or tubular metal is placed over the shoulders and down both the front and back for a distance of about eighteen inches, there is gross loss of all muscle strength in the person being tested. Apparently the device "short circuits" the different front and back polarity fields of the human body. This weakening effect seems to relate closely to the similar muscle-weakening effects of the lightning rod, pyramid, lead pencil, metal eyeglass frames, and prongs on a ring.

As if things like aluminum frames or sitting on a vinyl-padded table, in addition to all the other items—smoke detectors, digital watches, and the like—were not enough to boggle your mind, there is also a problem with shades of color. Two pink cards look exactly alike, but one grossly weakens the muscle strength and the other does not. One skeptical onlooker commented, "This proves the whole thing is a crazy idea, and obviously due to some psychological cause such as self-hypnosis."

Well, I didn't know quite how to reply to that remark. However, I thought about it that night, and by early morning I suddenly realized that pink is not always true pink, but might be a light red. For some as yet unexplained reason, orange and pink are the two colors that cause gross loss of muscle strength. But yellow and red, the two colors on either side of orange and pink in the rainbow order of colors in the total spectrum, do not cause similar weakness.

The visual function of the eye can mix colors. If a fast-rotating

Color

disk is half blue and half yellow, the result will appear green. Blue and yellow paint mixed together will appear green. It is the same with other colors. Yellow and red will look orange, but a spectro-analysis of such combinations of colors will still show two separate peaks of energy of the two original wavelengths of the colors involved. The spectro-analysis will not show the true wavelength of orange or pink or whatever the mixture of colors may appear to the eye.

To test this further, I bought cans of red, white, pink, yellow, and orange paint. I made certain they were the true colors and not blends, as some paints are these days. Then I painted pieces of cardboard each of the various colors. Those painted true orange or pink caused gross loss of muscle strength. And those painted red, yellow, or white did not. Those painted with a mixture of red and white that looked very close to the true pink color had no muscle-weakening effect, nor did the combination of red and yellow that came so close to the true orange that it was difficult to tell them apart.

Thus, while the eye will combine colors, the effect of such combinations of colors apparently still reacts on the retinal hypothalamic endocrine or energetic system as the specific wavelengths of the colors they really are. A mixture of red and white that looks pink is not the same wavelength of the electromagnetic spectrum as that of true pink, and once again, a very embarrassing situation seems to have been logically explained.

A controlled study conducted in a Sarasota, Florida grade school by the Environmental Health and Light Research Institute indicated that when radiation shields and full-spectrum fluorescent lights that cause no loss of muscle strength were used, the hyperactive children quieted down, overcame learning disabilities, and developed one-third fewer cavities in their teeth. Their academic level showed an increase over the control group of children who remained

under standard cool-white fluorescent lights without radiation shields.

This indicates that electrical stresses caused by ordinary fluorescent lights or lead pencils, as well as all the other things that weaken the muscle system, may also affect the brain and its ability to function at full capacity. There must be some reason why the test scores of the College Board Scholastic Aptitude Tests taken by high school seniors have shown a steady decline for the past seventeen years. Also, during this same period vandalism and violence have shown an alarming increase. More and more stories appear in the press about physical attacks on teachers, the need for armed guards to patrol the school corridors, and the installation of metal detectors such as those used in airports to check students every morning as they come to school.

A 1980 report of the California Department of Education indicated that the decline of children's scores on school achievement tests is closely related to the amount of time they spend watching television each day.

More than half a million public school pupils were surveyed, and their scores on the state's sixth- and twelfth-grade achievement tests were correlated with their TV watching habits. The survey found that sixth-graders who watched TV an hour or less a day scored about seven percent higher than those who spent four hours or more a day in front of the cathode-ray picture tube. Test scores declined greatly for all children who viewed television more than three hours a day. For high school seniors, the scores fell in almost direct relation to the amount of time they spent watching television. Twelfth-graders watching TV six hours a day or more scored about fourteen percent lower in all areas than those who watched TV an hour or less a day.

The buds of some nocturnal or night-blooming plants will open only during the dark nighttime period, whether or not

they are placed in a dark closet during the day. This suggests that the opening action of these buds is not due to the absence of visible light, but rather the presence of some form of nighttime radiation that could very easily penetrate ordinary building materials as readily as visible light comes in through the window glass.

A possible explanation for some sort of nighttime radiation that is not present in the daytime might be derived from Van Allen's suggestion that the solar winds, consisting of charged particles emitted continuously from the sun at velocities varying from 670,000 to 1,600,000 miles per hour, compress into a rounded thin layer on the daylight side of the earth and sweep into a long tail on the night side. Van Allen further suggests that the earth's magnetic field causes a positive electrical charge on the morning side of the boundary and a negative charge on the opposite or evening side.

This ties into the question of what actually goes on while a person sleeps. Does sleep merely represent a period of rest and relaxation? Or is it possibly a process of charging the electrical dimension in the body with nighttime radiation that supplies body energy during the daytime?

As discussed more fully in *Health and Light*, the chloroplasts in the cells of Elodea grass will continue their streaming process for about a day. They then run down like a dead battery and refuse to continue streaming until they have had their normal full dark nighttime period, regardless of how much the light intensity may be increased. When I took several plants down to the bottom of a coal mine, six hundred and fifty feet below the surface of the earth, in order to shield them from the general background nighttime radiation, none of their sensitive responses to being touched would function normally the next morning.

Drug-induced sleep is known to be less beneficial than natural sleep. My feeling about tranquilizers is that they sim-

ply dull your reactions to stresses that would normally be very disturbing. It is distressing to see elderly people in retirement homes spending so much of their time watching TV under fluorescent lights. It is even more distressing to hear reports from nurses working in these areas of increasing early senility and growing use of tranquilizers. Of course, essentially the same problem exists for office workers, also under fluorescent lights, looking into video display terminals all day. Tinted glass windows, such as are used in new office buildings and air traffic control towers, further compound the basic stress factor. During 1979, the sales of only one brand of a popular tranquilizer soared to over four billion tablets, indicating to me that there must be a rising stress factor to contend with. Perhaps the expression "the last spark of life" should be taken more literally, for it appears to be this electrical dimension that makes the difference between a living cell and a dead one.

6 THE THEORY OF MULTIFREQUENCY INTERACTION

THE ABSORPTION- and reflection-frequency characteristics, including the frequency harmonics of all matter interacting between two or more substances, will influence the overall electric potential of the combined mass. This includes living matter. Frequencies affect the electric dimensions of living cells in a way that directly influences human muscle strength, and may cause pathological disorders. Some frequencies may complement each other and result in a synergistic response, whereas others may counteract each other and result in no discernible response.

This is really not as complicated as it may sound. It merely states that every basic substance or element has its own frequency or electrical wavelength vibration that it gives off or radiates.

We are affected by such ingredients as sugar, starch, protein, various minerals, artificial coloring materials, chemical preservatives, and all the other substances that go into the food we consume. And we are also affected by the materials used in making clothing and by the objects we come in contact with. Somehow, the combined frequencies of the overall mass of indi-

vidual items has an effect on the electric dimension of living cells.

Food does not have to be eaten to affect muscle strength. The same food can produce a muscle-weakening effect even when it is not eaten. For example, if a small amount, half a teaspoon or less, of refined white sugar is placed under the tongue or dissolved in water and swallowed, muscle strength will be diminished for approximately four hours. If a small paper packet of refined white sugar, such as is commonly available in restaurants, is placed on the wrist or held against the forehead or navel, it will immediately cause gross loss of muscle strength. As soon as the packet of sugar is removed, the muscle strength returns to normal. If the person administering the muscle test holds the packet of refined white sugar in the left hand and presses down on the wrist of a second person being tested with the right hand, there will be not only a weakening of the muscles of the person holding the sugar, but also of the muscles of the second person being tested.

The person holding the sugar can also hold one hand of a third person, who, in turn, holds the hands of several more people, so that the last person in the chain uses the remaining hand to press down the wrist of the person being tested. The result is that all those involved will lose muscle strength. If any one or more of the people in the chain happens to be wearing a digital wrist watch or polyester clothes, the entire group will be affected. This is what is referred to as the "combined mass" in the theory of multifrequency interaction. Such a transfer of energy is like an electric transfusion, similar to giving a blood transfusion, and I believe gives some scientific credibility to the religious practice of the laying on of hands. It is similar to the effect of pointing the lightning rod, pyramid, lead pencil, or acupuncture needles toward the body.

As mentioned above, the sugar must be the white refined kind. Sugar "in the raw," partially refined and light brown in

color, or regular brown sugar, does not cause muscle weakness. The partially refined sugar has not had the molasses removed, and brown sugar is simply white refined sugar with some molasses put back in. It appears to be the molasses that makes the difference. A similar additive to the formula of polyester, vinyl or other synthetic plastics might conceivably eliminate the muscle weakening they cause.

White refined sugar is very commonly used as a placebo. White bleached flour is also sometimes used as a placebo. White flour produces the same muscle weakness as white sugar, whereas whole wheat flour does not.

Oddly enough, white refined sugar does not weaken the muscles under ordinary fluorescent lights. Neither does one of the popular drinks containing sugar that is supposed to give instant energy to athletes. But that is under fluorescent lights. Out on the football field is an entirely different matter—weak muscles!

Another popular thirst quencher especially formulated for athletes, but containing more minerals and no sugar, tests strong under both fluorescent lights (as might be the case in the locker room) and outdoors on the field under daylight.

To complicate matters further, the weak or strong condition of all the muscles is also drastically affected by whether the athletic field—football, baseball, or whatever—is natural grass or artificial turf made of plastic. Even the kind of turf the players stand on and the type of material their shoes are made of become part of the “entire mass” that involves the theory of multifrequency interaction. The increasing number of injuries may well be related to the weak-muscle problem, as most injuries seem to consist of torn ligaments and strained muscles. Sore feet, aching back, and the feeling of exhaustion at the end of the day have all been reported to me by housewives working on kitchen floors made of vinyl tile or even just wearing shoes with vinyl soles.

Other problems possibly related to weak muscles include such things as having to go to the bathroom more frequently at night, as a result of sleeping between polyester sheets. What weakens the arm, leg, and heart muscles undoubtedly also weakens the muscles controlling the bladder. Who would think that picking up a lead pencil or walking past a smoke detector, stepping on a vinyl floor in the kitchen, or eating some microwave-cooked foods could make you suddenly have to go?

The dose rate for some glandular extracts, vitamins, enzymes, and other medications is now being determined through kinesiological methods. There appears to be a direct muscle-strength reaction to the amount of the medication held in the palm of the hand, depending on the wavelengths of light and/or electromagnetic radiation to which the patient is being exposed while the test is being conducted.

Under certain types of artificial light sources that lack the wavelengths that the medication being tested reacts to, the test may indicate a need for a high dose rate to obtain maximum muscle strength. But under a full-spectrum light source or natural outdoor daylight containing all the wavelengths, the muscle test method may show full muscle strength without the need of any of the specific medication. The muscle test method may prove to be an excellent way of testing drugs for undesirable side effects in specific individuals.

The list of items that cause muscle weakness goes on and on. Commercially made cigarettes weaken muscles, whether smoked or just held in the hand. However, cigars, pipe tobacco, chewing tobacco, snuff, and tobacco for rolling your own cigarettes do not weaken muscle strength. I have been told by a friend whose family was formerly in the cigarette business that the tobacco used for the manufacture of cigarettes is treated with an insecticide to control a tobacco weevil that otherwise eats holes in the cigarette paper and makes the

product unsalable. Also, at one time cigarette tobacco was treated with a chemical to make it burn more evenly. Perhaps it still is.

I wrote to five of the popular-brand cigarette manufacturers about this. Three replied, denying emphatically that their companies treated the tobacco with any chemical pesticides. One reply did go on to explain that the tobacco weevil was kept under control through fumigation by the warehouse men during the storing and aging of the leaf. The letter emphasized that great care was exercised to use only chemicals and concentrations approved by the United States Department of Agriculture. All three letters denied that any chemicals were used to make the cigarette tobacco burn more evenly.

I called the Surgeon General's office and spoke with several people in different departments. The consensus was that the health hazard warning was required only on machine-manufactured cigarettes, because available research data indicated a higher lung cancer rate only with this particular tobacco product. It is suggested that cigarette smokers inhale more smoke than pipe and cigar smokers. No one in the Surgeon General's office—or those answering my letters—gave me any information about any treatment of tobacco used in manufacturing cigarettes that differed from the manufacture of other tobacco products. The unexplained fact remains that only machine-manufactured cigarettes weaken the muscles when standard kinesiological tests are used.

I can still remember clearly my father telling me over fifty years ago that cigarettes were thought to cause lung cancer but cigars did not. He said the two main reasons given for this belief were that some people thought cigarette smokers were apt to inhale more smoke, and others thought the higher cancer risk might be caused by the chemicals in the cigarette paper. However, holding a package of roll-your-own cigarette papers in the hand does not cause any muscle weakness. It is

of particular interest that the more recent health hazard warning of the Surgeon General is required only on packages of manufactured cigarettes.

Perhaps even more alarming is the recent health hazard warning of the Government's Center for Disease Control that the use of Rely brand tampons is related to a high increase in the rate of illness in young women known as the toxic shock syndrome, an illness that can lead to sudden sickness and death. Once again, the simple muscle test shows that just holding a package of this particular brand of tampon in the hand causes gross muscle weakness, whereas another brand tested did not.

Preliminary results of one study at the Federal Center for Disease Control in Atlanta suggest that some synthetic fibers inhibit the ability of white blood cells to kill the bacteria that are thought to be responsible for toxic shock syndrome. The manufacturers of Rely originally advertised that everything about their product was different, the shape (pointed), the material (new synthetic fiber), and so on.

Accumulating evidence further suggests that what weakens muscle strength and possibly inhibits the normal action of white blood cells may also have a depressing effect on the normal functioning and regularity of the entire digestive system. If so, then logically it could also affect the muscle tone and tissue structure relating to such problems as hernias and hemorrhoids.

Magnetic fields also affect muscle strength. If a normally right-handed person holds both arms straight forward and cups the palm of the left hand over the top of the right hand, the muscle strength of both arms will be high. By simply rearranging the hands so that the palm of the right hand cups over the top of the left hand, the muscle strength of both arms will be low. With a left-handed person, the matter of left-right is reversed.

If either a right- or left-handed person places either hand on either wrist of another person who may be either right- or left-handed and there is no other weakening factor such as fluorescent lights, digital watch, smoke detector, synthetic clothes or floor, the muscle will test strong. However, if the person doing the testing uses two hands, so that there are three layers (two hands and one wrist), the situation becomes quite complicated.

Opposite N-S poles of a magnet attract and the same poles repel each other. Thus, if both persons involved are right-handed, the hands must be placed R-L-R or L-R-L for the muscle to be strong. If they are placed R-R-L or L-L-R, the muscle will be weak. But the magnetic polarity fields are reversed between right- and left-handed persons. If a right-handed person is testing a left-handed person, or vice versa, the arrangement must be R-R-L or L-L-R for the muscle to be strong and R-L-R or L-R-L for weak.

Further confirmation that top and bottom sides of the hand possess opposite magnetic polarity can be demonstrated by turning any one of the hands in the stack of three over and the strong-weak condition of the muscle will be reversed.

A similar muscle-weakening effect will result if a person holds a straight bar magnet in the right hand with the South Pole against the palm of the hand and the North Pole pointing in the same direction as the fingers. By simply reversing the magnet so that the North Pole is pointed into the palm and the South Pole is pointed in the same direction as the fingers, the muscle strength will be high. When you switch the magnet to the left hand, the same polarity positions produce the opposite effects on the muscle strength. With a left-handed person similar weak-strong muscle conditions will occur, except that the North-South polarity position of the magnet is the opposite of that of a right-handed person.

Placing the bar magnet on the top of the hand and fingers

instead of underneath again reverses the weak-strong muscle reactions. This would seem further to confirm that the two sides, that is, top and bottom, of the hand have opposite polarity fields in accordance with the Yin Yang theory.

In doing this test it is important to identify the poles of the magnet. On some bar magnets the North Pole is marked with an N and the South Pole with an S. Others magnets use compass markings. The N is on the end that points north when placed on a pivot. This means it is actually the South Pole of the magnet, because it is the opposite poles that attract each other.

Either pole of a magnet placed against the ear will weaken muscle strength. This includes the little magnets in telephone receivers and hearing aids. This is another reason for using "Hear Wax" instead of hearing aids that have magnets in them.

The intensity of frequencies from man-made electrical devices like fluorescent lights, digital watches, ionizing smoke detectors, microwave ovens, video display terminals, and synthetic materials is greater than normally found in nature or natural substances, and has a greater effect on the electric dimension of the living cell.

Speaking of microwave ovens, I have long thought that they ruined the taste of many foods—especially meat—and have wondered if they actually might be detrimental to the quality of the food. However, since reading an article entitled "Effect of Packaging Material on Light Induced Quality Deterioration of Milk" by Drs. A. Sattar and J. M. deMan in the *Canadian Institute of Food and Technology Journal* (Vol. 6 No. 3, 1973), I have been giving the subject a lot more thought. Drs. Sattar and deMan state it is generally recognized that light-induced reactions have a damaging effect on the quality of a variety of foods, especially those containing fat. The problem is becoming increasingly serious because of the high intensities of

fluorescent light used for the illumination of display cases in supermarkets. Flavor changes that become evident after the exposure of milk to light have been repeatedly described. Reported results are confused by differences in the terminology used to characterize the flavors caused by photo-oxidation of proteins or amino acids and lipids.

Since milk is an important part of our food supply, any loss of nutritional value constitutes a serious problem. Changes in the packaging materials used for milk, especially the introduction of the clear plastic pouch pack, have greatly aggravated this problem.

A more recent study by Drs. Sattar and deMan on the influence of fluorescent light on vitamin A and Beta-carotene in milk fat was conducted at the University of Guelph in Canada. It was found that a loss of Beta-carotene in milk fat was caused by wavelengths less than 465 nm, and vitamin A was destroyed by wavelengths between 415 and 465 nm. It was concluded that these losses could be reduced by blocking the wavelengths of light below 465 nm through proper containers.

The 1973 study by these two investigators was undertaken to evaluate the effect of light under average display conditions on the quality of milk packaged in four different types of containers. Milk was exposed to fluorescent light at intensities of 100- or 200-foot candles at a temperature of 5°C for periods of three, six, twelve, or twenty-four hours. The samples, as well as unexposed controls, were analyzed for ascorbic acid and riboflavin content, and examined for flavor changes by a duo-trio taste panel difference test. Four packaging materials were used: clear pouch, opaque pouch, carton, and plastic jug. Light transmittance of the packaging materials in the spectral range of 380-750 nm was determined. Off-flavor was detected in all containers, and significant losses of ascorbic acid and riboflavin occurred in all containers except the opaque pouch.

Light intensities of 100 or 200 ft-c are now quite common in supermarkets. A survey of the supermarkets in the city of Guelph indicated that light intensity levels in the milk display cases, at the location of the packages closest to the light source, ranged from 25 to 500 ft-c. Levels of 100 to 200 ft-c were common, but many stores had levels from 400 to 500 ft-c. At such high light intensities, deterioration will be even more rapid than was the case in this study.

It is apparent from the information obtained in this study that several of the commonly used packaging materials for milk are inadequate in protecting this food from loss in flavor quality as well as nutritional value. Relatively simple and inexpensive changes in packaging materials may bring about a greatly reduced light transmittance which will ensure flavor quality and retention of light-sensitive vitamins.

Ascorbic Acid Content (mg/ml) of Milk Before and After Exposure to Fluorescent Light for 24 Hours in Different Packaging Materials

PACKAGE	BEFORE EXPOSURE	EXPOSURE 100 FT-C	EXPOSURE AT 200 FT-C
Clear Pouch	12.34	1.12	0.92
Opaque Pouch	12.34	10.74	10.22
Carton	12.57	9.60	8.68
Plastic Jug	12.34	1.70	1.28

Riboflavin Content (ug/ml) of Milk Before and After Exposure to Fluorescent Light for 24 Hours in Different Packaging Materials

PACKAGE	BEFORE EXPOSURE	EXPOSURE AT 100 FT-C	EXPOSURE AT 200 FT-C
Clear Pouch	1.75	1.36	1.26
Opaque Pouch	1.75	1.74	1.73
Carton	1.82	1.71	1.65
Plastic Jug	1.80	1.60	1.56

Several additional articles of interest on this subject are:

Stull, J. W. "The Effect of Light on Activated Flavour Development and the Constituents of Milk and Its Products." *J. Dairy Sci.*, 26:11, 1953.

Wildbrett, G. "The Effect of Light on Milk and Its Protection Against Light." *Milchwissenschaft*, 15:21, 1960.

Sattar, A., deMan, J. M. "Wavelength Effect on Light-Induced Decomposition of Vitamin A and B-carotene in Solutions and Milk Fat." *J. Inst. Can. Sci. Technol. Ailment* 10(1): 56-60, 1977.

Another interesting study conducted at the Chelsea, Massachusetts, Soldiers Home has shown that the body absorbs calcium more efficiently when individuals are exposed to an artificial sunlight environment than when they are exposed to cool-white fluorescent tubes.

I have been wondering for a long time about what microwave radiation might do to the nutritional value of various foods. I had done the muscle test on a number of people standing in front of many different makes and models of microwave ovens, and have not found one oven yet that does not grossly weaken the muscles within a distance of six feet or more (and ranging up to as far as approximately sixty feet). The amount of radiation also varies, depending on what is being cooked in the oven at the time of the muscle test. So many people have asked me what microwave cooking does to the food itself that I went to a nearby fast-food restaurant and bought two hamburgers-deluxe—lettuce, tomato, onions, ketchup, mustard, and a quarter pound of beef steak, all on a bun. I asked that one be cooked in their microwave oven and that the other be given to me uncooked and still frozen solid. Each was in a similar paper bag.

I asked three very strong, muscular, athletic young men to hold each bag, one at a time, in their hands while I did the muscle-test on them. To my amazement, each of the three young men muscle-tested strong while holding the uncooked, still frozen hamburger, and extremely weak with the microwave-cooked hamburger. I then cooked the frozen hamburger in an iron frying pan on a standard electric stove burner and repeated the muscle test on the same three men. Again all three tested strong holding the conventionally cooked deluxe hamburger with all the same trimmings and extremely weak holding the microwave-cooked deluxe hamburger! These results certainly need further follow-up and study.

Another test I did involving cooking had to do with margarine. Although I had no specific scientific reference, I had heard many doctors say that the ordinary temperatures used in cooking food in the conventional way—that is, not using a microwave oven—would affect the chemistry of polyunsaturated fats. After all, polyunsaturated margarine is a processed and refined natural fat that might be likened to refined white sugar or flour.

Again, using the simple muscle test, I found that either just holding an unopened package of a popular brand of margarine in the hand or swallowing a small amount of it would cause gross muscle weakening, whereas equal amounts of fresh dairy butter produced no such effects.

Next, I heated a one-quarter pound stick of the margarine in a stainless steel saucepan on a conventional electric stove and let it boil for approximately three minutes. After it had cooled down considerably, but was still in a liquid state, I poured it into a form made from the cardboard box that the margarine came in and placed it in the refrigerator to solidify. In approximately one hour I repeated the muscle test with the “cooked” margarine and the results showed no loss of muscle strength.

Shortly thereafter I read a most interesting article entitled "Is Margarine Worse Than Butter? Polyunsaturated Fats May Be Doing Us More Harm Than Cholesterol" by Albert Rosenfeld. The article, which appeared in the "Lifelines" section of the September 1981 issue of *Science* tells of the research work being done by biochemist Harry Demopoulos and his colleagues at the New York University Medical Center and by biochemist Ronald Estabrook of the University of Texas Health Sciences Center in Dallas. The article mentions that the problem with polyunsaturates seems to be that they increase abnormally the number of so-called free radicals, which are by-products of each cell's normal oxidation reaction. These extra pieces, broken off from their parent molecules, are left with highly unstable electronic configurations. To me, "oxidation reaction" and "electronic configurations" sound a little like my reference to "biological combustion."

The article then goes on to discuss how this process might go so far as to affect the cells' DNA. It stresses how ironic it would be if man, in trying to reduce the cholesterol level in the blood to prevent atherosclerosis and heart attacks, was instead shortening his life by prematurely aging his cells and perhaps even creating additional cancer risks.

In hopeful anticipation that further carefully controlled scientific studies will be undertaken in due time, I will report here the results of some additional personal observations. For the past several months I have been under medical care and taking medication for a condition of irregular heartbeat (arrhythmia), which occasionally occurs during and following periods of strenuous exercise. At times it was quite severe, at other times I seem to have no problem at all.

What I finally observed was that the arrhythmia was definitely associated with wearing a certain pair of old work pants. I thought I had set aside all my clothing made of poly-

ester, but these pants were old and not marked as to what they were made of. However, having someone do the muscle test on me while wearing them resulted in gross loss of muscle strength. I immediately discarded them and have since received the following letter from my physician.

Dear John:

Your physical examination was done this year on the 2nd of February, 1981. I thought you looked extremely well, and your physical examination turned out to be entirely normal. In particular, there is no arrhythmia with the heart now, and that's awfully good news.

Laboratory work included a 25-item blood chemistry test, cardiogram, complete blood count, urinalysis, and all of this is normal too.

John, this is an excellent report on your health.

To clear up one point of possible confusion, there is a direct relationship between frequencies and wavelengths. As the individual wavelengths are absorbed, each wave or bump creates an impulse. As these wave bumps are closer together in the shorter wavelengths than in the longer wavelengths, the time between the impulses is less. This time period is called the frequency. The shorter the wavelengths, the higher the frequency; the longer the wavelengths, the lower the frequency.

I learned about the interaction of these frequencies on human muscle strength the hard—and rather embarrassing—way. I was one of the speakers at a large meeting of architects, engineers, and scientists in California. I had known about the pyramid power muscle test experiment for only about ten days, but I had tried it on at least ten people and it worked perfectly each time. I thought it seemed a good way to demonstrate the electric dimension of living cells. I finally got up my courage to try it in front of this very distinguished group of scientific people, even though using a pyramid might not appear to be very scientific.

I called for a volunteer from the audience. It didn't work. I asked for another volunteer. It still just would not work at all. A big roar of laughter went up from the audience. Finally, the moderator quieted everyone down, and the attitude quickly changed from ridicule to sympathy. Obviously I must be getting a little senile. The moderator suggested just sticking with the pumpkin story and letting it go at that.

After the meeting was over, one of the volunteers went with me outdoors, and the test worked perfectly. We went back to the meeting room, and again the pyramid had absolutely no effect on his muscle strength.

It so happened that another speaker had talked about negative ions and negative ion generators. He had hung a number of them from the open rafters of the high ceiling in the meeting room.

The meeting was a two-day affair. The same volunteer went with me early the next morning to the meeting room. All the negative ion generators were still hanging in the same places, but had not yet been turned on. The pyramid test worked perfectly. When the generators were turned on again, the pyramid test no longer worked. Well, live and learn.

A similar situation developed after I did a demonstration on a Canadian network TV show. Among other things, I demonstrated that wearing, even just holding a digital wrist watch weakened the arm muscles. A group of high-school science students in Alberta decided to try to repeat what I did and reported just the opposite results. The students holding the digital wrist watch had more muscle strength. Some of the other tests proved inconclusive. They decided to try a placebo, something that could not possibly affect the muscle strength, so someone grabbed an ordinary lead pencil from one of the desks. They found that this weakened the muscles more than anything. They wrote a very complete report and sent it to the TV station in Toronto, where the program had

originated. The TV program manager forwarded a copy to me, asking for my comments.

I wrote back thanking the science students for the information about the lead pencil, as this was my first bit of knowledge about an ordinary lead pencil (but not plastic ball point pens) acting as a point emitter like the pyramid and lightning rod. I also explained that there must have been something else like an ionizing smoke detector within fifty feet, perhaps in the next room or hallway, that was causing all the test students to have weak muscles in what was thought to be their normal condition. If so, then those holding the digital wrist watch would be stronger, as a digital watch will counteract the weakening effect of the smoke detector and they would regain their normal muscle strength. Regrettably, I never received a reply from either the TV program manager or anyone at the school. I guess the science teacher had had enough.

I have also received letters from others, including several doctors who purchased new, expensive, muscle-strength testing equipment. Unfortunately, much of this new testing equipment uses digital read-out devices or has an imitation leather vinyl pad on the pressure-sensing unit placed on the wrist to do the test, and either of these items completely zaps the muscles by itself. Then again, others trying to do the test may not have heard the full story or may have forgotten to check for all the possible things that can upset the test—for example, fluorescent lights, smoke detectors, synthetic material used in clothing (especially the soles of shoes), upholstery and floor coverings, and what the person being tested may have eaten during the previous three or four hours.

On the more encouraging side, all the letters I receive are not critical. Following my address to a dental society meeting in Ohio, I received this letter:

Dear Mr. Ott:

Thank you so much for your letter and the enclosures. I am having all of my staff and associates (two of whom were unable to attend your program) cover the material; it is most interesting.

As far as the watch, I removed it from my left wrist and my shoulder improved immediately within 48 hours. Recently, about ten days ago, I wore the watch one day at the office and my shoulder was back with all kinds of discomfort.

To review your memory, my next-door neighbor, an excellent orthopedist who replaces hips and other prosthesis joints, had last June and again in September injected cortisone hoping that that would alleviate my type of tendonitis.

I placed the watch back on for eight hours in the office and by evening I could hardly move the shoulder. This is sufficient clinical experience for me that I now have a most expensive digital watch for sale.

Sincerely

H. E. Lauer, D.D.S.
Lima, Ohio

I have received the same story from many others.

Dr. Schultheiss has advised me that two of his patients, both young children with emotional problems, would have nothing to do with their fathers and would always run to their mothers whenever their father tried to show any normal parental affection. Dr. Schultheiss found that both fathers regularly wore digital wrist watches. When the fathers' watches were given to each mother, both children immediately accepted their fathers and would not go near their mothers.

A young couple advised me that they had a similar problem with a puppy. They had purchased the dog about a year previous. From the day they brought it home it would growl and run away from the husband whenever he tried to pat or pick it up, but it was always friendly to the wife. After hearing the story about the two children, the husband gave his digital watch to his wife. The dog immediately jumped into his lap

and shunned his wife. Needless to say, all three families have gotten rid of their digital watches.

There is also this letter from the doctor at the National Institutes of Health I mentioned earlier.

6 December 1978

Dear John:

Here is a summary of our two-day investigation at the Clinical Center, Clinical Pathology Department of N.I.H.

In a semi-quantitative assay system, various domains of the electromagnetic spectrum affect muscle tone and strength of the shoulder girdle. Because of time limitations, the only muscle groups of the musculoskeletal system tested were those of the shoulder.

Specifically:

- modest amounts of near-UV light, as part of a visually balanced, solar-like spectrum increase shoulder muscle tone and improve short-term strength compared to warm white fluorescent lights, of comparable illumination.
- radio frequencies (RF) in the 0.1 to 100 megahertz range also appear to weaken shoulder girdle strengths
- specific exclusion of near-UV (as is common with usual fluorescent and incandescent lights) reduced muscle tone and strength. The time constant (time to observe the effect) appears to be 3-6 seconds
- proper shielding of RF restores muscle tone and strength
- red-dominant illumination weakens more than blue-dominant illumination

Much work remains to be done to specify which muscle groups are most affected; what the precise time constant is; what the pathways involved contain, etc. Also, a more quantitative system of assay is highly desirable. With your encouragement, we are beginning these approaches.

While the mechanism for this effect is unknown, it may be analogous to a well-known phenomenon. There is an optical photo detector which responds to blue/violet light (including the near-UV) in the 290-430 nm range which causes constriction of the ciliary muscle. (The ciliary muscle controls the iris and, thus, controls the intensity of light entering the eye.) The practical meaning of this is twofold: first, there is a known mechanism whereby light directly affects a muscle; second, contact lens wearers are frequently 'light sensitive' because their lenses *block* the near-UV light, thus reducing the response of the ciliary muscle to a given light intensity.

In other words, we adapted to the full range of the solar spectrum and artificial distortions of the solar spectrum may have biologic effects.

In addition to the experiments reviewed above, we did perform several other studies which are also worth summarizing.

- Ray-Ban #15 Neutral gray sunglasses exclude near-UV and truncate the blue spectrum. These glasses are associated with a decrease in muscle tone and shoulder strength when a person exposed to solar-like illumination wears these glasses.
- UV-transmitting plastic sunglasses, of even greater illumination damping, did *not* show decreases in muscle tone or shoulder strength.
- Optical-quality glasses could, generally, be graded in the effect they would have on muscle tone and strength by their blue to red proportions: the more red/pink, the more reduction in muscle tone and strength.
- Background illumination did not materially affect results, suggesting that environmental scatter effects do not play a major role.

After our visit, I spoke in some detail with investigators of the National Eye Institute. They are willing to provide patients with selective deficits in cone vision; rod vision; and pigmented epithelial cell so that we can examine the mediators of this effect. Each patient will be carefully investigated by the Eye Institute for visual acuity; perception thresholds; and color vision. A few rare patients who show no electroretinal activity (i.e. no electrical response to light) will also be studied. Several of these people do show some 'vision' . . . this is quite a paradox to those who hold that cones and rods are all there is to vision.

We will also pursue the quantitative muscle testing studies. As you know, my personnel are fully committed to the ongoing projects of the lab and we are under a hiring freeze. The pace will be as rapid as we are able under these constraints. In addition, we shall investigate any demonstrable effects on other organ systems of the body.

Thank you for spending your valuable time with us. There have been many comments on the quality of your seminar and the importance of your observations. My best to your wife. Hope to see you in the near future. I will forward a progress report as each experimental set nears completion.

Cordially,

Russell M. Jaffe, M.D., Ph.D
 Commander, U.S.P.H.S.
 Senior Staff Physician, CC, CPD, CCS

Regrettably, as this book goes to press none of the further studies mentioned in Dr. Jaffe's letter have to my knowledge, been started, and Dr. Jaffe is no longer with the N.I.H.

However, more and more unbelievable causes of muscle weakness continue to show up as a result of testing items and materials never previously suspected. For example, some of the strings of violins, guitars and other musical instruments that were formerly made of "cat gut" are now made of synthetic plastic. Even though some are wrapped with a metal wire cover binding, if they contain any of certain plastic materials commonly used, the players of the instruments will lose muscle strength when they place their fingertips on the strings in the usual way.

The ends of the pointed prongs on a ring that hold a jewel will act as point emitters—just like the pyramid, lightning rod, or lead pencil—and cause muscle weakness and fatigue. However, if the design of the prongs is slightly changed to nullify the point emitter action, the points will have no effect on muscle strength.

It is more understandable how eliminating the point emitters would nullify the muscle weakness effect. It is the same as taking away the lightning rod, pyramid, or lead pencil. But how the digital watch and ionizing smoke detector or fluorescent lights and sugar counteract each other is not easy to explain. However, it is interesting to note that the digital watch emits a very low frequency and the ionizing smoke detector a very high frequency. Somehow they seem to offset each other's effect as far as weakening the muscles. But whether or not all other biological effects are nullified is not clear.

To my knowledge no studies have ever been made on frequency emissions from sugar, vinyl, polyester, and the like, or on interactions between color, sound, and temperature. In this area there remains much yet to be studied and learned in both science and medicine.

7 THERMAL EFFECTS AND ELECTRET CELLS

THE PHRASE "thermal effects" is simply a more scientific name for changes in temperature. And electret cells are cells that have special electrical characteristics in them. Although it appears that all cells have a specific frequency and an electric dimension, electret cells also have stronger magnetic fields.

All the materials that are used in making an electric battery have their own frequency and electric dimension, but when these materials are put together in a certain way it makes a whole of a difference in the amount of electricity that is produced. This is a good example of a synergistic effect. No amount of any one substance or material used in a battery would, by itself, light a flashlight bulb, but just a little bit of the right stuff put together in the right way will do it.

Going back to *Tuning in to Nature*, Callahan shows diagrams of various types of the most modern and sophisticated antennae designed by antenna engineers for all sorts of today's electronic equipment. Alongside each diagram is a drawing of the same basic design of some insect's antenna, engineered by nature and in use for quite a long time. Callahan points out that some insect

antennae are so small that you need a microscope to see them. Nevertheless, they still work.

Layering materials with different electrical conductive qualities is of vital importance in the design of such modern electrical components as capacitors, condensers, and transistors. The use of different semiconductor materials is rapidly increasing with the introduction of solid-state circuits that are replacing the old vacuum tubes.

Callahan further states that other researchers have made stable chemical electret cells from sulphur, pyrex glass, both plant wax and beeswax, sugar, and certain plastic materials. All of these substances have low dielectric constants, and thus can be considered as having the solid-state electrical properties suitable for forming waveguide antennae. All of these materials will also weaken the muscle strength if just a small quantity is held in the palm of the hand or placed against the wrist, forehead, navel or, undoubtedly, other areas of the body.

I plan to conduct further studies of all this myself, but it seems to tie many of the things together that relate to the overall electric dimension of living cells. I believe it indicates clearly the need for better communication between overlapping scientific and medical disciplines involved with the metabolic process.

Now, one more piece of information from Callahan. He points out that a number of researchers have discovered that the electrical charges of electret cells are affected by changes in temperature, humidity, pressure, and especially irradiation by various electromagnetic wavelengths (frequencies). Changes in pressure include sound waves through the air, and man-made electrets are now used in millions of microphones and also many other solid-state electric components being manufactured today.

Thus, the equivalent of the most basic component used in modern telephone and radio microphones for converting sound waves into electric waves is old stuff in Nature, and has been

performing this electrobiological function for many million years. It seems to me that this further suggests that evolution is just as much the work of God as is Creation, and may even be a continuing process not yet completed.

So much for electret cells. Now, let's look at thermal effects, and I will quote from my own book, *My Ivory Cellar*.

One film I made on tuberculosis for Eastman Kodak Company caused much difficulty and convinced me that some subjects looked more simple than they really were. The project was designed to demonstrate the use of X-ray films in diagnosing the disease, and it seemed to me that it would be interesting to illustrate a spot of TB on the lung by comparing it to a black spot on a rose leaf.

Dr. Earl Barth, Head of the Department of Radiology (X-ray) at Northwestern University Medical School, collaborated with the production and actually took part in it. Dr. Barth explained in a popular way that plants breathe through their leaves and animals breathe through their lungs. Consequently for purposes of illustration there was some interest in comparing a black spot on a rose leaf and a spot of TB on a lung. They are both serious if not quickly eradicated. One obvious difference, however, is that a black spot on a rose leaf is easily visible, but in order to detect a spot of TB on a lung, an X-ray picture or radiograph is required.

To illustrate this difference graphically, it was decided to show microscopic time-lapse pictures of the growth of the spores of the black spot organism. Dr. O. J. Eigsti, who had helped with microscopic pictures of pollen, obtained a pure strain of spores of *Diplocarpon rosae*, and we set out to take pictures of their growth.

This is the type of picture on which it is almost impossible to estimate a budget in advance because unexpected problems may arise. Both Dr. Eigsti and I could think of no reason why we couldn't complete this picture in one day. Maybe cameras might have to run during the night to obtain good growth of the fungus, but beyond this there should be nothing to it.

A batch of microscope slides were made up on the morning the project was started. We used our previously proven method of an agar base sealed under a cover-slip to prevent drying out. Two time-lapse microscopic cameras were started, and we figured the growth activity should be evident by lunch time or shortly after.

By late afternoon no fungus growth was yet evident, nor late that night, nor even the next morning. The same procedure was repeated the follow-

ing day. Again no luck, so at this point the budget had to be set aside again, and further experiments charged up to experience. Here was another challenge to see why the spores wouldn't grow, as it was so hard to keep them from growing on the roses outdoors in the garden.

We tried using rose leaves in place of the agar, combinations of rose leaves, agar and growth stimulants previously used in connection with the pollen tube pictures, but nothing happened. We decided the trouble must be that the cultures were dead, but we had no better luck with additional new cultures. We tried all sorts of ways of making our own fresh culture taken directly from rose leaves with black spot. Days turned into weeks, months, and not the slightest encouragement. I brought rose plants into my time-lapse studio and tried all sorts of ways of transmitting black spot to the leaves. I scratched them with a needle and rubbed these leaves with infected leaves. I rubbed spores on the top of leaves and underneath, on the stems and roots. Different varieties of roses were tried, but still nothing happened. I pricked them and broke them and tore them in half, but the rose plants in the time-lapse studio remained perfectly healthy. This was hard to understand, as the prevention of black spot was always a major problem with both amateur and commercial growers of roses, whether grown indoors or out.

The situation was no longer funny. No usable pictures yet, and the final deadline for the completion of the film already extended, time running out again, and oh, the budget! Still I wanted to follow this through further, even if just for my own satisfaction and experience. Dr. Eigsti had other commitments coming up that would make it impossible for him to continue longer. He felt everything possible had been tried but to no avail, so it was decided this project would have to be given up, at least for the present. Nevertheless, I asked him to make one last batch of twelve more slides to leave with me, and I would keep on trying as long as they lasted. This he did, and then departed. We were both pretty sad about our complete failure.

After he left I put one slide in each of the two microscopes and started the cameras going. It seemed almost useless, as there was nothing any different from what we had been doing for months, but maybe the spores might start to grow this time. As soon as everything was in order and running smoothly, I looked down at the remaining ten slides that Dr. Eigsti had left, and wondered if I might have picked the right two slides to begin with. If any of them were going to germinate, they would probably start at the same time like a row of seeds in the garden. Would it be just my luck to have several of the ten slides germinate at once, and neither of the two in the microscope being photographed? Maybe germination of the ten could

be delayed by putting them in the kitchen refrigerator until those in the microscopes could be tested for a sufficient period of time.

The next morning the two slides in the microscopes showed absolutely no sign of any fungus growth having taken place. I felt a little foolish to have ever held out the slightest hope that things might have been any different this time.

Now, what about those ten slides in the refrigerator? I hated to think of all the good film already wasted. This was really going too far, but strange things had happened before, and the microscopes and cameras had been scheduled for these ten more slides. Out went the first two slides, and two more from the kitchen refrigerator went into their places. Before there was even time to start the cameras, the spores looked different. Something was happening. I quickly started both cameras and watched intently. Within an hour something different was happening. The threadlike fungus growth was definitely showing. Each day for four more days, two additional slides were brought down from the refrigerator, and all of them germinated and grew perfectly. When the film was projected, the protoplasmic contents or cytoplasm of the spores showed a characteristic activity before any threadlike fungus growth started. This activity was quite similar to what showed within the grains of pollen before a pollen tube would grow.

It was a great relief to finally have the time-lapse pictures of the spore growth in the nick of time for use in the film on X-rays. It was even more of a personal satisfaction to have gotten them at all after so many months. There seemed to be some justification for having gone completely overboard as far as the budget was concerned. I shuddered though with the thought of what would have to be charged up to experience.

Now the question: What was it about the kitchen refrigerator that made these spores grow when they had been put there to hold them back? It so happened that I was also making a film at the same time on spring flowers. I had just finished studying the necessary cooling period spring bulbs must have before they will start growing. The same chilling process seemed to apply to the spores that cause black spots on rose leaves. At least this seemed to be a plausible answer to what had happened with respect to the spore cultures suddenly growing on the slides that had been chilled.

But what about the fact that the black spot disease could not be induced to grow on any of the rose plants in my time-lapse studio? In checking back on this, the night temperature control of the day-and-night double-acting thermostat was found not to be working properly.

The same even temperature was accidentally being maintained both day and night in the studio. When this was corrected, and the night temperature lowered considerably, it was no trick at all to develop black spot on the leaves of the rose plants in the time-lapse studio.

In another film I made on the use of anhydrous ammonia fertilizer, time-lapse pictures showed that the process of first chilling and then warming soil bacteria made them also suddenly become active and greatly increase in number.

I quote again from *My Ivory Cellar*:

In thinking back over various time-lapse projects, there is one in particular that seems to tie in closely to the effects of chilling. Early in the summer of 1948 Northwestern University Medical School was interested in a project of time-lapse study of the growth and division of cancer cells. Information of a new type phase-contrast microscope had recently been released, but following the war deliveries of all such equipment were still very slow and uncertain. Northwestern University Medical School had one on order from the Bausch & Lomb Optical Company. They had been quoted a two-year delivery date. This seemed a long way off and was very disappointing. However, it so happened I gave a lecture and showed some of my time-lapse pictures in Rochester, New York, where the headquarters of the Bausch & Lomb Company are located. Following the lecture, as was usually the case, a number of people came down front to ask questions. This particular night I was pressed for time to catch a train on to my next speaking engagement and had possibly been a little hasty in trying to pack up all the projection equipment and be on my way. On the train while pulling ticket stubs and similar miscellaneous items out of my pockets, there was a card I remembered receiving from an elderly gentleman. He had made the casual remark about being interested in time-lapse pictures, and for me to be sure to let him know if he could ever be of any help. Lots of people had frequently made this same remark just as conversation, so I had not taken this particular gentleman too seriously at the time. However, upon looking at the card again, I noticed he happened to be president of the Bausch & Lomb Optical Company. Could he be really serious in wanting to help in any way possible? Immediately upon arriving home, a letter to him was in the mail. The result was I had a phase-contrast microscope within two weeks instead of the estimated two years.

This accomplished, the next step was to design and have made some special glass chambers that would fit within the restricted space of this new type of microscope. They had to be optically perfect so as not to cause any refraction of light. The glass chamber held a regular cover-slip with the living cancer tissue suspended underneath. It was also equipped with an intake and discharge glass tube so a continuous flow of fresh plasma could be supplied to keep the cancer cells growing. Next an incubator cabinet was built with special access doors. Adjustments could be made on the microscope by reaching in through these small doors and not materially lowering the temperature of the entire cabinet. Finally a system of transporting the tissue culture slides in heated Thermos jugs from the medical school to the time-lapse studio was worked out so that the exact body temperature could be maintained while the slides were in transit. This was considered to be of the utmost importance, so that the subjects would not be chilled or otherwise subjected to any harmful effects.

The tissue culture slides were prepared from rat tumors. New slides were prepared every few days and brought out to the studio, a distance of approximately fifteen miles. This project continued all summer and well into the following winter. Dozens and dozens of slides were prepared and carefully transported in the heated Thermos jugs, but not a single picture showed any cell division taking place. Everybody had been so optimistic and hopeful that this project might reveal some important information through time-lapse photography. Unfortunately the results had so far been very disappointing, and the enthusiasm on the part of those participating was rapidly waning. Serious consideration was being given to the question of how much longer it was worthwhile to carry this project further. Then one day the intern who was bringing the hot Thermos jug carelessly allowed the cover to jiggle loose in the back of the car and come off. The slides were cold on arrival, and we both felt they obviously had been completely ruined. We came very close to throwing them out, but inasmuch as the cameras were all ready and nothing else was available to photograph at the moment, I put them in the microscopes anyway, and started the cameras going. There was just enough film on the end of a full magazine for one more time-lapse sequence. When the film was finished, it went in for processing as usual.

It had become rather monotonous, looking at film after film of these cancer cell pictures and nothing ever happening. As this particular film was projected, it seemed to be the same story over again. The first part showed no cell division. The last part of it contained the sequence of the cancer cells that had become cold and then reheated to body tempera-

ture. Would they look any different as the result of having been chilled? Finally this sequence was on the screen, and the cells did look different! They seemed more active, alive. Suddenly one pulled together into a compact round shape. The chromosomes within the cell lined up and split in two as the cancer cell actually divided. It was hard to realize that after all these months of work here was the picture we were after, and it had happened with a slide that through carelessness had been chilled so that we considered it hardly worth photographing at all. This was the first slide that showed any cell division. We didn't know why, but from then on discontinued transporting the slides in the heated Thermos jugs. I recorded in my notes that it just worked better that way, and put down a great big question mark. From then on we were able to get all the pictures of cell division we wanted, and the project was soon completed. The more recent observations on the effect of chilling certain bulbs and black spot spores seem to tie in with stimulating cell division in these earlier cancer pictures, but the question as to just what the significance might be needs further study.

From other information gained as a result of having produced a film on the story of garden pests and insects for Swift and Company, I am convinced that some insects must be chilled before they will complete the pupa stage. The cocoon or chrysalis is not solely for the purpose of self-preservation during the winter period. It is known that many moths and butterflies will not emerge from the cocoon or chrysalis if brought into the house too early in the fall. It is thought the reason is that they dry out if kept inside too long.

There is little if any information regarding the necessity of chilling in connection with insects, but there is considerable information available as to just how much warm weather is required for certain insects to emerge from the pupa stage. In discussing this with several "just plain good old-fashioned" nature-study teachers—if I may refer to them as such—I learned that if cocoons are placed in the refrigerator for a while, when brought indoors early in the fall, there is then no problem about their drying out. The butterflies and moths will emerge perfectly.

Now if we put the effects of chilling together with the responses of electret cells, we can begin to see changes of temperature influence the electric dimension, break the dormancy of spores, seeds, spring bulbs, bacteria, and insects, and trigger the process of cell division in animal cells.

I had the opportunity of showing my time-lapse pictures dealing with temperature to Dr. Callahan and his associates at the University of Florida. It was the general opinion of those present that there must be a similar mechanism at work in the spores, bacteria, and mammalian cells in regard to changes of temperature, as Dr. Callahan has demonstrated in the electret cells of the insect exoskeleton.

It seems to me that the various layers of the skin would be an obvious area to start looking for human electret cells. It is now known that the Langhans cells in the epidermis play an important role in the immunological milieu of the individual instead of merely being dead squamous cells being pushed toward the surface. This is an important discovery, but it's just the beginning. We have only begun to scratch the surface of a whole new world of electrobiological research.

Some of the "loose ends" discussed in previous chapters are beginning to fit together. But each day, it seems, more "loose end" observations are added to the list. I shall touch upon only a few of those that have come to my attention.

Not long ago I received a letter from a TV viewer stating he had seen me do the muscle test demonstration and wondered if I was aware that holding a glass of fluoridated water would cause muscle weakness. I was not. As the water supplied by our local utility is *not* fluoridated, I tried the muscle test on a person holding a tube of a fluoridated toothpaste—and down went the arm. I went on with additional muscle testing and found that holding a glass of water from our own private well did not cause any muscle weakness. Neither did holding a glass of rain water collected in a brass bucket, or a glass of commercially distilled bottled drinking water. But holding a

glass of the nonfluoridated utility company water from the cold water tap in the kitchen sink did definitely cause muscle weakness! Why?

I learned that the local utility company had one of the newest and most modern high-voltage electro dialysis types of water purification system. I lost no time going over to the water works plant and talking to the superintendent. He explained that the high-voltage electro dialysis system had been installed to remove the high mineral content of water previously used, but now the water was coming from another nearby utility system and was natural river water that did not require demineralization, so the high-voltage system was no longer in use.

Looking elsewhere for an answer, I thought of the new type of polyvinyl chloride plastic pipe extensively used in water systems in place of the old type of cast iron pipe. Further testing showed that holding a glass of water taken from a new nearby private well with polyvinyl chloride plastic piping or any water that had passed through pvc plastic pipe would cause muscle weakness, but water from older wells or older water mains using cast iron pipe and no pvc plastic pipe caused no loss of muscle strength.

Recalling that heating polyunsaturated margarine reversed its weakening effect on muscle strength, I boiled some water taken from the cold water faucet in a stainless steel saucepan and found that holding a glass of it no longer decreased muscle strength. Neither did a glass of water from the hot water faucet that had been cooled to room temperature. (The thermostat on the hot water heater had been turned down to 140° F to conserve energy.)

While I still had some water boiling on the kitchen range, I dropped the tube of fluoridated toothpaste in it, left it there for about ten minutes, then let it cool to room temperature. It too no longer weakened the muscles when held in the hand.

This led me to wonder if the effect of heating and cooling

could be reversed by first cooling and then heating, and thus restore the muscle-weakening characteristics of those materials that lose their muscle-weakening effects when first heated and then cooled.

I placed the tube of fluoridated toothpaste that had been heated and cooled and no longer caused muscle weakness in the refrigerator for an hour, then let it warm to room temperature. Again it caused muscle weakness when held in the hand.

I did the same thing with an ordinary carpenter's hammer. First, I tested it by having someone hold the steel head of the hammer in the palm of the hand—with no effect on muscle strength. I then put it in the freezer compartment of the refrigerator for several hours until it was thoroughly cold to the very center of the steel. When held in the hand while still cold it had no muscle-weakening effect, but after it had warmed to room temperature it caused substantial muscle weakness. Could it be that the muscle-weakening effects are caused by the warming side of the chilling-warming cycle?

With more experimenting I found that when the head of the carpenter's hammer had been chilled, then warmed, it weakened muscle strength when held in the right hand of a right-handed person, and had the opposite effect when held in the left hand, as the bar magnet did. As with the bar magnet, the muscle weakening was reversed with left-handed people.

It would seem that reversing the muscle-weakening effects by changing the position of the bar magnet in the hand must be due to switching its north-south magnetic polarity. The changes of temperature in either heating-cooling or cooling-heating the steel head of the hammer apparently likewise alter its magnetic polarity. However, the bar magnet definitely has a North and South Pole, and reversing its position end for end when held in the hand also reverses its effects

on muscle strength, whereas with the carpenter's hammer it appears to make no difference how the head is held in either hand. This would indicate that it has only a single polarity or monopolar field which may be either north or south and that the polarity can be reversed by changes in temperature.

The steel head of the carpenter's hammer is made basically of iron and can be magnetized. Iron is very important in the blood of animals, including humans. It is also important to plants.

An outstanding question is: What is the overall function of iron in the electric dimension of living cells?

A second question: Is the increase of body temperature from a fever a part of nature's way of checking or controlling the electrical dimension of living cells?

And a third: What additional interaction may there be on the electrical dimension of living cells from the effects of different types of hyperthermia equipment such as R.F., microwave, or ultrasound systems for heating tumors in the treatment of cancer?

Mind-boggling questions certainly, but not without answers. Simpler answers perhaps than presently supposed.

8 LIGHT—THE MISSING LINK?

IN RESEARCH, the expressions "true cause and effect," "cage differences," and "exceptions" are quite common.

The importance of establishing the results of any therapy or research study to the true cause cannot be overemphasized. It is always a temptation to draw a conclusion prematurely, especially if the data appears to support one's original hypothesis.

However, research data today is largely computerized, and a computer is capable only of analyzing the data it receives. It lacks the ability of the human mind to override statistics with a little common sense.

On the other hand, it can be argued that omitting any suspect data, or deciding which data should be given to the computer as an exception, opens the door to weighting the results. Accordingly, it is generally accepted that by using a greater number of animals, the overall averages will lessen the chance of error from any misinterpretation of the relationship between the true cause and effect, cage differences, and/or possible exceptions.

It is, of course, highly important to approach any research study with a truly open mind and not with the intention of

proving some preconceived idea, even if the idea represents the long-standing accepted or orthodox explanation of the phenomenon at point.

This may all sound very rudimentary, like reminding someone to drive carefully when getting into an automobile, but accidents do occur on the highways.

For example: In the October 1963 *Science* an article entitled "Long-Term Isolation Stress in Rats" reported on the effects of isolation stress on white rats. A marked difference in the toxicity of isoproterenol between community-caged rats and isolated rats provided a criterion for following the development of isolation stress. Isoproterenol is a drug that causes heart palpitations, lung dilation, and nervous disorders. According to this group of investigators, the reversibility of isolation stress was also established, the reversal being attributed to the effects of short-term versus long-term isolation. Short-term isolation stress was defined as one to ten days and long-term from ten to thirty days.

My particular interest in this article centered on the reported condition of *caudal dermatitis*, or scaly tail, which also followed a reversibility pattern attributed to the short-term versus long-term isolation stress. Although this condition was not nearly as serious as the condition of the tails of our mice kept under different types of light, the similar reversibility patterns were definitely of interest.

My interview with the principal investigator in charge of the isolation stress study, and with all of his coworkers, revealed that, coincidentally, at the precise interval between those times designated as short-term and long-term isolation stress, the lighting environment of the two groups of animals was drastically changed. All the cages containing the isolated animals were on one large rack at one end of the animal room, with the cage doors directly facing the windows. The colony groups of animals were on another similar rack in a dark area and with the cage doors facing away from the windows. During the interview it

was learned that one of the laboratory assistants had moved the racks when mopping the floor and had inadvertently switched their location.

Under these circumstances of substantially different light intensities, it is of particular interest that the criterion for following the development of isolation stress was the toxicity level of the drug. It is now well established that light significantly influences the toxicity level of drugs.

An example of the danger involved in classifying gross variations in data obtained merely as an exception is evident in an article entitled "Pterygium Among Veterans" (*Archives of Ophthalmology*, August 1963).

A high incidence of pterygium, an abnormal growth on the eye that impairs vision, was found in a group of veterans who had been stationed in the desert area of the southwestern part of the United States. It was first suggested that the dust and blowing sand in this area may have been a contributing factor. However, an equally high incidence of pterygium was found in servicemen returning from the high rainfall areas of the South Pacific. It was concluded that the only factor common to both these areas was the high-intensity sunlight and ultraviolet. The article then mentioned a major exception to these findings, a group of Cree Indians in northern Manitoba, Canada, who were found to have an exceptionally high rate of pterygium. However, at this latitude these Indians would definitely not be subjected to the high-intensity ultraviolet in tropical sunlight.

Accordingly, I personally investigated this situation and found this group of Cree Indians had been issued specially designed sunglasses, of the wrap-around kind, and trimmed with leather to prevent even the slightest bit of ultraviolet sunlight from reaching the eyes. These special sunglasses had been issued in connection with an earlier experiment designed to study problems of glare, etc., from the snow and ice. When the study was completed, these people were allowed to keep their sunglasses.



Holding a lightning rod against chest weakens all muscles, including heart muscle.



Unknown stress frequency from vinyl plastic material also weakens muscle strength.



If the lightning rod is turned around and pointed toward the chest, the muscle strength immediately returns and in some cases is actually enhanced.



A pyramid will act as a point emitter just like the lightning rod.



So will a lead pencil held in the ordinary writing position.



The distorted light spectrum plus added radiation from one 20-watt fluorescent tube produces stress that not only weakens the muscle system but also causes other pathological problems.



Primary eyeglasses that block the ultraviolet, also sunglasses, including those that darken when worn in sunlight, cause measurable loss of muscle strength.



Radiation from digital watch is within government safety levels, but grossly weakens muscles.



This is how Sara's left eye looked when Dr. Salov took her as a patient.



In approximately one month there were definite signs of some improvement beginning to show.

After four or five more weeks there was real reason for encouragement.



After five months of treatments by Dr. Salov there was no trace of tumors remaining. In two more months Sara's vision was back to normal.





Magnet in hand with North Pole pointed out weakens muscles.



Magnet on top of hand with North Pole pointed out strengthens muscles.



Before fluorescent lights were changed note boy lower left banging head on table, boy upper center fumbling with chair, and two on extreme right climbing on top of tables.



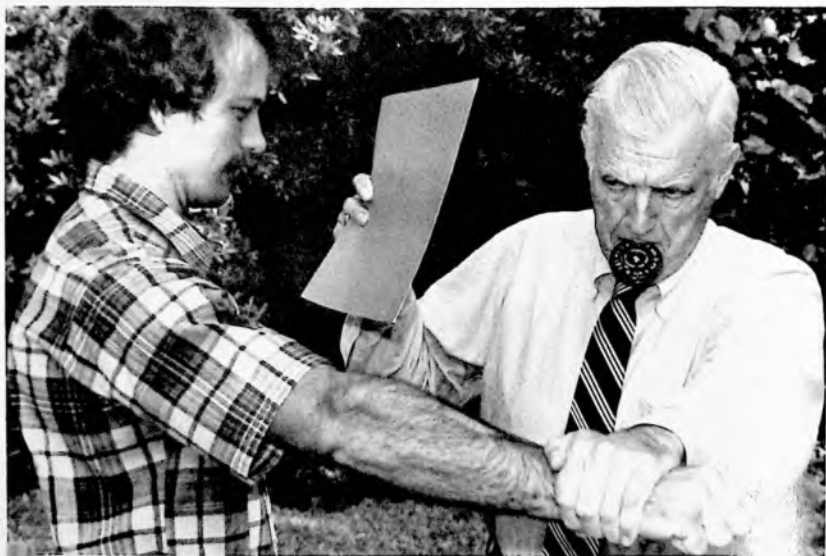
Will this boy ultimately become a dropout?



Sixty days after lights were changed this boy moved up to front row with his hand raised to gain recognition from teacher.



He is now at blackboard taking part in regular classroom activities.



If a person looks at a pink card while someone else sounds High C on a pitch tuner, this particular note will counter the pink color and restore the muscle strength to normal.

Holding a Pyrex pie dish in the hand causes muscle weakness, but holding a dish made of ordinary glass does not.



Items of clothing need not be worn to do muscle test, simply held in hand.





Author (center) with architect and contractor removing protective paper covering from Ultraviolet Transmitting Plastic installed in sliding doors on porch of new house, Lake Bluff, Ill., in 1960.



Author examines Full Spectrum Radiation-Shielded Fluorescent fixture opened to show separate small blacklight tube. Lead foil shields cover each end of all tubes where cathodes are located. Double wire grid radiation shield inside opened, ultraviolet-transmitting diffuser is also visible.

Shortly thereafter, in checking a limited number of individuals who had developed pterygium while on military duty in the tropics, I found that all had constantly worn prescription sunglasses.

The article did not state whether any consideration was given to the wearing of sunglasses, which is almost universally done in the tropical areas, but in view of the findings regarding the Cree Indians and the servicemen returning from the tropics who did wear sunglasses and developed pterygium, it would appear that the conclusions drawn—that the ultraviolet in sunlight is a causative factor of pterygium—cannot be justified.

P. Wilson and coworkers reported on the "Induction of Alcohol Selection in Laboratory Rats by Ultraviolet Light" (*J. of Studies on Alcohol*, November 7, 1976). Reference was made to previous work of Sinclair and Geller in *Science* indicating that rats drank more alcohol after exposure to darkness over the weekends when no one came into the laboratory and turned the lights on.

Nobel Prize-winner Dr. Julius Axelrod had earlier found that the pineal gland produces more of the enzyme melatonin during dark periods. Injections of melatonin into rats on a regular light-dark cycle turned these rats into alcoholics.

That alcoholism may be related to the pineal gland is also under study by Dr. Kenneth Blum, a pharmacologist at the University of Texas Medical School. In near-total darkness, rats with pineals drank more alcohol than water while rats *without* pineals drank more water than alcohol.

Our work has indicated many biological responses in both plants and laboratory animals. We have found that they respond to specific narrow bands of wavelengths, and not just to the difference between light and dark.

If the specific wavelengths to which a photoreceptor mechanism responds are missing in an artificial light source, then this would be the equivalent of darkness to the photoreceptor mech-

anism. There would be no response, even though there were other wavelengths present. This then raises the question as to whether the alcohol preference of the rats kept under the UV light by Dr. Wilson is caused by the presence of the 350 nm-wavelength UV or the absence of the specific visible wavelengths to which this response may react.

In making a film for the McCardle Memorial Laboratory for Cancer Research at the University of Wisconsin Medical Center, I ran into another example of how important specific wavelengths of light can be. The film showed how to culture *physarum polycepholum*, an ideal slime mold organism for cell research. This mold normally grows on dead, decaying trees outdoors, but making it grow in the laboratory is another matter.

The doctors at the McCardle Lab had developed a procedure for culturing the cells, making a plasma and putting some in flasks that were automatically shaken for a certain length of time. The plasma was then poured on pieces of filter paper placed in petri dishes. A growth medium was added and the mold grew very nicely. It would spread out over the filter paper, but would not sporulate. This means it would not develop spore heads that ripen and break open to release more spores. The wind carries the spores great distances to start new fungus growth over a greater area.

The doctors working on the project discovered that if the flasks of plasma were placed in a light box under fluorescent tubes for six hours before the plasma was poured out on the filter paper, the sporulation would then develop normally.

Some time later, I was giving a lecture at the University Medical School at the University of Minnesota and some doctors there were complaining that they had followed the protocol specified by the doctors at the McCardle Laboratory. They had made the light box exactly to specifications, but the slime mold would not sporulate.

During my lecture I showed the pumpkin pictures and the effect of the two different types of fluorescent tubes bringing forth staminate or pistillate blossoms. As it turned out, this was the answer to the sporulation problem with the slime mold.

In writing up the report on culturing *physarum polycephalum*, the doctors only mentioned the size of the box, the number and wattage of fluorescent tubes, and the distance from the flasks—but not the type of fluorescent tubes that were used. It so happened that cool white were used in the light box at the McCardle Lab and warm white at the University of Minnesota. As soon as the warm white tubes were changed to cool white, the sporulation developed perfectly.

Another new and interesting application of light therapy for the treatment of cold sores and fever blisters was developed by a group of scientists at Baylor College of Medicine, and reported by Dr. Troy D. Felber at the 120th annual meeting of the American Medical Association in June 1979 at Atlantic City, New Jersey.

The new technique consists of applying a certain type of dye to the skin lesion and then irradiating it with an ordinary *day-light* type fluorescent light. The virus then somehow becomes inactivated through a process described as photodynamic inactivation.

The work has implications that go beyond skin infections. One type of the same virus—herpes simplex—is believed by many scientists to cause cancer of the cervix.

Another group of doctors at a university in Iowa reported that they were unable to duplicate Dr. Felber's work. However, in the same report they mentioned using ordinary *incandescent* light. At the National Institutes of Health a further study failed to confirm Dr. Felber's work with daylight-type fluorescent, which is strong in the blue wavelengths that are almost totally lacking in ordinary incandescent. The N.I.H., too, had used ordinary incandescent light.

A more definite indication of a direct carcinogenic relationship between light and the effects of certain chemicals was reported in Japan (*J. Genetics*, Vol. 44, 231-240: 1969, S. Takayama and Y. Ojima, Kwansei Gakuin Univ., Nishinomiya, Hyogo). Cultured cells were exposed to each of eight polycyclic hydrocarbons, and then illuminated with white light from a tungsten lamp. Five carcinogenic hydrocarbons were found to be much stronger in photosensitizing activity than three noncarcinogenic ones. Among the former compounds, benzopyrene is the strongest and benzanthracene the weakest. As far as the present experimental system is concerned, a clear positive association between photodynamic activity and carcinogenicity was found.

More recently, I ran into a somewhat similar case concerning Laetrile and differences in laboratory lighting. The situation may best be explained by the original correspondence.

Memorial Sloan-Kettering Cancer Center
New York, New York 10021
December 1, 1977

Dear Dr. Ott:

Thank you for the promised reprints you sent with your letter of November 29. I know from our conversation I will find them interesting.

I spoke with Dr. Good a day or two after you and I met and he indicated his real interest in the possibility of an informal seminar from you in our Institute. Maybe one could be arranged in connection with your visit to the ACS here in New York.

Please let us know as early as you can on what might be possible in order to see how it fits Dr. Good's schedule and that of several others here.

Sincerely,

C. Chester Stock, Ph.D.
Vice President and
Associate Director
for Administrative and
Academic Affairs

January 20, 1978

C. Chester Stock, Ph.D.
Memorial Sloan-Kettering Cancer Center
1275 York Avenue
New York, New York 10021

Dear Dr. Stock:

I thought the response to my seminar at Sloan-Kettering was reasonably encouraging, but I have heard nothing since and am wondering if there has now been time for you to have received any official feedback. Because of the controversial nature of the subject, I thought it best not to mention anything regarding Laetrile, but I am scheduled to give another seminar for Doctor Harold Manner at Loyola University in Chicago on February 14th. The subject of the different types of fluorescent lights used in his laboratory as compared to those used at Sloan-Kettering is bound to come up for a lot of discussion.

The different results obtained by Sloan-Kettering and Doctor Manner and the lights used in their respective laboratories tie in exactly with the results I obtained as mentioned in my book *Health and Light*. These results have now been repeated by doctors at six medical centers as listed in the enclosed article, "The Eye's Dual Function" Part Three.

When I visited Doctor Manner on November 14, 1977, he stated that for some unknown reason many of his animals were suddenly dying. Our meeting was cut short because he had to leave for the airport, but before leaving he turned me over to several of his students who showed me their animal laboratory. I noted the fluorescent lights were similar but not identical to those used at the Sloan-Kettering laboratory in Rye. I asked if those lights had been recently changed and learned that the maintenance department had relamped the laboratory approximately two months earlier and had replaced cool white fluorescent tubes with warm white.

I now understand that the cool white tubes have been put back and the animals are already doing much better. I also learned that the cause of the sudden death of many animals was thought to be possibly due to injecting the animal tumors with certain enzymes at too fast a rate, and this procedure was corrected at the same time that the lights were changed back to what was originally in the laboratory before the animals started dying.

I have suggested that they continue the slower rate of injection and change the lights back to the warm white fluorescent and then see what happens.

I have enclosed copies of several additional articles that either have been or are scheduled to be published this current month. I am trying to stress the need for including light as a variable in all research laboratories and to analyze the reasons behind the resistance to doing anything different or making changes in established procedures. I am very pleased to be working with a number of research laboratories at medical schools and universities across the country, including Roswell Park Memorial Institute and the new laboratory of the National Institute of Environmental Health Sciences (N.I.H.) at Research Triangle Park in North Carolina. All the results so far from every experiment, to my knowledge, except those done or sponsored by the electrical industry, have shown significant results under different types of lighting. The results from the original experiments at Roswell Park have now been repeated and duplicated and are presently being written up for publication. These results show not only that light has a significant effect on the endocrine system of laboratory animals, but also affects the principal organs as well. . . .

Sincerely,

John Ott, Sc.D., Hon.

February 6, 1978

Dear Dr. Ott:

There were a number of those who attended your lecture who found your results of real interest. I believe a number of us recognize the nature of the lighting is a variable which should be controlled in experimentation.

It is just as well that you did not mention the Laetrile studies. We have not tried to conduct experiments duplicating those of Dr. Manner. I do not know to what extent he tried to duplicate ours. I believe I saw a newspaper item saying he had repeated some of our and NCI experiments with similar results. The experiments in which he considers he has favorable results are so different from ours that there are far more important variables or different conditions than those due to lighting differences. . . .

Sincerely,

C. Chester Stock, Ph.D.

February 28, 1978

Dr. Harold Manner
Dept. of Biology
Loyola University
6525 North Sheridan Rd.
Chicago, Illinois 60626

Dear Harold:

I certainly appreciated the opportunity of showing my time-lapse films to your class and the others who attended my recent seminar.

I have previously sent you a preprint of my article, *Light, The Missing Link, Cause and Effect, Cage Differences and Exceptions*. Enclosed is an officially published copy published in the Journal of the Northwest Academy for Preventive Medicine, which is just off the press.

Although the differences in the results between your experiments with Laetrile and those reported by Sloan-Kettering may be due to your use of additional enzymes, rate of injection or even some other unknown variables, I think it is extremely important to pin down as soon as possible the matter of the different types of lights used and to determine whether light is or is not a contributing factor.

I came away from our last meeting on February 14th when I showed the two films, with the feeling that some of your students felt quite satisfied that having changed to a slower rate of injection was totally responsible for getting the experiments back on track so the animals were not dying as you had previously mentioned to me.

If this is the true cause and the recent animal deaths were not related to having changed the lights in the laboratory, it should then make no difference if the lights were changed back again to the warm white fluorescent. It would be nice to switch some of the animals to the warm white and keep the remaining ones under the cool white, but in view of the lack of necessary additional space, I strongly urge you to change all the laboratory lights to warm white, even taking into consideration the possibility of completely disrupting your experiment again.

This question of light must be definitely determined sooner or later, and until it is, all past and present research risks the possibility of becoming invalid when light has not been recognized a variable and under scientific control.

Please give this matter your serious consideration and I will look forward to hearing from you as to your decision.

Very sincerely,

John Ott, Sc.D., Hon.

(No reply received)

Haarlem, Orangeplein 11
The Netherlands

May 11th 1978

Dear Dr. Ott,

Thank you for your letter. Indeed I have read about your fascinating work but I had never associated it with Laetrile treatment. So as a matter of fact your letter set me thinking about the lives of my patients and something emerged which I did not expect. My very first patient was a boy with an astrocytoma. My very first Laetrile patient that is. He was inoperable and they took a piece of the tumor, localised in the small brains out and gave him some radiation. This boy is a nearly pure Laetrile patient, as he was not holding his diet very well and did not take his vitamins. He is now 18, and quite healthy. Now this is a schoolboy, who has to be on bike four times a day and who is doing outdoor sports like rowing.

My second Laetrile patient was a woman with a recurrence of an ovarial carcinoma, big as a fist. She was inoperable and got some endoxan, but she was in much pain and was looking very bad indeed. We are five years later now and she is so good that the cancer institute is dying to open her up but she refuses. Now this woman is doing long stretches on her bike every day. She is an outdoor type and she lives in rather a rural country with wide open skies.

Another patient is a man who lives in the same area. He came last year to my office, dying from lung cancer. He was blue in the face and gasping for breath and he had to be helped in by his wife and his brother. After half a year he was in much better condition and—this is important for you—this man is working outdoors in his small garden where he cultivates vegetables most of the day. Lately the specialist became irritated

that the man had not died yet and suddenly gave him huge doses of chemotherapy and since then he is deteriorating.

The last two patients were given diet, vitamins, minerals and bromelain with Laetrile.

On the other hand another patient with a big stomach tumor who according to the hospital had two weeks to live, lived for 10 months, but he never went outdoors at all.

And a colleague of mine has given Laetrile to a lot of patients about half a year ago and they all died. He lives in the northern part of our country where people often are strictly religious and cover themselves up in black clothes. All these things are no proof of course but it certainly is a strange thing that the first three successful cases that came to my mind all were outdoor cases so to speak, and that the unsuccessful cases (because I only mentioned one, but there are a lot more) hardly ever moved outdoors and if they did so, it was by car.

I will certainly look into this matter further and if I find more material that could be of importance to you I will certainly write you. As a matter of fact I was quite honoured to get a letter from Dr. Ott himself.

The three successful cases I wrote you about do not wear glasses.

With best wishes for your most important work,

Sincerely yours,

Hans C. Moolenburgh

April 7, 1980

Dr. Charles Moertel
Director
Cancer Research Center
Mayo Clinic
Rochester, MN 55901

Dear Dr. Moertel:

It is most gratifying to read in our local newspaper that studies will be undertaken at the Mayo Clinic to test the effect of Vitamin C and Laetrile, two very controversial theories regarding cancer.

Accordingly, I am taking the liberty of sending you some reprints of articles reporting on the results of several studies done at the Environ-

mental Health & Light Research Institute indicating an interaction of specific wavelengths of light energy with the wavelength absorption characteristics of all substances including such vitamins and drugs as Laetrile and ascorbic acid or Vitamin C.

At the present time I am scheduled to give seminars at the annual meeting of the Indiana Optometric Society in Orlando, Florida on April 24-25, at the School of Allied Health Professions of the University of Wisconsin, (Milwaukee campus) on April 28-29, and the Wisconsin Society of Architects at the Abey Resort Hotel, Lake Geneva on May 1-2.

I feel so strongly about the need to consider light energy as a variable in such studies as you are undertaking, that I would greatly appreciate an opportunity to come to the Mayo Clinic and further discuss this matter with you. Monday, May 5th, would be the most convenient for me, but I could stay over until Tuesday, May 6th, if necessary.

Very sincerely,

John Ott, Sc.D., Hon.

Mayo Clinic
Rochester, Minnesota 55901

April 14, 1981

Dear Doctor Ott:

Your letter of April 7, 1980 to Dr. Charles G. Moertel was referred by Dr. Moertel to me in my capacity as director of our cancer pharmacology program. Your interest in research encompasses an area in which we have no major research programs. I read several of the reprints of articles you enclosed with interest. The results of Doctor Chignell's work will be of interest to many individuals despite their area of research.

Unfortunately, it will not be possible to organize a forum appropriate for the seminar you have kindly offered to give in May. Thank you for expressing your interest in the Mayo Clinic Comprehensive Cancer Center. We look forward to following the progress of research in this area.

Sincerely yours,

John S. Kovach, M.D.

As previously outlined in chapter 3 on Biological Combustion, all nutritional substances, including medicines and drugs such as Laetrile, have a specific wavelength absorption. If those wavelengths are missing in the artificial light source a person is exposed to, then no biological combustion will take place and the nutritional benefits of the particular substance will not be utilized.

I further comment on the apparent better results of Laetrile in the sunnier climates of Mexico and Southern California than under the very pinkish fluorescent lights used at Sloan-Kettering Research Laboratory. I do not know what type of lights are used at the Mayo Clinic but I believe it is of interest that the recent Laetrile tests done at the Mayo Clinic and other hospitals in different areas of the country were carried on primarily during the winter period of 1980-81 when hospital patients are least likely to be outdoors in natural sunlight.

While there have been several recent articles in medical journals warning against the high level of the photo-toxic effects of certain wavelengths of light on certain drugs, my feeling is that this basic principle of the interaction of specific wavelength absorption characteristics of these photo-toxic drugs should be carried further to what might include more normal responses of substances like Laetrile and even Interferon and other drugs used in so-called orthodox chemotherapy, not only to visible light but to the entire electromagnetic spectrum.

In view of the possibility that the different types of light sources used by Sloan-Kettering and Dr. Manner were a contributing factor in the different results obtained, I believed it would be of interest and possibly very helpful to know what the wavelength absorption band of Laetrile was. Accordingly, I called Dr. Ernst T. Krebs, Jr. at the John Beard Memorial Foundation in San Francisco. Dr. Krebs and his father are, I believe, considered basically the originators of Laetrile and

responsible for much of the research that has been done on it. I asked Dr. Krebs if he could give me the specific wavelength absorption of Laetrile. He advised me that he could not and that he did not know of anybody or any laboratory that had tested Laetrile for its specific wavelength absorption. He did, however, agree that this might be of interest and would be a good project for someone to undertake.

Accordingly, I arranged to have a sample of Laetrile shipped to a research laboratory and requested that it be tested for its wavelength absorption characteristics. The results clearly show that the wavelength absorption starts in the blue end of the spectrum, continues to rise on through the near ultraviolet and has a very sharp peak in the far shortwave ultraviolet between 270–250 nanometer range. This peak absorption in the shortwave ultraviolet is so strong that the usual recommended dilution of Laetrile with water had to be diluted several times so that the light beam of the recording spectrophotometer could penetrate it in order to get a reading.

As previously mentioned in both *My Ivory Cellar* and *Health and Light*, the earth's atmosphere cuts off in the ultraviolet at approximately 290 nanometers. The official wavelength chart of sunlight put out by the U. S. Bureau of Standards shows an absolute cutoff at 290 nm, as do all the other wavelength charts I have ever seen. Any ultraviolet wavelengths in natural sunlight shorter than 290 nm are considered nonexistent and the possibility of any trace amount would be so minimal that the matter is totally ignored.

However, it is recognized that trace amounts of still shorter wavelengths in the X-ray, gamma, and cosmic rays do reach the surface of the earth. Generally, they are all combined into a sort of hodgepodge of general background radiation and referred to only in terms of total energy.

References to radiation from various electronic devices or

household appliances are frequently made as being no more than the level of natural background radiation that a person living at a higher altitude such as Denver would receive. This is because of the lesser amount of atmosphere the radiation from the sun and outer space has to penetrate in order to reach the surface of the earth. As also previously explained, the total energy in general natural background radiation is a relatively broad, even amount of energy across the entire general background spectrum. When this broad spectrum of total energy is concentrated down to a narrow band or even single wavelength, the effect is drastically different, even though there is the same amount of total energy.

A rough comparison may be demonstrated with a magnifying glass in the sunlight. The total amount of sunlight over the entire surface of the magnifying glass might feel quite comfortable, but when the sunlight is concentrated down to a pinpoint, the result will start a fire. Of course, the magnifying glass is concentrating all the wavelengths that will penetrate through the glass whereas the reference to the energy level of radiation from electrical devices and household appliances are generally to increased energy levels that are all in a specific single wavelength or very narrow band of wavelengths. This would have a much greater effect on a photoreceptor mechanism or wavelength absorption characteristic responsive only to the particular wavelength or narrow band of wavelengths so involved.

What I am driving at is the need to pay more attention to the importance of trace amounts in radiation, as has been accomplished in recent years in chemistry. Not so long ago one part per million was hardly worth considering or bothering about but now one part per trillion is recognized as having possible significance in affecting biological responses.

In my wavelength charts, instead of showing an absolute cutoff of the sunlight energy in the ultraviolet at 290 nm, I am

continuing the line at the very bottom of the chart into the shorter wavelengths of ultraviolet to indicate the trace levels that many physicists now recognize do reach the surface of the earth.

Thus, even though the principal absorption bands of Laetrile are in the 250–270 nm area, which are beyond the 290 nm basic cutoff point, they are so sensitive that only a trace level of energy is needed to activate the biological combustion process.

Other chemicals or minerals with less sensitive absorption characteristics would need higher energy levels to produce the same results. When a peak energy level happens to coincide with a very sensitive absorption characteristic, then a photo-toxic reaction occurs, such as we are now hearing more about.

The fact that the wavelength absorption begins to show in the blue or shorter wavelengths of visible light strongly suggests a possible explanation for the difference in results obtained under the very pinkish lights at Sloan-Kettering and the cool white used by Dr. Manner at Loyola University. It would further logically explain the better results obtained in sunnier climates, where there is a trace amount of the 250–270 nm shortwave ultraviolet.

Today, one of the most important areas in research has to do with cancer. In addition to extensive studies with laboratory animals, there are reports published from time to time of cases of complete remission in humans. Naturally, there is always speculation as to some possible explanation. But as a general rule, consideration is given only to what the person did in an effort to treat the disease. No consideration is given to what the person may have stopped doing that may have been a causative or at least a contributing factor. The human body has a tremendous healing or repair capability if given half a chance. There is probably nothing that brings about a

more complete change in someone's daily routine than learning of a terminal disease such as cancer.

The cover story of *Time* magazine, about ten or fifteen years ago, mentioned such a complete remission. A man, upon being told he had terminal cancer, immediately stopped going to his office and started reading in a rocking chair on an open back porch and also working in his rose garden. The cancer disappeared and he became a medically proven case of complete remission.

The cover story of *Guideposts*, April 1972, tells of "The Healing of Maude Blanford." This lady had received radiation treatment and surgery, but the cancer had gone too far and it could not be removed. She was put on narcotics to relieve the excruciating pain and sent home to die. But she had spirit and took up reading the Bible, conscientiously.

Her husband set up a cot for her outdoors under the trees because the Holy Spirit had given her an intense desire to be out-of-doors and a hunger to meet Jesus in His world. She soon felt better and wanted to go fishing, which became a daily occurrence. She looked at the breeze rippling the water, at the wheeling birds and the distant hills. She praised the Lord and kept on reading her Bible (outdoors). She soon became another most unusual case of medically proven complete remission.

This lady was convinced that "faith" had cured her cancer. No thought whatsoever was given to the change brought about in her daily routine and the fact that she read her Bible outdoors in the natural sunlight. What if, under the circumstances, she had tried some controversial drug that many people go to sunny Mexico for? What might be the interaction of this drug with the UV in sunlight?

Another similar case of complete remission I have heard of from several reliable sources, and hope someday to be able to verify firsthand, concerns a Scandinavian doctor who dis-

covered she had a terminal cancer. She was a great nutritionist and thought fresh fish from the sea would be helpful, because they contain all the minerals from the sea and would be freest of artificial preservatives and other additives. She gave up her practice and went to a small town in northern Norway, where living was very simple, and went out with the fishermen every day to help catch her fish. She, too, became a case of complete remission, but when she prescribed fresh fish in the diets of her patients back in the city, it didn't work. (Any additional facts on this case would be greatly appreciated.)

One factor common to all these "exceptions" to the general rule, as far as terminal cancer is concerned, is natural outdoor light as compared with artificial, or filtered, light. Unfortunately, light is not even thought of as a possible variable to be considered in cancer research.

But if light energy is associated with cancer, then the question might be raised as to the comparative cancer rate of people still living under primitive conditions with those in more highly industrialized nations. Unfortunately, the statistics on primitive people are the hardest to find and the least reliable. Nevertheless, John Gunther mentions in his book, *Inside Africa*, that "Africa has malaria, tuberculosis, leprosy, syphilis, elephantiasis, yaws. Cancer is, however, almost unknown among Africans. . . . but the worst African disease is something more prosaic than we have already mentioned, malnutrition."

If nutrition were the major factor with cancer, then it would seem logical to find more cancer where malnutrition has been a major problem. I am also concerned with the number of prominent nutritionists in this country who have died of cancer. This concern encompasses the loss through cancer of the president and the head of research of Sloan-Kettering Memorial Hospital in New York City.

While visiting a tree shrew breeding farm in Bangkok, Thailand, I encountered a comparable situation involving nutrition. At that time there was a flurry of interest in using tree shrews as experimental laboratory animals, because they are a low form of primate, small and much less expensive to work with than monkeys. However, the main source of supply was Thailand, and new quarantine restrictions were creating severe difficulties in importing them.

An attempt was made to breed them in one of the laboratories at Harvard Medical School (under fluorescent lights) but serious problems arose that were attributed to nutrition. It was not practical to obtain the special diet of natural native food from Thailand that tree shrews apparently need.

In Thailand I found the breeding was done in open sheds, with no artificial lights at all, and not even any window glass to "screen" the natural sunlight. When I asked the doctor in charge about the tree shrews' diet, he took me over to the supply closet, opened the door, and showed me a ceiling-high stack of bags of a popular brand of dog food imported from the United States. I asked if any native food was added as a supplement, and the answer was "only a little water."

I had also the privilege of meeting the daughter of the late Dr. Albert Schweitzer. Our conversation dealt mostly with her experiences as assistant to her father at Lambarene, on the west coast of Africa. I asked her about the rate of cancer of the people in that area, and she replied that when her father had first started the hospital, they found no cancer at all, but that now it was a problem. I asked if the people living there had started installing glass windows and electric lights in their otherwise simple surroundings, and she said they had not.

Then I half-jokingly asked her if any of the natives wore sunglasses. She looked startled, and told me that the natives paddling their dugout canoes up and down the river in front of the hospital often wore no more than a loin cloth and sun-

glasses, and, indeed, some wore only sunglasses. She further explained that sunglasses represented a status symbol of civilization and education and had a higher bartering value than beads and other such trinkets. This is, of course, hardly scientific proof of a correlation between the wearing of sunglasses and cancer, but it does raise an interesting question.

However, scientific proof of the influence of light on tumor development (cancer) has now been demonstrated in an increasing number of scientifically controlled studies at recognized medical centers, confirming the results obtained in my backyard laboratory.

In 1959, during a meeting with Dr. Jane C. Wright, who was then in charge of cancer research at Bellevue Medical Center in New York City, she became intrigued with the idea that light energy transmitted through the eyes and stimulating the pituitary gland might conceivably be a growth-regulating factor, as far as tumor development was concerned.

Shortly thereafter Dr. Wright selected fifteen terminal cancer patients who visited the outpatient department for treatment of various types of tumors. A series of instructions entitled "Suggestions for Outdoor Living" was given to these patients. These instructions requested patients to avoid artificial light or light received through glass and to remain outdoors as much as possible. Wearing ordinary glasses or sunglasses was not recommended. (See the end of chapter 11 for complete instructions.)

At the end of the summer, Dr. Wright advised me that, while it was difficult to make an evaluation, it was her opinion, and that of her assistants, that fourteen of these fifteen patients showed no further advancement in tumor development and several showed possible improvement. Subsequently, it was discovered that the one patient whose condition had deteriorated had not fully understood the instructions. She had stopped wearing sunglasses, but con-

tinued to wear her regular prescription glasses, which blocked the transmission of the ultraviolet portion of the natural sunlight spectrum from entering the eyes.

Since cold weather was approaching, it was not possible for these people to remain outdoors much of the time in the New York City area. So Dr. Wright made arrangements for me to show the time-lapse pictures and explain the story again to the general research staff of the M. D. Anderson Hospital and Tumor Clinic in Houston, Texas, on January 27, 1960. It was hoped that in view of the results obtained with the pilot experiment in New York, a greater number of patients might be kept outdoors under natural daylight conditions without their glasses the year round in a southern climate with a milder temperature.

However, as I presented my story, I became aware that the atmosphere was becoming progressively colder. In fact, the general response, even before I had completed the story, was stone cold. Dr. Wright, in New York City, started to make plans to repeat the experiment there the following summer, but, shortly before the project was scheduled to be started, I received a letter stating that circumstances made it necessary to call off the project. In fact, criticism of the project had been so great that it seemed advisable not to make any further mention of the previous year's experiment at all. The main objections were that no patients were actually used as controls and that any such experimental procedures should be first proven with laboratory animals.

Later in 1959, Dr. Samuel Lee Gabby, Sherman Hospital, Elgin, Illinois, set up a project using the C₃H strain of mice, which are highly susceptible to tumor development. Different lighting conditions were the only variable used.

Following is a summary of his report, dated October 18, 1961:

"Observations on the effects of artificial light on the health and development of mice," by Samuel Lee Gabby, M.D., Senior Staff Member, Sherman Hospital, Elgin, Illinois.

For the past two years the research department of Sherman Hospital, Elgin, Illinois, has been endeavoring to determine the effects of different wavelengths of artificial light on the health and development of mice. The strain of mice used was C₃H/H and J with the original pair coming from the Jackson Memorial Laboratory, Bar Harbor, Maine. The mice were continuously brother-sister inbred. This strain of mouse will spontaneously develop carcinoma of the breast in 98 percent of females and males.

Thirty pairs of test mice were kept in a room lighted only with daylight white fluorescent tubes. Thirty pairs of test mice were kept in another room lighted only with pink fluorescent tubes. As a control experiment, eight pairs were kept in still another room where they received daylight through the ordinary window glass of a basement window.

In the room lighted by pink lights every female developed cancer except one, which died of a liver abnormality, the exact cause of which we could not determine. Of the females in the room lighted by daylight white lights, all but six developed cancer. Two died of liver degeneration. At this date four have not developed cancer and still survive. In both artificially-lighted rooms, the size of cancer growth was approximately the same. However, the females in the pink lighted room all died about a month earlier than those in the room lighted by daylight white bulbs. Those under pink lights stopped breeding about two months earlier than those under daylight white light and their individual litters were smaller. They gave birth to one or two offspring instead of the normal six to fifteen.

The control mice in the daylight cages developed carcinoma of the breast some two months later than the test mice which were kept in daylight white artificial light and three months later than those under pink lights. Two pairs of control mice out of the eight original pairs have not developed carcinoma and still survive.

Our preliminary findings indicate to us that we should make further investigations. We intend to continue our study on the effects of different wavelengths of light energy on animal life.

Also during 1959, Dr. Charles E. Galloway, associated with the Evanston (Illinois) Hospital, and Dr. Charles Huggins, of

the Ben May Cancer Research Laboratory of the University of Chicago, arranged to introduce me to Dr. Katherine Sydnor, who had been conducting a research project with rats at the university for six years.

Dr. Sydnor had been administering carcinogenic chemicals to rats while keeping them under different light conditions. Some were kept in total darkness and others were subjected to various periods of artificial light of two different types. One was daylight incandescent and the other was standard incandescent light. Some of the rats had been blinded and the eye itself removed. Dr. Sydnor was completing the six-year project at the Ben May Laboratory and was planning to move to London, England for a year of study.

During her remaining time at Ben May Dr. Sydnor remarked that the fur of the rats kept in total darkness was soft and smooth in texture but quite thick and fully developed. The same breed of rats exposed to the artificial lights had bristly, coarse fur. Many of the animals under daylight incandescent lights were completely bald on the top of their heads; baldness continued down the ridge of their backs.

Dr. Sydnor also reported that the tumor development in the rats kept under the lights was significantly greater than those maintained in total darkness and that the rats kept under the standard incandescent lights showed considerably more and larger tumor developments than the group kept under daylight incandescent lights. Dr. Sydnor indicated complete surprise with the results and felt it would be necessary to repeat the experiments several times and give the matter further thought before publishing the results.

Early in 1963, I was invited to give a seminar to the medical staff of Evanston Hospital in Evanston, Illinois. Dr. Edward F. Scanlon, head of the Cancer Research Committee, advised me that a project currently under way consisted of injecting hamsters with several different tumor transplants in connec-

tion with their studies of the effectiveness of various anti-tumor drugs. He suggested postponing the drug injections with a particular group of animals if we would select half the animals, at random, and keep them in the air curtain compartment in our laboratory animal quarters, where they would be subjected to natural daylight. The other half would remain in their regular laboratory quarters under cool-white fluorescent lights. Dr. Scanlon and several members of his staff periodically visited our laboratory as the project proceeded.

The results of this experiment showed that the animals that had received a very fast-acting tumor transplant exhibited little difference in the life span between those under the air curtain and those that remained in the regular animal laboratory facilities at the hospital under cool-white fluorescent tubes. However, those animals that received a slower-acting type of tumor transplant did show a significant difference. The animals remaining under the cool-white fluorescent tubes showed an average life span of 29 days, whereas those kept under the air curtain averaged 43 days.

As a result of this preliminary experiment, a proposal for an expanded project in this area was developed which would include larger numbers of animals with different types of tumors with a larger number of controls.

With the unanimous approval of the entire research committee of the hospital, Dr. Scanlon wrote a report, together with a request for a small research grant to carry on further studies, and submitted this to the Illinois branch of the American Cancer Society. The Illinois branch in turn forwarded the report and request to the American Cancer Society headquarters in New York City, and in due course the following reply was received:

In a memorandum under date of December 9 we have received information from the Assistant Vice President for Research at National that

the Advisory Committee has recommended disapproval of this application, with the following comments:

It is proposed to study the effects of visible and near-visible light on the growth of transplantable hamster cancer in hamsters, by exposing inoculated animals to various bands of the spectrum and following the animals through their life spans.

It should be noted that the assay—life span—is a summation of a host of factors not necessarily connected directly with tumor behavior *per se*. The results will be difficult or impossible to interpret in any meaningful way. Any direct effect of light on tumor cells cannot be observed in this study and no evidence exists or is presented to warrant the belief that such exists. No account is taken of the penetration of visible and near-visible radiations into the animal or the tumor cells, nor of thermal and photochemical effects (e.g. burns); statistical precision for meaningful correlations will be insufficient.

While there is every likelihood that exposure to different kinds of light will affect certain physiological response in the animals, they [sic] will only confuse the issue.

Support of this proposal and project as presented is not justified on scientific grounds.

The power and authority of such a distinguished scientific committee is awe inspiring. There is no recourse. Their word is final. Their combined knowledge and wisdom is supreme. But how can anyone be so certain as to what *cannot* cause cancer until it is known what *does*? To say that considering light as a variable would only further confuse the issue is difficult to reconcile with the basic concepts of research.

Being turned down again was discouraging, to say the least, but none of the reasons yet given by any reviewing committee has offered any convincing evidence that light energy might not be a missing link. In fact, all of the reasons given for opposing the suggested light hypothesis indicated to me a great need for additional and determined pursuit of the subject.

The next project sponsored by the Environmental Health and Light Research Institute covered the period from

November 1, 1970, to October 31, 1973. It compared cathode-shielded, full-spectrum fluorescent light versus cool-white, warm-white, pink, and black light fluorescent on the development of Harding-Passey mouse melanoma, and was carried out by T. W. Sery, R. Pollikoff and M. Kaczurowski of the Wills Eye Hospital and Research Institute, Philadelphia.

This study was undertaken in an effort to confirm earlier reports that natural sunlight had an influence on the rate of occurrence of spontaneous mammary tumors in C₃H inbred mice. The Harding-Passey melanoma (HP) in albino BALB/c strain mice was also utilized.

The procedure followed was to inject HP cells subcutaneously in mice in groups totaling up to 80 mice, placing all mice in a single cage for random dispersion and then randomly separating them into groups of 10 mice per cage. Cages were then divided into two or more groups for special lighting conditions.

Tumors which were examined at autopsy were found to be multilobulated in mice which were kept under cool-white light whereas mice kept under shielded, full-spectrum lights tended to be not only single lobed, but fewer in number and smaller in size.

The results indicate that cathode-shielded, full-spectrum fluorescent lighting may be an important environmental factor in slowing down tumor development, and that exposure to increased intensity of near ultraviolet light alone may also have an influence on increasing tumor development.

As yet, there are many unanswered questions in this field. However, one very pertinent point clearly emerges from the studies given here: specific wavelengths of light affect the incidence and severity of tumors in experimental animals, and they may have an effect on tumors in humans.

A more recent addition to the above data was presented at the Fifth International Congress of Radiation Research, held

in Seattle, Washington, July 14-20, 1974. Abstract number A-10-3 is a paper entitled "Illumination and X-Ray Effects on Tumorigenesis in Rodents," by Kiki B. Hellman and C. David Lytle of the Bureau of Radiological Health, Rockville, Maryland.

Female weaning Osborne-Mendel rats were inoculated with an average of $5-10 \times 10^5$ cultured tumor cells; this resulted in 80-100 percent incidence of tumors by seven days after injection. This model was used to investigate the effects of light illumination or X-irradiation on tumor initiation and progression. The inoculated rats were exposed to a 12-hour cycle of overhead illumination from fluorescent lights that were filtered to provide broad wavelength bands of either red or blue light ($100 \mu\text{W}/\text{cm}^2$; 30 foot-candles). Blue light illumination resulted in decreased tumor incidence that was not seen for either the control or red light illumination.

No figures were given to indicate the degree of decreased tumor incidence, but these results appear to confirm the results found by Dr. Sydnor regarding tumor development in rats under standard incandescent lights as compared to rats under daylight incandescent lights. This pattern also showed itself in the experiments performed by Dr. Gabby in the comparison between the pink fluorescent lights and the daylight white fluorescent lights.

Most of the foregoing information has been published in many of the different articles listed in the bibliography, and much of it is in *Health and Light*. I am hopeful that by putting it all together in this chapter, it may be more obvious that light is the missing link in cancer research.

To me, the major inconsistency in present-day cancer research is that in spite of all the "breakthroughs" and claims for improved methods of both detection and treatment, and the billions of dollars spent, the cancer death rate is continuing to rise at an alarming rate. Whereas, according to the latest U.S.

Public Health figures (1978), all the other diseases show decreases—except influenza, which remains unchanged for the period 1970–78.

It is difficult to reconcile with the general concepts of cancer research the fact that the findings reported by six major medical centers that light influences the rate, size, and number of tumors in laboratory animals is being completely ignored by both the National Cancer Institute and the American Cancer Society.

In an interview by Joel Greenburg, science writer for the *Miami Herald*, Dr. Bayard Morrison, Assistant Director of the National Cancer Institute, said, "No one here is involved in that kind of research. There is no built-in bias against Dr. Ott or anyone else; it's just that his proposals have not been relevant to ongoing work."

However, I am apparently not the only person with proposals that are not relevant to the ongoing work or narrow limitations imposed on cancer research by the peer review committees of the National Cancer Institute. I quote from a recent newspaper article:

"The National Foundation for Cancer Research is a private organization that primarily funds the work of Dr. Albert Szent-Gyorgyi" (a two-time Nobel Prize winner) said a spokeswoman for the Cancer Information Service of the University of Miami School of Medicine."

The spokeswoman further noted ". . . that the foundation had applied in 1973 and again in 1975 for a grant from the National Cancer Institute. The earlier grant, though approved, wasn't funded. The 1975 application, for research into electronic states and cancer, 'was unable to be approved on the basis of scientific merit.'"

The identity of the peers on the N.C.I. Review Committee seems to be classified information, guarded more rigidly than national defense secret information that reaches the press

quite regularly. I sincerely hope that the committee members are truly qualified to tell scientists like Dr. Szent-Gyorgyi which areas of cancer research they may investigate and which they may not.

All the foregoing represents statistics only, and statistics by themselves can get pretty boring. I have heard that one picture is more realistic and worth 10,000 words. If so, the following sequence ought to equal quite a few words, including a lot of statistics.

These pictures show a five-year-old girl named Sara, and the following information has been given to me in a report on Sara's case by Leslie H. Salov, M.D., director of The Vision and Health Center of Whitewater, Wisconsin:

In the latter part of August 1978, Mrs. K., mother of Sara (who at that time was 4½ years old) noticed the sudden onset of a protrusion of the child's left eye. This protrusion is called a proptosis. With the protrusion, the eye became very inflamed, red, and the lids swollen. In the following three days the eye continued to push out from the orbit rather rapidly until the eye protruded out of its socket almost three quarters of an inch. The eye was grotesque and the parents became alarmed by the appearance as well as the significance of what this condition might mean.

The child was taken to see an ophthalmologist. Several visits and examinations by other ophthalmologists followed in succession, as well as consultations with a neuro-ophthalmologist and pediatricians. The child was hospitalized and put on several different kinds of medications. After several days of the use of these medications, hemorrhaging occurred and the medications were discontinued.

Let me explain what can cause protrusion of the eye. This can result from orbital inflammation, edema, tumors, injuries, congenital glaucoma, thrombosis of the sinus caverns or even extremely high myopia (nearsightedness). There is also the consideration of hyperthyroidism which results in edema and lymphoid infiltration of the orbital tissues and this can cause the protrusion of either one or both eyeballs. (Protrusion is also called exophthalmos). Another possibility could have been an arteriovenous blockage or aneurysm which involves the internal carotid artery (one of the main arteries leading from the heart and going up to the brain). Because of all these possible differential diagnoses in

Sara's case, extensive neuro-scanning as well as angiograms were performed. An angiogram is the injection of contrast material (a dye) injected through a needle into the blood stream. This procedure necessitates the careful choice of the contrast material, its viscosity, lack of toxicity and efficiency of opacification. Iodinated compounds are usually used. The contrast material travels through the blood stream, and in Sara's case, through the circulation in and around the orbit. X-rays are then taken at six times per second of the blood as it passes through the blood stream. This will indicate where there might be an obstruction, tumor, etc. Since the film exposure cannot be seen during the injections, the adequacy of timing and injections is not known until the films are developed. All contrast media are hypertonic and are excreted by the kidneys. There are complications which can develop with such a procedure, but as in all invasive diagnostic tests, the risks must be calculated.

As a result of these tests it was determined that Sara did indeed have five blood tumors—called lymphangiomas—behind the left eyeball and that these tumors were pressing on the veins and optic nerve, causing the pushing out of the eyeball. If this condition were to continue, the pressure would soon kill off the optic nerve and the result would be blindness in that eye.

There followed at this time several surgical procedures which included a biopsy, a temporalectomy, and orbitotomy, and decompression of the left eye was also tried. In an attempt to get at the tumors, one of the surgical procedures, the temporalectomy, required incising the left temporal bone. The child survived all of the surgeries, but none of the procedures was successful, nor were the efforts to decompress the protruding eye. Sara's proptosis did not improve, but seemed to be getting worse. By this time, Sara's vision in her left eye had deteriorated to her ability to see only hand motions when the hand was held within inches of her left eye. The eye protruded out of her socket more than $\frac{3}{4}$ of an inch now.

The then-attending ophthalmologists and surgeons advised the parents that there was "nothing more that could be done" and that the prognosis was poor. It was suggested that they wait until the left eyeball was completely exposed out of the socket and then they would go in surgically through the front and remove the left eyeball and the entire mass and total contents of the left orbit, and in this way remove all the tumors. The parents were devastated. The thought of their little girl losing an eye was tragic for them even to contemplate.

It was just about this time that Mrs. K. happened to see a notice of a

lecture being given by me on November 4, 1978, where I would be speaking on "Wholistic Ophthalmology." Both parents attended the lecture and afterward came up to me and told the story of their child and asked if there was "anything that could be done for her." In my experience treating eye and health problems, I have found that sometimes there is hope—even when a patient has been told that "there is no hope." But before I could even suggest bringing the child to Vision and Health Center in Wisconsin for ophthalmological examination and evaluation, I told the parents I would like to speak with the little girl. It was my feeling that if there was any possibility of being able to do anything, I would first have to find out what kind of a child Sara was—because a child that young, under normal circumstances, would be unable to follow a regimen of a wholistic approach which would mean the complete cooperation of the child in following directions and guidance.

After spending several hours with Sara, having her sit on my knee and establishing a kind of grandfather-granddaughter relationship, talking to her, I was convinced that here was no ordinary average 4½-year-old. I had the intuitive feeling that this little girl would be able to follow directions and would be able to cooperate if indeed I should find that I could help her. It was then—and only then—that I advised the parents that it would be necessary to bring the child out to our Vision and Health Center in Wisconsin and they would have to spend the entire day with me—just the parents, Sara and myself—starting at 8:00 a.m. until 6 o'clock in the evening.

Prior to their visit, I requested all of the medical and surgical reports to be forwarded to me from the previous doctors and hospitals. The child was brought to our Center and the day was spent examining the child, explaining to the child about her eye problem in simple language. She understood exactly what I explained to her and had the intelligence and ability to understand about the treatment and therapies that I had in mind for her to do. Again, I had the strong intuitive feeling that this child was very special, and she would be able to do exactly as I wanted. She understood so well that when she went home after spending the entire day with me, she drew a picture of what I had explained to her was in the back of her eye.

I demonstrated a technique to her called visual imagery, which was one of the modalities that I had in mind for her. I explained that she was going to look at the picture that she had drawn of the five tumors behind her eye and that her mother was going to give her a pail and a bulb which would be filled with red water. She was then going to imagine that when

she squeezed the bulb that had the red water in it, she would "see" the red water go down into the pail . . . and that she would imagine that those tumors behind her eye were like the bulb, and when the bulb was squeezed the bulb would get smaller and smaller as the red water came out of it—just like the tumors behind her eyeball.

When I asked her to repeat what I had told her, this is what she said: "My mommy is going to give me a rubber bulb that has red water in it and she is going to give me a pail. Then I am going to make believe that the bulb is those bags of blood in my eye and when I squeeze the bulb the bags of blood are going to get smaller and smaller." The amazing interpretation of her repeating the instructions was that *she substituted* red water to "blood," and her imagination was so vivid and the demonstration so real to her that I had no further qualms about any of the other therapies that I was going to institute for her.

To explain medically and scientifically the value of the "visual imagery" that we used, we know that as a wholistic modality, "visualization or visual imagery or mental imagery" is a powerful tool, and as visualization and expectancy are attached to one's own volitional effort, the skill is developed and embodies genuine self-regulation of the autonomic nervous system. This, in turn, can affect organic and functional changes in one's body. This has been proven time and time again with biofeedback instrumentation, as demonstrated by Drs. Elmer and Alyce Green at the Menninger Clinic, Carl O. Simonton, M.D., oncologist, as well as in hospitals, medical schools, etc. throughout the world.

We advised both Sara and the parents of our wholistic (holistic meaning "entire") concept and from that point on, we had the complete cooperation of both Sara and her mother and father.

Sara was then placed on an intensive program which consisted of a variety of therapies and modalities, some of which included: light therapy, color therapy, sound therapy, the highest and purest of nutrition which excluded all additives, chemicals, denatured foods; vitamin therapy, special exercises, relaxation procedures, deep rhythmic abdominal breathing exercises, guided imagery and other modalities. Even during the winter months of December of 1978 and January-February of 1979, the child was exposed to sunlight under controlled conditions, with her head bare, to receive the light and full spectrum and cosmic energy into her eyes and whole body, not only through the photoreceptors in her eyes, but the additional photoreceptors that we are now sure are present in the brain and skin of the entire body.

Sara and her parents were unbelievably cooperative. The progress was gratifying.

It is said that "pictures can say more than a thousand words" and by the progression of these photos [see illustrations] from November 1978, when we first saw Sara, to December 1979, the progress and absorption of the tumors from behind the left eye, as well as the restoration of the positioning of the eye so that it is now in its normal depth in the orbit, can be seen.

Sara's vision at the present time in her left eye is gradually approaching normal. She continues under treatment for further vision improvement.

This patient is an inspiring example of the wholistic approach in rehabilitating an eye condition even as severe as this one, which did not respond to traditional medical or surgical intervention.

It is of the utmost importance to say that the great understanding, cooperation, dedication and love of the parents and all those involved in caring for Sara played a major role in her recovery.

Leslie H. Salov, M.D.

I asked Dr. Salov more about the light therapy and color therapy mentioned in his report, and he explained that he had her wear blue clothes and her room was redecorated in blue. She took off her clothes and sat in a blue cloth tent in her room four times a day for fifteen minutes, and she also regularly went outdoors in the sunlight four times each day, for at least fifteen minutes during the coldest weather and longer when weather permitted. She did not watch television.

The following are reproductions of two letters regarding Sara:

July 31, 1979

The Honorable Patricia Harris
Secretary
Department of Health, Education and Welfare
200 Independence Avenue
Washington, D.C. 20201

Dear Madam Secretary:

Enclosed are several photographs showing improvement in the left

eye of a five-year-old girl from tumor mass, which was diagnosed through biopsy as lymphangioma. She had been operated on three times to remove the tumor mass without success, and the surgeon recommended removal of the eye and all orbital tissue.

At this point, her parents placed her under the care of Dr. Leslie Salov, an ophthalmologist, located in Whitewater, Wisconsin. Dr. Salov terminated all traditional medication and placed the little girl on a high nutritional, natural food diet and light therapy program. The light therapy consisted of using blue light as is now common in treatment of jaundice in premature babies, and also especially natural sunlight.

Also enclosed are copies of several newspaper articles and a reprint entitled, "The Eyes' Dual Function" from *Eye, Ear, Nose and Throat*, giving more details of the studies confirming the effects of light on tumor development which were done at six recognized major medical centers.

I am also enclosing an autographed copy of my book *Health and Light*, with the full story including the continuing negative response from the National Cancer Institute to the written report signed by the medical doctors in charge of cancer research at the six medical schools and hospitals mentioned above.

I am bringing this matter to your attention with the hope that you may be able, through the Department of Health, Education and Welfare, to emphasize the urgent need to include light as a variable in cancer research and under scientific control, rather than being left up to the janitor as is being done in virtually all research laboratories at the present time.

I hope you will have time in your busy schedule to give some consideration to these enclosures.

Very sincerely,

John Ott, Sc.D. (Hon.)

August 24, 1979

Dear Dr. Ott:

Ms. Patricia Harris, Secretary of the Department of Health, Education, and Welfare, has asked the National Cancer Institute (NCI) to respond to your recent letter in which you enclose various papers relating to your work in the field of photobiology. I appreciate this opportunity to review these documents and your book, *Health and Light*, which you also were good enough to send.

In your letter you urge that light be studied as a variable in cancer research. I think that your book and the additional materials you sent serve to illustrate the increasing attention being paid to this area of research. Dr. Thomas J. Dougherty of Roswell Park Memorial Institute is, for example, an NCI grantee working with photoradiation therapy for cancer. I have enclosed the abstract of a paper on the subject that he presented at the April 1978 meeting of ASCO. I suspect that the National Institutes of Health (NIH) is supporting a considerable amount of other work relating to the biologic effects of visible and ultraviolet light.

We have no record that you have submitted research proposals to NIC in recent years, but emphasize that any proposal submitted will be evaluated critically and fairly. Inasmuch as the sum of research funds requested far exceeds the amount of money available to fund research applications, less than fifty percent of approved new proposals can be funded. The review of research proposals is conducted not by NIH personnel, but rather by non-Government people who, through a rigorous dual review system, assign priorities in terms of quality of science, adequacy of facilities, scientific relevance and promise, and qualifications of the investigator.

You probably do not remember, but I was one of those present when you described your work to some members of the NCI staff in 1972. I also had the opportunity to chat with you on another occasion. We are much aware of the prominent role you have played in illuminating and drawing attention to a largely unexplored field.

I hope my comments will be useful to you. Please let me know if I can be of any further assistance.

Sincerely yours,

Bayard H. Morrison III, M.D.
 Assistant Director
 National Cancer Institute
 Department of Health, Education, and Welfare
 Public Health Service
 National Institutes of Health
 Bethesda, Maryland 20014

Following is another letter of interest from my files:

October 6, 1977

Dear Dr. Ott:

I came to know of your work concerning the effect of light of different wavelengths on plants and animals through a lecture that you gave at the National Institutes of Health in Bethesda, Maryland and through reading your book entitled "Health and Light." I have also read your manuscript entitled "The Importance of Laboratory Lighting as an Experimental Variable."

I recently came to the National Institute of Environmental Health Sciences to take over as Chief of the Laboratory of Environmental Biophysics. Our laboratory is concerned with the effects of physical factors including nonionizing radiation and noise on man and other experimental animals. At the present time we do not have any program to study the effect of light as a biological agent affecting man. However, we are considering setting up a program to study the effect of light on experimental animals and their response to different environmental agents. In your book and in your manuscript, you make reference to studies involving the effect of light of different wavelengths on spontaneous tumor development in C_3H mice. These experiments seem to indicate that different wavelengths of light energy do indeed influence the time required for spontaneous tumor development in C_3H mice. I would very much like to know whether the study was finally published and whether these studies are continuing.

Sincerely,

Colin F. Chignell, Ph.D., Chief
Laboratory of Environmental Biophysics
Department of Health, Education, and Welfare
Public Health Service
National Institute of Environmental Health Sciences
Research Triangle Park, NC 27709

As a result of the above letter, I gave two seminars at the Laboratory of Environmental Biophysics, N.I.E.H.S. in Research Triangle Park, N.C. and following is another most encouraging letter from Dr. Chignell:

May 15, 1981

Dear John:

Enclosed you will find a preprint of our paper entitled "The Effect of Different Types of Fluorescent Lighting on Reproduction and Tumor Development in the C_3H Mouse." The manuscript has been submitted to *Photochemistry and Photobiology* for publication. As you will see we did find some effects on both tumor development time and reproduction in the cool white and pink groups. Since the C_3H mouse suffers from progressive retinal degeneration which is complete at the time of weaning, it is not apparent whether the observed changes are mediated via the eyes or the skin.

Best wishes.

Sincerely yours,

Colin F. Chignell, Ph.D., Chief,
Laboratory of Environmental Biophysics

Additional encouraging published articles are listed as follows:

- "Mutagenicity and Toxicity of Visible Fluorescent Light to Cultured Mammalian Cells," Matthews O. Bradley and Nancy A. Sharkey, *Nature*, Vol. 266, 21 April 1977, pp. 724-726.
- "Influence of Visible Light on Organ Weights of Mice," Cora G. Saltarelli and Christine P. Coppola, *Laboratory Animal Science*, Vol. 29, No. 3, June 1979, pp. 319-322.
- "Spectral Power Distribution of Light Sources Affects Growth and Development of Rats," Yoshisuke Ozaki and Richard J. Wurtman, *Photochemistry and Photobiology*, Vol. 29, 5 July 1978, pp. 339-341.
- "Phototoxicity, The Neglected Factor," Dennis P. Valenzano, Ph.D., and John P. Pooler, Ph.D., *JAMA*, Vol. 242, No. 5, Aug. 3, 1979, pp. 453-454.
- "Uremic Pruritus Treated with Ultraviolet Light," Bryan C. Shultz, M.D. and Henry H. Roenigk, Jr., M.D., *JAMA*, Vol. 243, No. 18, May 9, 1980, pp. 1836-1837.
- "Fluorescent Light Induces Malignant Transformation in Mouse Embryo Cell Cultures," Ann R. Kennedy, Mark A. Ritter and John B. Little, *Science*, Vol. 207, 14 March 1980, pp. 1209-1211.

"Ionizing Radiation from Tinted Single Vision Spectacle Lenses," J. Louis Pecora, M.D. and James Brownridge, *Journal of the American Optometric Association*, Vol. 51, Number 1, 1/80, pp. 44-45.

"Blue Light and Bilirubin Excretion," Antony F. McDonagh, Lucita A. Palma and David A. Lightner, *Science*, Vol. 208, 11 April 1980, pp. 145-151.

"Food Dyes Impair Performance of Hyperactive Children on a Laboratory Learning Test," James M. Swanson and Marcel Kinsbourne, *Science*, Vol. 207, 28 March 1980, pp. 1485-1487.

Note: The above article mentions using a placebo (sugar) for comparison of results with various artificial food dyes.

"Behavioral Responses to Artificial Food Colors," Bernard Weiss, J. Hicks Williams, Sheldon Margen, Barbara Abrams, Bette Caan, L. Jay Citron, Christopher Cox, Jane McKibben, Dale Ogar and Stephen Schultz, *Science*, Vol. 207, 28 March 1980, pp. 1487-1489.

"Neurotransmitter Release from a Vertebrate Neuromuscular Synapse Affected by a Food Dye," George J. Augustine, Jr. and Herbert Levitan, *Science*, Vol. 207, 28 March 1980, pp. 1489-1490.

9 RESISTANCE TO CHANGE IN CANCER RESEARCH

B-1 BOMBERS? No! Airplanes are out of date. No longer orthodox. Cruise missiles now.

What would Billy Mitchell have thought about that after all the trouble he had in trying to convince the Army to try using airplanes to drop bombs on the enemy?

Streetcars? When I started working as a security analyst in the trust department of a large Chicago bank, streetcar bonds were on the approved list of securities suitable for the investment of widows' and orphans' trust funds. They were sound securities with a good outlook for future earnings, and recommended highly by our Senior Trust Investment Committee.

What do you imagine would have been their response if I had submitted a report criticizing the future outlook of the Chicago Streetcar System, and talked about men going to the moon in a rocket and back to earth again, landing a couple of robot laboratories on Mars to study soil samples for signs of life, and sending back color pictures and detailed information and talking with the men on the moon and—enough! Get rid of that lunatic. He should be locked up for good! At that time, the expression “crazy

as talking about Man going to the moon" was used to convey the ultimate of the ridiculous and the impossible.

Then what about suggesting that wearing pink-tinted contact lenses might cause cancer? Well, that might need a little explaining, too. On the face of it, it seems almost too ridiculous to waste the time, money, and effort to bother with when there are so many other important and more orthodox areas of cancer research to be investigated.

Our Senior Trust Investment Committee was comprised of experts, men who had spent years studying the problems associated with investing money; they were experienced in all kinds of investment securities; they had followed the development and progress of the Chicago Streetcar System since its inception and were thoroughly familiar with both its management and operation. They had all graduated from college with top honors and degrees. Certainly it would not be prudent to ask a streetcar motorman or mechanic anything about running the company.

There have been stories about the office boy becoming president, but these are exceptions to the general rule, and office boys should certainly not be depended on for making management decisions until they do become president. This is just the way things are, the way the ball rolls. This is the orthodox way to run a bank or a streetcar system or anything else, including cancer research.

Like our Senior Trust Investment Committee, it is quite logical that doctors with the highest honors and degrees should be on the Medical Review Committees. They know the medical literature on cancer backward and forward. They have virtually memorized it, and nothing about tinted lenses, sun glasses, or artificial light has ever been mentioned in medical school. Very little was ever mentioned about nutrition either. So why get excited about tinted lenses and light when there are so many other possible causes of cancer constantly being reported by

orthodox researchers all the time? So many things we eat, breathe, or otherwise come in daily contact with are now hazardous to your health. It has almost reached the point where the normal life process is hazardous, because ultimately you are going to die. Of course, the real question is when. At what age? Ten, sixty-five, or one hundred and ten?

But why should there always be such antagonism and opposition to any and all new ideas unless they can be supported by the literature? It seems to me that one serious fallacy in our present approach to orthodox cancer research lies in the fact that the answer may not be in the literature. We may have to look elsewhere for it. My ideas may be overly naive, but I would suggest looking into the case histories of the people who have experienced complete recovery from cancer. I would talk with their doctors and compare the various types of treatment used, changes made in the patients' daily routine and environmental exposure instead of threatening to revoke the doctor's license for having used an unorthodox treatment. More emphasis should be placed on the results.

I think there is some unrecognized reason for so-called spontaneous remissions in cancer, and a greater effort should be made to find out what it might have been. I also question whether the type of treatment to be used should be a matter for the Supreme Court to decide. In the early days of medicine, holes were drilled in the skulls of mentally ill people to let the demons out. And during the early days of our country, bloodletting was a very common practice for the treatment of the ill. Today, transfusions are given. If the answer to cancer is in the literature, then some of our most scholarly students would surely have found it by now.

Memory and the photographic mind are unquestionably important qualities. The person with the best memory may come up with all the right answers in the final college exams, but he or she may still lack the aggressiveness necessary for a new ap-

proach to do things differently. Maybe the answer, when eventually found, won't be exactly orthodox, as far as present-day thinking is concerned. Think of the humiliation and disgrace under present-day standards if an educated expert did try something new and different, and was wrong, and lost his job for making such a mistake. Just like the security analyst, the researcher's job is made much more secure by being conservative and doing nothing that might rock the boat.

Serendipity and empirical are words that should be taken more seriously and not just shrugged off as a joke. Webster's dictionary defines serendipity as "the finding of things not sought for" and empirical as "relying on experience or observations alone without proper regard for considerations of systems, science, and theory."

Too many scholars with excellent memories and photographic minds lack the initiative or ability to fully apply their knowledge, or they are afraid to speak their minds for fear of criticism or ostracism by their colleagues.

When NASA started the space program, none of the transportation experts on our trust investment committee were asked to help design the rockets. What do you think a symphony orchestra made up of all the top music critics would sound like? But that is just the kind of music we are getting from the peers on the cancer review committee. You seldom find a historian making history.

Until the answer to cancer is found, how can anyone be certain that tinted lenses or any other hypothesis is wrong? Too many scientists are ultra-conservative in their own views as to what may cause cancer, but they speak out unequivocally and confidently in stating what could not possibly be a contributing factor. What is desperately needed is better communications and more open discussions on the subject, bearing in mind Webster's definition of "research" as "a critical and exhaustive examination having for its aim the discovery of new facts and

their correct interpretation, the revision of accepted conclusions, theories or laws in the light of newly discovered facts, or the practical application of such new or revised conclusions, theories or laws."

Many of the great discoveries of the past have come about accidentally. But whether the discovery is accidental or the result of long studious hours of work, the results always seem to meet resistance by those reluctant to give up the old ideas for new. There is still a society for preservation of the belief that the world is flat.

10 TWO SIDES TO EVERY STORY

IT MAY BE difficult to present adequately the opposing side of what you honestly believe yourself without prejudice, but I will try.

In the early 1960s, Kenneth E. Keuter, who was in charge of caring for all the laboratory animals at Abbott Laboratories in North Chicago and very active in all the research done at Abbott with laboratory animals, worked with me unofficially, during his off-hours, on the first major study of the effects of different types of light on laboratory animals. We did this at my "backyard laboratory" in Lake Bluff, Illinois, which was adjacent to North Chicago, where Abbott's headquarters were located.

We jointly presented the results at the 15th Annual Meeting of the Animal Care Panel of the American Association for Laboratory Animal Sciences held at the Edgewater Beach Hotel in Chicago in 1964. Our paper, mentioning the effects of different kinds of fluorescent light on tumor development, sex ratio, and other physiological processes, was very fully and accurately reported by the *Medical Tribune* in the issue of October 19, 1964.

Two years later, at the 17th Annual Meeting of the same organization held at the Edgewater Beach Hotel in 1966, R. J.

Blinzley and W. L. Hafley—both of Westinghouse Research—reported that they could not observe any significant trends or indications as the result of keeping laboratory animals under different types of fluorescent light.

When I first reported finding X-rays coming from television sets, Charles J. Hirsch, head of research for RCA, sent out the following letter:

RADIO CORPORATION OF AMERICA PRINCETON, N.J.

November 3, 1966

Mr. Rexford Daniels
Mr. Carl B. Braestrup
Dr. Herbert Stauffer
Dr. Clifford E. Nelson
Mr. Henry Rechen

Gentlemen:

The attached statement is sent by RCA in answer to individual inquiry regarding Mr. John N. Ott's statements about alleged biological effects from color television sets.

This statement is transmitted for your information.

Sincerely,

Charles J. Hirsch

November 2, 1966

Alleged Effects of Radiation from Color Television Sets

At various times, Mr. John Ott, an eminent time-lapse photographer, has made statements, which were reported by the press, regarding the possible harmful effects of radiation from color television sets. The following statement was prepared as a reply to Mr. Ott.

To limit the X-ray dosage received by television viewers to a very small fraction of that received from the normal background, the National Council for Radiation Protection and Measurements (NCRP) recommended that the

emission of X-rays should not exceed 0.5 milliroentgens per hour at a distance of two inches from any accessible part of a television set. (One milliroentgen is the equivalent of one millirem of any type of ionizing radiation in producing biological damage.)

Normal background ionizing radiation from surroundings averages 100 millirems per year, although it may reach 200 millirems per year in some places, such as Denver, Colorado. The Federal Radiation Council recommends that exposure of the whole body of individuals in the general population shall not exceed 500 millirems per year from all man-made causes except for deliberate medical reasons. The Radiation Code of most states follow this recommendation.

Television set manufacturers have long been concerned that the level of X-rays from any accessible part of television sets shall not exceed the level specified by NCRP and have taken steps to that effect. For example, a typical 25-inch color television set operated under normal conditions emits about one tenth of that level (0.05 mr./hr.) from the screen. The remainder of the picture tube is shielded so that the radiation level from the rest of the set is too low to be measured.

A child located only 40 inches (one meter) from this typical set and watching three hours per day would accumulate in one year only four millirems from the television set and 100 millirems from the floor, walls, etc. for a total of 104 millirems. If he sits 80 inches (two meters) from this set, he receives only 1.0 millirem from the television set and 100 millirems from his surroundings. He may absorb more ionizing radiation from the sand when lying on the beach. This dosage is far less than if he lived in Denver where most children are quite healthy, in spite of the higher level of radiation.

In view of repeated statements in the press, attributed to Mr. Ott, a request was made to an independent pathological laboratory to check the validity of Mr. Ott's test results on rats and plants. This laboratory is directed by an eminent pathologist connected with several hospitals. Experts on plants from a large university were also consulted by the laboratory. Histological examinations were performed on the sternum, spleen, ileum, gonad, and brain of a large number of rats. The pathologist's summary follows.

Summary of Work "Experiments designed to duplicate the work of Mr. John Ott, in which bush beans and rats were raised directly in front of color television sets, failed to yield the results he obtained. The growth and behavior of our plants and animals fell within normal limits and our statistical samples were of larger magnitude than his.

Weaning Wistar rats, all located within 24 inches of a color television set operating eight hours per day, developed normally and produced normal offspring who in turn developed and produced another generation of offspring whose behavior and anatomy were normal. Likewise, bush bean seedlings and Tradescantia cuttings similarly exposed grew to maturity and reproduced without demonstrable abnormal morphology.

Note: The ionizing radiation from late model 25-inch sets is closer to 0.01 mr per hour than to 0.05 mr per hour used above for conservative reasons. This means that at viewing distances of 40 inches and 80 inches, the ionizing radiation from the television set is one fifth of the levels mentioned above or 0.8 and 0.2 millirems respectively. The ionizing radiation due to surroundings averages 100 millirems.

I offered to let RCA test the TV sets I was using in my experiments, but my offer was not accepted. Chapter 12 in *Health and Light* gives the complete TV radiation story about the many thousands of TV sets of different makes and models that were recalled because they were found to be giving off X-radiation in excess of government safety limitations. As recorded in the *Congressional Record*, the highest level found was 1.6 million times greater than the permissible level of .5 milliroentgens per hour, which had been lowered nine times since the original safety level for exposure to X-rays of 25 roentgens per 24 hours was first established shortly after their discovery in 1895 by Wilhelm Roöntgen. As a result of my further studies, I firmly believe that the present safety level needs to be substantially lowered.

When I reported finding two types of radiation coming from fluorescent lights, there were a number of articles that appeared challenging this finding, including one entitled "We Cannot Believe . . ." by C. L. Crouch, Director of Research of the Illuminating Engineering Research Institute, which is sponsored by the Illuminating Engineering Society. It was published in the *Human Factors Society Bulletin*, April 1975.

In his article, Crouch states that "John Ott is currently claiming that normal fluorescent lighting is causing irritability and

hyperactivity in school. We cannot believe at this point that fluorescent lighting, which has been in wide use since the early 1940s, is causing such a disturbance of physiological and psychological effects as Ott indicates. If this were true, people would have been severely handicapped in being efficient in learning or working in offices, schools, libraries and industry."

I was particularly pleased to be invited by the editor of the *Human Factors Society Bulletin* to submit a reply to Mr. Crouch's article and also that Dr. Bernard Rimland, noted author on child behavior and director of the Institute for Child Behavior Research, San Diego, California, assisted me in preparing my reply which appeared in the same issue of the *Bulletin* as Mr. Crouch's article.

Mr. Crouch stresses that if fluorescent lighting caused any such psychological or physiological disturbances as I have suggested, there should be some evidence of it in school children and office workers by now, since this type of lighting has been in wide use since the early 1940s. Apparently, he is not aware of any such problems as an increase in the rate of hyperactivity, crime and violence, and the downward trend in the high school and college student aptitude tests.

The November 1973 issue of *Lighting Design and Application*, published by the Illuminating Engineering Society, contained a section on the subject of photobiology.

The first article by Luke Thorington, vice president of engineering of the Duro-Test Corp., manufacturer of Vita-Lite, was entitled "Light, Biology, and People." The subtitle reads, "It is not possible to provide light only for vision." In the article he states, "We are now only beginning to appreciate the extent to which light continues to influence higher forms of life, including humans."

The next article was written by Sylvester Guth, manager of applied research, Large Lamp Department, General Electric Company, Nela Park, Cleveland, Ohio, and was entitled "Some

Observations on the Biological Effects of Light"—subtitle, "Although laboratory tests have indicated ill effects on rats and similar animals, such tests were not conducted in real-life situations."

Dr. Guth states that "Many biologists and others speak glibly of the desirability of duplicating natural daylight, implying that this is fixed in terms of spectral quality and amount—whereas it actually is variable in many respects." Dr. Guth also includes a subheadline: "Pink fluorescent lamps meant fewer fertile eggs, until it was discovered the rooster was sterile!" The study, involving the problem of infertile eggs, was reported by the research staff at the Quaker Oats Research Farm near Chicago, a project in which I participated.

The third article was by Richard Corth, a fellow engineer in the Fluorescent and Vapor Lamp Division of Westinghouse Electric Corp., Bloomfield, N.J., and Roger A. Hoffman, professor of biology, Colgate University, Hamilton, N.Y. The title of their article was "Does Artificial Light Affect Man's Health? Probably Not." The subtitle reads: "The authors find no evidence that the spectral power distribution of artificial illumination is implicated in man's health. Furthermore, they find that the influence of light on mammals depends on the number of quanta absorbed in the retina, rather than on wavelength or radiant energy of the source. Also, data suggest a possible detrimental effect of high-intensity light on nocturnal animals."

Two additional articles dealt only with the effect of artificial light on commercial plant growth and indicated that the "day may not be too far off when commercially produced plants will be grown entirely under combinations of H.I.D. (high intensity discharge) light sources, independent of natural daylight."

In early 1976, three representatives of General Electric research and marketing visited me. This was prior to my re-

tirement as director of the Environmental Health and Light Research Institute in Sarasota. I showed them the classrooms where our light studies were done under the control of Dr. Lewis Mayron et al. They examined the radiation shielding and full spectrum tubes that were used. We discussed the results of the study in detail. They took copies of the final report, all published papers, and the time-lapse pictures of the children back to G.E. Research Headquarters at Nela Park. They said they were interested in supporting further research and would recommend E.H.L.R.I. to the General Electric Foundation that makes grants for such purposes.

All of us at E.H.L.R.I. were quite encouraged and optimistic with the prospects of possible funding to support further studies. At least, we were encouraged until I received a letter from the editor of *The Journal of Abnormal Child Psychology*, enclosing a copy of a paper entitled "Fluorescent Lighting: A Purported Source of Hyperactive Behavior," submitted by K. Daniel O'Leary and Alan Rosenbaum of the State University of New York, Stony Brook, and Philip C. Hughes of General Electric.

The editor of the *Journal* also sent me an invitation to submit a rebuttal, which I greatly appreciated. I asked Dr. Mayron, who had acted as chief investigator in charge of the E.H.L.R.I. study, to write the rebuttal, which the editor then submitted to the Stony Brook-G.E. group for their further comments. All three papers were then published in Vol. 6, No. 3, 1978 issue of the *Journal*. I thought this was an extremely courteous and fair way for the editor to handle the matter.

Dr. Mayron pointed out numerous instances in which the procedures used in the Stony Brook-G.E. study varied significantly from those of the E.H.L.R.I. study. Possibly of greatest interest was the fact that the E.H.L.R.I. study in-

volved four regular elementary windowless classrooms, two with the standard type of fluorescent cool-white tubes and two with the new improved full spectrum, radiation-shielded fluorescent fixtures. There were forty-eight children in the two rooms lighted with standard cool-white tubes and fifty children in the two rooms with the new full spectrum, radiation-shielded lighting. Time-lapse pictures taken with hidden cameras at monthly intervals during the full school term produced a permanent record of the children's actions that could be reexamined as many times as necessary. The significant results as reported in the E.H.L.R.I. study became evident in the children under the two different lighting conditions after sixty to ninety days.

The O'Leary-G.E. study used only seven children in one classroom with windows and shades pulled down to six inches from the bottom of the windows, thus allowing considerable daylight into the room even though it was filtered through the glass. The O'Leary-G.E. study used different types of fluorescent tubes for both types of full spectrum and standard lighting conditions, plus a different type of radiation shielding of their own design. The lighting in the one classroom was then changed each week back and forth for an eight-week period (56 days) so that the children were not under either type of light for more than five days (one school week) at a time. Two observers marked down the children's activity and the conclusion was that "no effect of lighting condition and hyperactive behavior was evident."

While the O'Leary-G.E. study did not confirm our E.H.L.R.I. findings, two schools in California and one in Washington State did carry out their own separate studies that confirmed a relationship between hyperactivity and fluorescent lights. Further details of these three separate studies are as follows:

COUNTY OFFICE OF EDUCATION
RICHARD R. FICKEL, SUPERINTENDENT
SANTA CRUZ, CALIFORNIA

FOR IMMEDIATE RELEASE

July 7, 1975

FLUORESCENT LIGHTS AND HYPERACTIVITY IN CHILDREN:
AN EXPERIMENT

Do fluorescent lights—the kind used in almost every classroom in the country—increase the agitated behavior of hyperactive children? An experiment recently conducted by a Santa Cruz school teacher suggests that such indeed may be the case.

When Mrs. Burnis Lyons, employed by the Santa Cruz County Office of Education as a teacher of the handicapped, turned off the fluorescent lights in her classroom and substituted incandescent lights, the hyperactive behavior of her pupils decreased by 32.3%.

Mrs. Lyons teaches a class of nine children variously diagnosed as autistic and emotionally disturbed, many of whom exhibit symptoms of marked hyperactivity. The special classroom, at Green Acres elementary school, is lit by conventional, bright, cool-white fluorescent lights—the same sort that are generally used in schools, offices and public buildings.

The experimental design was simple: for one week, at the same time every day, for one hour, a qualified observer sat quietly at the rear of the room, counting the incidents of hyperkinetic activity that occurred. The kinds of behavior scored were defined and agreed upon beforehand: jumping up and walking around inappropriately, standing on chairs, yelling, inappropriate clapping, hitting teachers, classmates or self, grabbing another's possessions, or behaving in a disruptive manner that elicited a reprimand from the teacher.

A total of 297 such incidents were counted during the week.

The following week the fluorescent lighting was turned off and incandescent lamps—ordinary floor and table lamps borrowed from home—were substituted. Following the advice of a lighting expert from California's State Department of Education's School Facilities Planning Bureau, the new lights were chosen and placed to approximate as closely as possible the same candlepower and contrast of illumination in work areas that the fluorescent lights had provided.

Because these disturbed children are often agitated by changes in

routine, they were given one week to become accustomed to the new lights.

Then, during the second week of the incandescent period, the same observer again counted incidents of hyperactivity in the room, using the same criteria, for one hour at the same time of day. Every effort was made to keep the class activities (highly structured as a matter of course in this kind of classroom) exactly the same during this week as they had been during the fluorescent charting week.

A total of 201 incidents were counted during the incandescent week—a drop of 32.3% in the hyperkinetic activity exhibited in the classroom.

Robert Pepper, the classroom aide who served as observer during the Lyons study, said he was skeptical from the beginning that changing lights would affect behavior, but conceded at the end of the week that there had been a change, especially in one boy.

This extremely hyperactive nine-year-old is usually unable to control his behavior, often becoming very upset for no apparent reason, and trying to run out the door. He has never been in school before, since no other class would accept him, and has spent a good part of his young life at home watching television. He parrots TV commercials, and rarely gives appropriate responses. He requires almost constant one-to-one adult supervision.

But Pepper's notes show that the youngster calmed down considerably during the incandescent period. "On the last day," Pepper reported, "he sat for six whole minutes alone, and gave good attention to the teacher. That's the first time I've seen him sit that long without someone beside him to control him, without his jumping up or running or clapping his hands or yelling."

Another fact noted in the course of the experiment, said Mrs. Lyons, was the invariably positive reaction of other teachers, aides and visitors upon entering the incandescent-lit room. They described it as "warm . . . pleasant . . . home-like . . . restful . . . non-institutional." Nearly all teachers expressed strong dislike for the conventional fluorescent lighting in their own classrooms.

In her 12-year teaching career Mrs. Lyons has noticed that many teachers share this aversion to fluorescent light, sometimes using the simple device of briefly turning off the lights to calm down a restive class.

At Bonny Doon Elementary School, a small multi-graded school in the Santa Cruz mountains, teachers noticed that two classes transferred to older rooms with incandescent lights exhibited fewer cases of headaches, nausea and irritability than they had the previous year while occupying

newer, fluorescent-lit rooms. Last year the teaching staff requested that incandescent lighting be installed in the new classrooms now being constructed on the campus. The school board agreed.

(Fluorescent lighting is used almost universally in modern public buildings because it is cheaper and more efficient, giving much more light while consuming much less energy than an incandescent system does. It also generates less heat.)

Mrs. Lyons was motivated to try her experiment after learning of the work of John Ott, a Florida researcher who believes that standard fluorescent lights emit certain kinds of radiation that may trigger hyperactivity.

While the Santa Cruz experiment was conducted as carefully as possible, Mrs. Lyons stressed that the results could not be considered conclusive because of the many variables that could not be controlled, and the short length of time and small number of children involved.

Len Thigpen, psychologist for the county's special education programs, agreed but after examining the data said he saw the Lyons study as a prelude to a longer, more rigorously controlled research project.

"There's no question that there was a variable that changed the behavior of those children," he said. "I believe it was the lights, but we have to isolate the variable to be sure. Based on the fact that so many different people have had similar observations about the effects of lights—and apparently some people are much more sensitive to it than others—it seems to me it's really in the interest of those children to take out some of those lights and see what happens."

Thigpen noted in passing that when the fluorescent lights were turned off in the clinic conference room where weekly staff meetings of county psychologists and therapists are held, "we seem to have far fewer conflicts, and people are able to sit and discuss things with one another much better."

Now that the lamps have been unplugged and returned to the living rooms from which they were borrowed, and the cool-white fluorescent lights are switched on again in Mrs. Lyons' classroom, the level of hyperactivity in the room seems to have returned to its previous high level, says Mrs. Lyons, though score is no longer being kept. The hyperkinetic nine-year-old mentioned earlier seems to have resumed his previous patterns of behavior.

"It's not as mellow as it was," observed a teacher's aide from a neighboring classroom. "And the kids seem more jumpy and wirey. I liked it much better before."

For more information on this study, call or write:

Marylyn Painter, Education Writer
Santa Cruz County Office of Education
Educational Media Center
2500 Rosedale Ave.
Soquel, CA. 95076
(408) 425-2306

ENVIRONMENTAL RESEARCH ASSOCIATES
1628 - 23rd - LONGVIEW, WA 98632

September 1, 1976

Dear Dr. Ott:

This spring Judy Thut and I completed a small research project on the effects of fluorescent lighting vs "natural" window lighting on the behavior of second-grade students. The enclosed article, published in our local paper, explains our experiment.

We used a manual for coding discrete behaviors in the school setting by Joseph Coff and Roberta Ray.

A thorough statistical analysis has been completed on the data. The data concludes that students spent a statistically significant greater amount of time in attentive behavior during the time the fluorescent lights were shut off.

If you wish, we will be happy to give you a more detailed outline of our project and data analysis.

We are anxious to hear of any progress you have on securing grant monies which may help finance our project, or if you know of any funding agency to whom we might apply for funds.

We are looking forward to hearing from you soon.

Sincerely,

Judith Bartholomew Raiter

The health and healing benefits of ultraviolet are indicated by the significant improvement being obtained with partially sighted children at The Overbrook School for the Blind in

Philadelphia. Jerome Werlin, director of The Living Light Center at the school, reports the excitement of children with severe sight impairment seeing objects and colors for the first time, using fluorescing objects under long wavelength black-light ultraviolet. Werlin further reports a noticeable calming effect on hyperactive children from the ultraviolet light that makes it possible to reduce their medication. Other schools all over the country are reporting similar beneficial results in using Werlin's blacklight ultraviolet equipment.

Again, I stress that if any particular band of wavelengths has a beneficial therapeutic effect—and especially those wavelengths so grossly lacking in the artificial lights that many people live under today—it sounds logical to add the normal proportionate amount found in nature into our artificial light sources.

In figuring the economics of different types of artificial lights, the health, work output and efficiency of employees should also be considered along with lumens per watts used. Furthermore, what helps partially sighted people see better should also benefit others with less severe eye problems, and even lessen eyestrain for those working under fluorescent lights who have not yet developed any problems.

It is worth noting that old age, no cancer, and good eyesight are common factors associated with people living at high altitudes where the atmosphere is thinner and consequently the ultraviolet is stronger.

A story in the Chicago Sunday *Sun-Times* of January 6, 1980, told of Chicago's miracle teacher, Marva N. Collins. Five years earlier, with books salvaged from a garbage bin, she started teaching unteachable children in two rooms of an old building on the west side of Chicago. She has worked wonders in the Westside Preparatory School, as she called it, and has been given a great deal of coverage by newspapers, magazines and television.

She has been offered the post of Los Angeles County Superintendent of Schools, which she refused, and was recommended by many for the position of Secretary of Education in President Reagan's Cabinet. She has given educational workshops across the country—from grade schools in Sante Fe, New Mexico, to the halls of Princeton University.

All this notoriety stems from her outstanding success in stimulating the interest to learn in dropouts and children with severe learning disabilities.

According to the *Sun-Times*, "The students of Westside Prep, aged 4 through 13, leave the national norms far behind in reading, writing and arithmetic. They know their Sophocles, Cicero, Shakespeare, Longfellow and Tolstoy. They memorize poetry and snatches of Latin for fun. The Pythagorean Theorem? A piece of cake. They'll tell you all about Pythagoras, too.

"They love it so much that they refuse recess and wish holiday vacations would never arrive.

"And Westside Prep's graduates, previously headed for the unemployment line or worse, now go to ivy-covered places like Phillips at Andover and the Hotchkiss School."

Of particular interest to me is that the original two rooms occupied by the Westside Preparatory School had old-fashioned large windows and no fluorescent lights. The school has since moved into larger quarters, another older building where some of the rooms have windows but some inner rooms do not. All the rooms do have fluorescent lights, but not of the high intensity kind used in more modern school buildings. The fluorescent lights in the rooms with windows are used only when necessary, and not left on all day.

In a recent visit to the school, the matter of lighting was brought up for discussion, and the teacher who showed the interviewer around the school did mention that he had noticed the children in the rooms with the windows definitely

seemed to be calmer and did better in their school work.

Another article on school lighting worth noting appeared in the July 28, 1977 *Ft. Worth Star-Telegram*. The school board voted unanimously to remove the controversial, high-pressure, sodium vapor lights from approximately a dozen schools where they had been installed to conserve electricity. This was the result of a previous, very comprehensive report prepared by the school district listing the many complaints by both teachers and students of such problems as headaches, eyestrain, nervous tension, and nausea.

A similar story appeared in *The New York Times* of August 5, 1979. The sodium vapor lights were removed from the Norton Elementary School in Cheshire, Connecticut, for the same reasons.

The clear-cut line of demarcation in the results obtained in some industry research or industry sponsored research and that done by independent researchers at top ranking universities is of great concern to me. However, the pressures of vested interests are very great. This became very obvious to me from the number of times I was asked to make time-lapse pictures that would show results ranging from what was frequently described as just "gilding the lily a little" to pictures that would be unquestionably fraudulent.

However, such problems are not mine alone but seem to tie into similar criticisms of some research sponsored by vested interests that have appeared in the press from time to time, including the chemical, pharmaceutical, sugar, asbestos and other industries. For example, I quote the headline from the front page of the *Wall Street Journal*, February 21, 1978: "Safety Problem—A Lab's Troubles Raise Doubts About Quality of Drug Tests in U.S.—I B T Flunks Federal Exam, Loses Clients, and Causes a Furor in the Industry—Were There Deliberate Slips?" Also, I quote a headline from *Los Angeles Times/Washington Post News Service*, March 10,

1978: "U.S. Probers Say Testing Lab Falsified Data on Carcinogens." And so it goes—a disgrace to all that is good and honest in the vast majority of research studies being carried on in our country today.

Of further interest are two reports, both appearing in the press during April 1981, only a few days apart. One was issued by the Food and Drug Administration and stated that "Video Display Terminals Pass U.S. Test" and pose no health hazards to their operators. The other was issued by the National Institute for Occupational Safety and Health (NIOSH) and stated that, at the request of a coalition of labor unions, five work sites were examined, including newspaper offices and the clerical departments of Blue Shield in San Francisco. Eighty to ninety percent of the clerical VDT operators experienced eyestrain or muscle strain. High levels of anxiety, depression and fatigue were reported by VDT users at all of the work sites.

The NIOSH research team found that "VDT operators in strictly clerical type operations showed *higher stress ratings than any group of workers NIOSH has ever studied including air traffic controllers.*"

The difference in findings appears to be the result of the FDA's study testing a number of video display terminals and finding no level of radiation in excess of present government safety standards, whereas the NIOSH study was the result of interviewing and examining the operators who spent many hours in close proximity to the machines.

Neither report mentioned anything about the video display terminals tested being new or old, but usually those tested for meeting radiation safety levels are new ones furnished by the manufacturer especially for that purpose. Quite naturally, the manufacturer would check them out thoroughly first. Obviously, the operators questioned at the five work sites mentioned were using VDT's that had been in use for some time.

Such procedural differences in testing for radiation from TV sets may explain other contradictory reports of the past. The TV set in front of which I placed the young laboratory rats with half of the picture tube shielded with lead and the other half with black paper was identified later as an old TV set. As I mentioned in *Health and Light*, the young rats in front of the half covered with black paper that would not stop X-rays first became irritable, aggressive, and constantly fighting one another and then so lethargic you would have to poke them to make them move. The young rats in front of the other half of the picture tube covered with the lead that would stop X-rays remained perfectly calm and docile.

When bean seeds and other plants show distorted growth under unshielded fluorescent lights; when young rats first become irritable, aggressive, fighting one another all the time, and then lethargic in front of an unshielded TV set; when hyperactive school children with learning disabilities calm down and learn to read when full-spectrum radiation-shielded lights are installed; and when VDT operators complain of eyestrain, headaches, backaches, and nausea, I feel that my suggestions of looking into this matter of shielding such electronic devices may have some merit.

More recently, the expressions "burned out" and "psychic fatigue" have been applied to office managers and workers who have lost their "oomph." In my next book, I would like to go further into the subjects of radiation and the use of amphetamine medication for hyperactive children, tranquilizers, marijuana, harder drugs, crime and violence. Also, international terrorism may now be added to the list.

The story originally mentioned in *My Ivory Cellar* (1958) and repeated again in *Health and Light* (1973) about the late Joseph E. Ragen, former warden of Stateville Penitentiary in Illinois, who was able to rehabilitate and obtain parole status for some of the men with the most severe psychiatric criminal

records through horticultural therapy, seems to fit in here. Ragen said that other forms of physical therapy, including painting and sculpture done indoors, did not have the same beneficial effect. This seems to be another example of light (sunlight) being the missing link.

On January 28, 1981, I was asked to give a seminar on the effects of low-level radiation on human health and behavior at the Bureau of Radiological Health, a division of the Food and Drug Administration in Rockville, Maryland. My feeling was that the response was exceptionally good.

Following my seminar, the doctor in charge of the meeting spent a half hour with me, holding his arm out as I tested his muscle strength. Down it went under their fluorescent lights with special ultraviolet shielding. However, under the full-spectrum fluorescent fixtures with added ultraviolet, but shielded for X-rays and radio frequency, he had full muscle strength. He shook his head in disbelief, but said the test certainly seemed to work. He and many of the other scientists stayed on, testing the lightning rod, pyramid, lead pencil, pink card, and all the other unbelievable and impossible things that have an effect on muscle strength.

On March 2, 1981, I received a written contract from the Food and Drug Administration "to provide professional and scientific assessment of low level radiation effects on human health and behavior and to provide professional and scientific advice on experiments on animals investigating light and other radiation effects on the neuroendocrine systems."

11 THE PINK ROOM

DURING JULY 1978 I gave a lecture at the offices of the Washington State Criminal Justice Training Commission in Olympia, the state capital. There were a number of law enforcement and correctional training officers present, and I met Alexander G. Schauss, one of the correctional training officers. Alex had become interested in the effect of nutrition on criminal behavior, aggression, and violence, and had written a number of papers on the subject. He has since published a fascinating book entitled *Diet, Crime and Delinquency*. In it he cites figures on the appalling rate of increasing crime and violence and what it is costing our society. He also gives many interesting case histories of criminal offenders who were rehabilitated and could be returned to society when imbalances in their body chemistry were corrected.

Alex points out that the brain is the most chemically sensitive organ of the body and stresses the need for more emphasis on diet and nutrition than the present psychological and psychiatric approach to treatment of delinquents. It did not take long for both of us to realize the importance of the interaction of light and nutrition on both human health and behavior.

Meanwhile, I had already retired in 1977 as chairman and executive director of the Environmental Health and Light Research Institute, which I had originally incorporated in Illinois in 1962 as the Time-Lapse Research Foundation. This was done to separate the research work from other time-lapse projects and set it up on a tax-exempt basis so that supporting grants could be applied for. The move to Sarasota, Florida, was made in 1968, at which time the name was changed to E.H.L.R.I.

During all this time I had made numerous efforts to establish some sort of official relationship with a recognized university—one with a medical school, if possible—to supervise and carry on the research in studying the biological effects of light on plants and animals. Several well-known universities did show serious interest in such an arrangement—that is, as far as studying the effect of light on plants, but definitely not on animals. Why not animals? I asked. The answer was always that everybody knew that light had no real biological effect on animals, and it would be embarrassing and could even hurt their scientific standing if word got around that such studies were being permitted at the university.

To make a long story as short as possible, I was delighted when the Roswell Park Memorial Institute in Buffalo, Department of Health, State of New York, offered the necessary space and invited E.H.L.R.I. to become affiliated with that very prestigious cancer research center. The director of Roswell Park Memorial Institute, the business manager, and the head of the medical school agreed to serve on the board of trustees of E.H.L.R.I., and the name was changed at that time to The Center for Light Research. Everything was moved to Buffalo.

It sounded too good to be true, and it was. Shortly thereafter, I received a letter simply stating that the Roswell Park Memorial Institute Administration had concluded that they were not in a position to honor their previous commitment and that was the end of what I had thought looked so promising for the future of The Center for Light Research.

In the course of events, Dr. Cora Saltarelli, who had taken my place as director of the Center for Light Research, advised me that her husband, who was head of a large corporation in Buffalo, had decided to move his corporate headquarters to Florida. The final outcome was that Dr. Saltarelli also moved the Light Center to Nova University in Ft. Lauderdale, and set it up in the science building.

No sooner were things beginning to get under way again than Nova University decided to shut down the science building and turn it over to a special government project. This was just at the time when I happened to meet Alex Schauss. The result: the Center for Light Research moved again, this time to Tacoma, Washington. It became affiliated with City College in Seattle, and Alex Schauss became its new director.

Now, going back to the seminar I gave to the Washington State Criminal Justice Training Commission, I demonstrated how looking at a pink sheet of paper held in front of the eyes weakened the entire muscle strength of the person. This apparently made quite an impression, for I soon received a report from Alex Schauss, from which I quote in part as follows:

As a result of this provocative [pink card] demonstration, two officers at the U.S. Naval Correctional Center, Naval Support Activity, Seattle, Washington, Chief Warrant Officer Baker and Commander Miller, proceeded to order that a holding cell at the center be painted pink. On March 1, 1979, an entire holding cell, except for the gray floor matting, was so painted.

The holding cell was selected to be painted because experienced correctional officers know that a new inmate is most prone toward violence at initial intake. It is at this time that the detainee is likely to be depressed or agitated. For this reason, the chief warrant officer and commander ordered that all new detainees be held in the pink holding cell for 10 to 15 minutes to allow time for processing of the new detainee's papers.

The results have been impressive. After 156 days of continuous use, the U.S. Naval Correctional Center, Naval Support Activity Correctional Center, Seattle, Washington, reported to the Bureau of Naval Personnel, Law

Enforcement and Corrections Division, Washington, D.C., that "since initiation of this procedure there have been *no* incidents of erratic or hostile behavior during the initial phase of confinement. Before painting the holding cell pink, duty intake officers remarked that hostile behavior by inmates was 'a whale of a problem.'"

Similar results have now been confirmed by the commander of the Santa Clara County Jail, San José, California. This county has not only painted a holding tank pink, but also the "fish tank." The fish tank holds approximately 15 men at a time until cell assignments can be made. Since changing the large cell's color from green to pink, staff have observed the detainees to be in a "humorous and restful mood." Since these pilot facilities began using their pink rooms, other facilities using pink have reported similar results.

What is most important about the use of pink color in reducing aggression and causing muscular relaxation is its humaneness. The phenomenon seems to affect the primitive centers of the brain. In repeated experiments with subjects of varying ages, I have observed the muscular relaxation phenomenon to occur, on the average, in 2.7 seconds. This nondrug anesthetic effect has yet to be explained. However, this technique is noninvasive, nontraumatic and has demonstrated no toxic or adverse affect. It cannot be controlled by conscious or unconscious effort. This has been proven, to my satisfaction, by doing this experiment with trained yogis and accomplished athletes of the martial arts. I would suggest its usefulness in any situation where sudden or uncontrollable aggressive behavior is likely.

The story about both the U.S. Navy and the Santa Clara jail using the color pink to calm violence and aggression was intriguing, to say the least. The news media soon picked it up and gave it wide coverage in the press, news weeklies, radio, and TV. There are now many studies under way, and it is being tested in several schools for problem children and psychiatric hospitals.

When I first learned about the weakening effect on the muscles of looking at the color pink, I could not reconcile this with the results of our previous experiments with laboratory animals, which became more aggressive and even cannibalistic when kept under pink light. However, this was accidentally explained one day when a new inmate being processed was inadvertently left in the pink cell for almost four hours and virtually went

berserk. If being left for four hours in a pink room has this effect, what may be the effect of four or more hours of exposure to pink (or orange) sodium vapor, or so-called crime prevention, lights?

Like other forms of stimulants, a little can have one effect, while a larger dose or exposure will produce an opposite effect—for example, having one martini as compared to having ten or more. It never occurred to me to put a mouse under pink light for fifteen minutes; our experiments ran for six months or more.

It seems quite evident that a child's room, or any room, should not be decorated all in pink. A little pink here and there along with other colors is probably all right, but pending the outcome of further studies, I would prefer using pastel shades of blue, green, and gray for walls and floor coverings, with small accents of yellow, orange, and red.

It has long been recognized that color has a psychological effect on people. This has always been difficult for me to fully understand. However, if you think of color as a specific wavelength or frequency of radiant energy and then recognize its direct interaction with the chemicals in the blood, and also its effect through the eyes on the endocrine system, I believe it is a little easier to understand how light can affect all the organs of the body in a physiological way. The physiological function of the muscles can be demonstrated with the muscle strength test, and the physiological function of the brain is evidenced by a person's mood, thinking ability, alertness and like responses of a psychological nature.

When using a pink card, or any other color, you must make sure that it is large enough and close enough to the eyes to cover the full field of vision. If other colors in the background can be seen around the edges, they will counteract the effect of the pink card or any other colored card that is being tested. This is in accordance with the theory of multifrequency interaction. However, frequencies from other than colored objects in the background will also influence the "overall mass," as previously

shown with items like digital wrist watches and ionizing-type smoke detectors.

Interestingly enough, just looking at a pink card will weaken all the muscles. The effect from the pink frequencies is apparently mediated through the eyes because, if they are closed, the full muscle strength quickly returns to normal within a second or two. This slightly delayed reaction, I believe, indicates that the response to the pink color or frequency is through the retinal-hypothalamic-endocrine system and not the visual pathway to the brain. If it were visual, I think the response would be more instantaneous. Another factor supporting this hypothesis is that people who are color-blind also lose their muscle strength when they look at a pink card.

It seems, though, that for every frequency that causes a muscle weakness response, there is also a counteracting frequency or frequencies. If a person looks at a pink card under a mercury vapor light, such as those commonly used in squash courts, there is no loss of muscle strength.

If a person looks at a pink card while someone else sounds High C on a mouth organ type of pitch tuner, this particular note will counter the pink color and restore the muscle strength to normal. High C will also weaken the muscle strength when a person looks at a blue card. However, sounding Middle C, an octave lower, has no effect.

It is interesting to speculate on how sound waves counteract light waves, and what the mechanism is in the human body that responds to both. We naturally think of the eyes responding to light and the ears to sound. But, then, remember the effect on the electrical dimension of changes in temperature, electromagnetic radiation, including light waves, changes in pressure, and sound waves on electret cells that must be located somewhere, possibly in one of the layers of the skin. There is certainly a great need to learn more about the electric dimension of both living cells and also nonliving matter.

As this book goes to press, I am happy to be able to announce that a plan has been approved for reestablishing the Center For Light Research as the Institute for Psychobiological Studies of Color and Light. The Institute will be an integral part of the San José State University, San José, California 95192. Professor Robert J. Pellegrini will serve as Director, Professor Robert A. Hicks as Assistant Director, and I will have the honor of being Senior Research Associate, semiretired.

12 WHAT THE AVERAGE PERSON CAN DO

THE PREVIOUS ELEVEN chapters are admittedly rather disturbing. One wonders if there is anything left these days that is not hazardous to one's health. I personally believe the situation is serious but not hopeless if quick action is taken to reverse the trend. It has come about through ignorance and lack of responsibility on the part of industry, government, and the public in letting the matter get so far out of hand by doing nothing to stop it. Those few scientists who tried to give warnings were hopelessly outnumbered, ridiculed, and fired unless they quit their jobs first, as did three in one case involving a major corporation.

When the first few gas buggies appeared on the streets, the possibility that they could increase in numbers to the point at which they would be a major factor contributing to air pollution was incredible. When industry was small, everyone continued to throw his waste materials out in the back lot, as individual craftsmen had done since the beginning of time. There wasn't enough to cause any problem. There were no laws against it, and precedents were established.

As small companies grew larger, they simply had larger back lots to accommodate more waste material—unless there was a river or a lake or a convenient ocean to dump it in. As small corporations grew larger, they became more powerful, and it became harder and harder to stop the practice. It grew like Topsy—and all of a sudden everyone realizes that a real problem exists today.

I can remember building a crystal set years ago, and being intrigued with listening to the newly invented radio. It never dawned on me at the time that this small beginning could grow so quickly into the present electronic industry of today, but it did. No one at that time thought about harmful radiation from a crystal set, nor from the first small radio sets. The public just accepted them without question.

Medical science had no background experience or equipment to measure and deal with trace amounts of toxic materials—especially radiation—to determine what would be a safe level. Why bother about trace amounts of radiation when light and radiation were generally thought to have no biological effects of any consequence on animals, including human beings?

However, some farsighted companies were beginning to look ahead into the future. They were raising the question as to the possibilities that light might, after all, affect animals, and were trying to evaluate the implications that this would have. In 1958 I had the honor and privilege of being asked to serve as a consultant in the general field of biological effects of light on animal life, and I made numerous trips to General Electric's large lamp research headquarters at Nela Park in Cleveland, Ohio. In May 1960 the company sponsored a three-day seminar on the implications of the life sciences to General Electric. There were many very scientific papers presented by eminent scientists, many of whom were also serving as consultants. I had the privilege of being the after-dinner speaker at the main evening function. The president and a number of top executives of

General Electric were present. A committee of their top medical advisors was also present. Following the dinner, I gave my presentation, which included time-lapse pictures of the pumpkins and also some of the earlier experiments with laboratory animals. When I was finished, the head of the medical advisory group was asked what he thought about what I had presented. The response was very clear that he thought it was the silliest, most unscientific presentation he had ever witnessed. He pointed out that I was recommending full-spectrum lighting with added ultraviolet, which was known to be harmful. He recommended that G.E. should reexamine all their existing light bulb sources, and that if any ultraviolet was found in any of their lamps, a way should be found to filter it out, completely.

Who was the president of G.E. to believe? Whom would you believe under the circumstances? A retired banker with a hobby of taking pictures of flowers in his basement? Or a committee composed of prominent medical scientists from some of the leading medical schools in the country?

Needless to say, my consulting contract with General Electric was not renewed, and I personally believe that this was the turning point in the industry toward the development of more efficient light sources, such as the sodium vapor lights we now have. They give off more lumens per watt of electricity consumed, which is a very important consideration, especially during today's energy crisis. However, they are also the most distorted light source, as the light energy given off is highly concentrated in either the pink or orange part of the spectrum. They were originally called crime lights, because they were going to eliminate crime in big cities.

From my own banking background, I am well aware of the problems involved in making any major change in such a program as the entire industry is now embarked on with the new sodium vapor lights. However, I am personally convinced more than ever that these lights are a major contributing factor to the

increasing problem of crime, violence, and juvenile delinquency. There is no question but that it presents a very difficult and also very serious problem.

At this point, I might also interject my past hard-line banking experience into the interdisciplinary communications of research that I have previously recommended. It seems to me that too much emphasis has been placed on medical care and treatment and not enough on finding the cause and ways of preventing disease. This is particularly true in cancer research. The cost of medical care has skyrocketed as new, vastly more expensive equipment has been developed, requiring more technicians, more specialists, more opinions, and longer in-hospital time—and still the per-capita death rate from cancer continues to rise at an alarming rate.

One cannot deny that medical care today, together with all of its related industries, is big business. Preventive medicine isn't, for the simple reason that there's much less profit to be made. If the businessmen can't put a price tag on a health care item, then they're just not interested, and sunlight falls into the general category of those best things in life that are free. Conventional medical care understandably enjoys the sympathy and backing of the general public, since no one wants to deny a loved one the best medical care available at a time of need. But today, catastrophic medical expenses that are continuing to increase every year, along with inflation, are more than the average middle class family can afford, and completely out of reach of low-income groups. It is a temptation to expect government to step in and assume the financial burden through additional medical care programs. Social Security taxes have been drastically increased, but even before the new higher rate could be put into effect, it became evident that the anticipated additional income was not enough to balance the runaway rising expenses. Here is where more thought and funding should be given to that "ounce of prevention."

Several years later I happened to meet one of my former coconsultants who was still consulting. He pointed out to me several reasons why my presentation at the Life Sciences meeting met such stiff criticism. He made it very clear that my suggestions were not "sufficiently oriented to the company's existing products and management policies." I had presented too much irrelevant material, such as the relationship of light to hay fever and arthritis, and chilling to the common cold (*My Ivory Cellar*, Chapters 4, 5, 12).

Much of our knowledge today has been gained through hindsight. The cumulative effects of trace amounts of various types of pollution, including radiation, were not recognized, nor were delayed responses like the present increase in leukemia and other forms of cancer turning up in the armed forces personnel exposed to atom bomb tests done 25 years ago. Although some attempts appear to have been made to conceal the facts, nevertheless, much of the problem is now being recognized, which is very encouraging, as this is necessary before anything can or will be done about it. The government is currently talking about spending billions of dollars to clean up some of the chemical dumps and a lot more will be spent before the job is finished. The federal government did stop the practice of dumping radioactive atomic waste in both the Atlantic and Pacific oceans in 1972, but now the barrels it is being accumulated in are beginning to leak. The people down East want to ship them all out West, but the people out West don't seem to want them out there either.

It will mean changing the design of many products and replacing many that are already in general use in the hands of the public. We did not get into this mess overnight, and it is going to take a long time to clean it up completely. Obsolescence of existing equipment will help, but it is now time to bring the entire story out into the open so that the public will be made aware of the situation.

Now, I will give some of the encouraging side of the story, and try to point out what the average person can do about it.

Windows, Sliding Doors and Skylights

There are at least two commercial brands of ultraviolet transmitting plastic available. One is UVT Acrylite, manufactured by the American Cyanamid Company; the other is UVT Plexiglas, manufactured by the Rohm and Haas Company. Both companies also make the ultraviolet absorbing (UVA) that does not transmit the ultraviolet, so it is important to be sure to get the UVT. The plastic comes with a protective paper covering that should show exactly which type it is. Since it also comes in different thicknesses, it is advisable to use as thin a piece as possible for two good reasons. First, the thinner it is, the more ultraviolet will penetrate through it; and the thicker it is, the more it costs—and, unfortunately, plastic *does* cost considerably more than glass.

Your plastic dealer can give you the recommended thicknesses for different-sized panes and, also, depending on whether they are vertical windows or horizontal skylights. As a rough rule of thumb, I have found $\frac{1}{8}$ " thickness satisfactory for sizes up to approximately $10' \times 14'$, $\frac{1}{4}$ " for sizes around $3' \times 4'$, and $\frac{3}{8}$ " for $4' \times 8'$. However, plastic has a tendency to bend or bow a little if there are extreme differences in temperature on either side; and, accordingly, if there is a very narrow distance between sliding doors, there is a possibility of scraping and scratching. In such cases, $\frac{1}{2}$ " or $\frac{5}{8}$ " thickness is recommended, as the thicker plastic is more rigid.

Plastic possesses much better insulating qualities than glass, and when we put $\frac{1}{8}$ " thickness plastic in our windows in the Chicago area we found storm windows were not necessary. Humidity inside could be maintained as high as 25 percent

during subzero weather without the windows frosting up.

In washing plastic, I recommend using a sponge and chamois with soap and water, as plastic scratches more easily than glass. Do not use chemical cleaners or squeegees with a rubber edge, which might scratch the plastic if there is any remaining sand or grit left on the surface.

If you want to find ultraviolet transmitting plastic, look in the Yellow Pages under "Plastic."

Eyeglasses and Contact Lenses

✓ Ultraviolet-transmitting spectacle lenses are manufactured by Armormite, Inc. as "Full Spectrum" lenses, and by Eye Kraft Optical, Inc. as "Sun/Lite" lenses. These are available in clear or neutral gray for sunglasses if necessary. Bausch and Lomb "Soflens" contact lenses are also ultraviolet-transmitting. Ask for them wherever you get your glasses. (Not recommended for anyone who has had surgery for cataracts without specific approval of an ophthalmologist.)

✓ *Fluorescent Lights*

All fluorescent tubes give off radiation that should be shielded, so it is necessary to use lighting fixtures that provide the necessary shielding. Full Spectrum Radiation Shielded Fluorescent Fixtures are currently being manufactured by Environmental Light and Heat Foundation in Tampa, Florida (address in appendix). These fixtures also provide a separate socket for the black light ultraviolet fluorescent tube, so that it may be replaced as needed. This is necessary because the phosphor that gives off the ultraviolet wavelengths has a burning life of only 7,000 to 9,000 hours, whereas the visible phosphors will last up

to around 36,000 hours. Therefore, when the black light phosphor is mixed with the visible phosphors in the same tube, the benefits from the ultraviolet are gone long before the tube finally burns out, and you cannot tell the difference by just looking at them. One manufacturer of a full-spectrum fluorescent tube advertises putting in more of the black light phosphor to overcome this problem, but it seems to me this would merely provide too much to begin with. When the phosphor burns out, the benefit is gone, no matter how much there is to start with.

Colors for Interior Decorating

The wavelengths of light reflected from a colored surface are affected in the same way as wavelengths passing through a colored filter. The only difference is that the colored filter transmits certain wavelengths and blocks or stops others. The colored surface reflects certain wavelengths and absorbs the other. The end results are the same as far as the wavelengths that reach the eye or surface of the skin are concerned.

Therefore, in keeping with the full-spectrum theory, a room should not be all one color, and preferably not even all the walls one strong color—especially not pink or orange. White is the exception, as white reflects all the colors or wavelengths. However, some white surfaces reflect more ultraviolet than others. This is a matter to which I hope manufacturers of both paint and paper (for wallpaper and books) will give serious consideration.

My recommendation of colors for ceilings and walls is white or light pastel shades of blue, green, gray, or beige. Accent this with other colors, even small spots of pink and orange, in the curtains, furniture and floor coverings. Make it as much as possible like the natural colors outdoors. Remember, the brilliant pinks and oranges of sunsets last only about fifteen minutes, which has been determined as the maximum time a person can

be left in the pink cell of correctional centers and prisons before the beneficial short-term effects begin to give way to the long-term effects of increased depression, aggression and violence.

Television Sets and Video Display Terminals

When the first large-size picture tubes came on the market, the tubes had to be so long that the sets stuck way out into the room. This was very objectionable, especially in small apartments. To overcome this objection, the tubes were placed vertically, pointing upward, with a mirror set at an angle that the viewer looked at to see the picture. It worked satisfactorily. As improvements in the design of the tubes were made, manufacturers were able to shorten the tubes and still get the larger size picture. As a result, the tubes were put back again in the horizontal position.

Placing the tubes in the vertical position was done only to overcome the problem of length of the tubes, without realizing the additional advantage that was provided in shielding the radiation coming from the front of the tube. A mirror will act as a beam-splitting device, reflecting the visible light rays out toward the person viewing the picture and letting ionizing radiation penetrate straight on through the mirror.

In the manufacture of TV tubes, lead is put into the glass to cut down on the amount of radiation, but if enough lead were put into the glass to stop the radiation completely, you would not be able to see any picture either. With the mirror, all the lead you need can be placed behind it to stop the radiation from going up to the floor above, if there is one.

There is no real problem in shielding the sides of the tube or the set itself, and all the talk about no radiation from the new solid-state sets applies only to the rest of the set. There is no way yet to make a solid-state picture tube, and a picture tube is what

the viewer must still sit in front of and look directly into. Remember, a TV picture tube or video terminal display tube is a cathode ray tube and works on the same principle as an X-ray tube.

Several companies are now beginning to think about my suggestion for using the basic mirror system, but such sets are not yet available as this book goes to press. Let's hope they may be in the not-too-distant future. Until then, I think the Ott family will continue to listen to the radio, even though some of the grandchildren seem to view the situation as a sign of being underprivileged.

Exploring the Spectrum

A 46-minute color-and-sound film with time-lapse sequences showing the biological effects of light and low-level radiation on plants and laboratory animals, is available from International Film Bureau, 332 South Michigan Ave., Chicago, IL 60604 (phone: 312-427-4545). The film also includes time-lapse pictures of hyperactive school children calming down under the new full-spectrum, radiation-shielded fluorescent lighting.

✓ *Suggestions for Outdoor Living*

So many people, both doctors and patients, have written to me asking for the instructions for "Outdoor Living" given to the fifteen patients by Dr. Wright at Bellevue Medical Center in New York City that I am repeating them here, along with updated information to include such recent new items as smoke detectors, digital watches, synthetic materials, etc., that must also be considered. These instructions should in no way be taken as medical advice. They are offered only as

helpful suggestions to be referred to one's physician for consideration as part of an overall program of medical treatment.

In order to obtain the maximum benefits from living outdoors under natural conditions, a minimum of six hours a day of natural daylight is suggested. For people living in large cities, this may be rather difficult, but it is hoped the following suggestions may be helpful. These suggestions are made in connection with the theory of photocrinology, the effect of light received through the eyes on the glandular system, in addition to the known benefits of sunlight received through the skin.

In addition to being outdoors as much as possible, brilliant artificial light or sitting indoors or in an automobile looking through the ordinary window or windshield glass should be avoided. Virtually all glass in ordinary use today filters out the ultraviolet wavelengths of sunlight energy, so the wearing of ordinary glasses and particularly dark glasses should be avoided. Ultraviolet transmitting spectacles and windows that let natural daylight come indoors are now available. Actually, if a person could go to the country and live in a cottage with a large screened porch, this would be ideal. Sleeping on a screened porch is also recommended.

As the glandular system may be more sensitive to light immediately following the night sleep period, both artificial light sources or sunlight filtered through glass should be particularly avoided, even for brief periods of a few moments' duration for the first hour or two after awakening in the morning, or following any rest period during the daytime. For this same reason, a dim blue night light such as a Christmas tree ornament light should be used so as not to interrupt the night period with ordinary electric lights which seem particularly bright when the eyes are accustomed to total darkness. If it is necessary to remain indoors, ordinary glass windows should be kept open as much as possible, and the curtain drawn across any portion of

the glass that will not open. If a person is being driven in an automobile, it is best to look out through the open side window rather than through the windshield ahead. Constant interruption of the natural sunlight by either artificial light or sunlight filtered through glass even for brief periods can offset the benefits received and should be conscientiously avoided. In other words, the greatest benefits can be derived from virtually living under natural light conditions outdoors or, next best, full-spectrum light indoors.

It is not necessary to be in the full direct sunlight, and of course all precautions should be taken not to strain the eyes or become severely sunburned. The object is merely to let the natural light into the eyes rather than artificial light or the sunlight filtered through glass. A person may sit on a screened porch or under a shade tree. If you are not accustomed to being outdoors in the bright light, or have always worn sunglasses, it may seem difficult at first to become adjusted to full sunlight conditions.

Sunbathing under natural sunlight is recommended, but no dark glasses and particularly no artificial sun lamp sources. Suntan lotions are questionable and not recommended. Sunlight is beneficial to the skin and synthesizes vitamin D. It is natural for people on short vacations to want to be out on the beach or in the sun as much as possible. Suntan lotions do effectively filter the different wavelengths, especially the ultraviolet. They also create a distorted spectrum. What the effects of an unnatural tan might be are not known, but are questionable.

If you have not been out in the sunlight for some time and your skin and eyes have lost their natural resistance to it, then be extra careful not to get excessive sunburn. Avoid the hottest midday hours from 10:00 A.M. to 3:00 P.M. (standard time, not daylight saving). Limit your exposure to fifteen minutes each side the first day and, if you have no excessive redness or ill effects, then thirty minutes the second day. Build the time up

gradually each successive day. "Common sense" is the key phrase. Remember, you do not feel the harmful effects of sunburn until several hours after exposure.

Watching television is definitely not recommended. Listen to the radio instead. Red-hot oven heating elements, stove burners, and infrared heat lamps should be avoided. Microwave communication systems are a health hazard threat of such magnitude that for the full story I recommend reading the book, *Zapping America*, by Paul Brodeur.

Outdoor sports are highly recommended during the daytime, but not under artificial light at night. Relief from excessively bright light may be obtained by using a regular sun visor in lieu of dark glasses. The underside of the visor should be dull black or dark gray, but definitely not any translucent material such as dark green plastic, which will transmit filtered light into the eyes.

To carry this plan out to the fullest, the person should live by day and sleep at night; in other words, go to bed at sunset and awaken at sunrise. Stay outdoors as much as possible or on an open porch, even during cloudy or rainy weather. This includes mealtimes also. Eat on an open porch or at the back yard barbecue table. Picnics outdoors are fine if they do not necessitate looking through the automobile windshield en route for long distances.

Light alone is not everything, but it is a very important factor to be considered. It is also important to eat sensible, well-balanced meals and avoid the use of tobacco or the consumption of liquor.

It is hoped the above suggestions will prove helpful in obtaining the maximum benefit from sunlight energy, but it is also of the utmost importance that anyone following the above suggestions should also maintain very close contact with his or her doctor.

Do not use tinted lenses or sunglasses of any color except

✓ full-spectrum neutral gray, and then only when absolutely necessary. Most plastic will not transmit ultraviolet, and full-spectrum ultraviolet transmitting plastic must be very definitely specified and insisted on when ordering eyeglasses or contact lenses. ✓ Ultraviolet transmitting plastic is also available for windows and doors. UVT "Plexiglas" and UVT "Acrylite" are the two most available brands. ✓ Check the yellow pages in the phone book for nearest dealer. Some dealers may not be aware of the two different types of plastic—that which blocks the transmission of ultraviolet, and that which transmits the ultraviolet. On the other hand, many people have the erroneous belief that all plastic is ultraviolet transmitting, which is not true. ✓ Most plastic dealers at the present time carry only the type of plastic that does not transmit ultraviolet, but they can order the UVT. If incandescent bulbs are used, "daylight incandescent" bulbs are recommended. ✓ The blue glass cuts down on the excessive red and infrared of standard incandescent bulbs, but they are not full spectrum. Most hardware or electric stores have them or will get them for you.

Suntan parlors have become popular, but different locations may use different types of sunlamps that vary greatly in their ultraviolet wavelength output and intensity. If goggles are needed for eye protection, then beware. This is an indication that the artificial sunlight source contains short-wavelength ultraviolet or germicidal UV, which can be very harmful to the eyes and also to the skin. Exposure time with the goggles usually ranges from approximately one to three minutes as the resistance of the skin builds up. Other types of sunlights have some short-wavelength UV, and the recommended exposure time is a little longer. The number of light bulbs or tubes and their wattage and distance from you is a very important factor to consider.

As mentioned previously in this book, and also in *Health*

and Light, the short-wavelength UV is what the atmosphere and ozone layer filter out of the sunlight so that only a trace amount reaches the surface of the earth. Calling the short-wavelength ultraviolet or germicidal lights "sunlamps" is certainly a misnomer and grossly misleading. I would be in favor of the Federal Trade Commission or other appropriate governmental agency restricting their being advertised as such. The long-wavelength ultraviolet is sometimes referred to as blacklight or the near UV. These wavelengths come right next to the violet part of the visible spectrum. The short-wavelength UV is sometimes referred to as the far UV and right next to them come X-rays. From the biological reactions caused by the short-wavelength UV, it might be better to think of them as near X-rays rather than far UV. Only a similar trace amount of each reaches the surface of the earth.

I am obviously a great believer in the health value of a reasonable amount of natural sunlight, but too much can definitely be harmful. The big question is how much is a reasonable amount, and this can vary with light- and dark-skinned people. I, myself, am pretty much average, and, living in Florida, I personally try to be outdoors in full sunlight, wearing a bathing suit, at least one hour every day. I avoid the hot summer sun at noontime, and increase the exposure during the winter months as weather permits. ✓

I try to maintain a light suntan. After all, tanning of the skin is Nature's way of building up some shielding protection when the skin has had enough UV. Real dark, dark tanning can only be for cosmetic purposes. I look on it as Nature's screaming, "Too much!" Very dark tanning cuts way down on the amount of UV that can get through to where it does any good.

In addition to being outdoors in the sun, we have ultraviolet transmitting plastic in all the windows of the rooms of our house where we spend any appreciable amount of time.

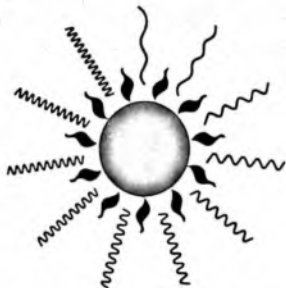
All members of the Ott family who wear glasses have the ultraviolet transmitting type. We have the full-spectrum radiation-shielded fluorescent light fixtures where practical, and use daylight incandescent bulbs where fluorescent lights are not practical. We are trying to replace all our clothing, etc. with natural fiber materials, but this is difficult to accomplish overnight. We have heavy scatter rugs with thick rubber padding in front of the sink and the stove in the kitchen until we can take up the vinyl tile flooring and replace it with some other material with a neutral frequency. This is all very difficult and expensive to do, but I am trying to practice what I preach as fast as possible.

Frequencies may be divided into two categories, neutral and stress. Neutral frequencies are those that do not cause muscle weakness, and stress frequencies are the ones that do. Generally speaking, natural fibers such as cotton, wool, linen, silk, hemp, and wood have neutral frequencies, but may be affected by colored dyes or other chemical treatments.

Synthetic materials have varying degrees of stress effects in causing muscle weakness. Vinyl and polyester seem to cause the greatest loss of strength and acrylic the least. Different electronic devices also cause varying degrees of muscle strength loss, as do processed foods. In testing any specific item, make certain you are not involving any offsetting or counteracting frequencies such as a digital watch or ionizing-type smoke detector. The digital watch has only a short range effect while the ionizing smoke detector will weaken muscles within a range up to 65 feet. The counteracting effects of certain processed foods are also affected by the time factor, which usually lasts about four hours after food is consumed. My recommendation would be to use as many neutral stress foods, materials, and electrical devices as possible and avoid or eliminate the stress frequency items as quickly as practical.

Look for this symbol of approval to assist in selecting tested full-spectrum and neutral-stress products:

Symbol of Approval



FULL SPECTRUM — NEUTRAL STRESS

®

OTT LABORATORIES, INC.

APPENDIX I

MORE ON KINESIOLOGY

Near the beginning of Chapter 4, entitled "Kinesiology," I stress "however, this test does not always work as there are other factors grossly affecting muscle strength that must be eliminated." Throughout the book and especially in Chapter 11, "The Pink Room," I mention some actual applications where the basic kinesiological muscle test methods are put to practical use.

Since this book was first published in 1982, I have continued to give many lectures. Everyone always seems to particularly enjoy and have a lot of fun whenever I demonstrate how looking at a pink card or wearing certain types of digital watches weakens the shoulder muscles, and, of course, the ionizing smoke detector story always brings forth a good laugh. People attending my lectures often volunteer new information that I have not heard of before and I learn a great deal from them; in particular, more and more about different items that affect muscle strength.

After one of my lectures a person came up to me and asked if I was aware that one's state of mind and what he or she was thinking also

influenced muscle strength. I suddenly realized that I had not given this aspect of the effect of psychological stress on muscle strength much thought at all. I was aware that if someone were suddenly frightened this could make the heart beat harder and faster, but the suggestion that simply quietly thinking about white refined sugar, or anything else generally believed to cause muscle weakness, would also cause muscle weakness sounds preposterous! Not only did I find this idea preposterous, I have to admit it also annoyed me, because I had long thought that some psychologists and some psychiatrists had been going overboard in attributing many physiological illnesses to psychological stress of some sort when they could find no other explanation. However, whether or not I liked this new idea was beside the point as a quick demonstration right there on the spot showed that it worked. This now added a new parameter of variables that would, offhand, seem virtually impossible to control. How would it be possible to control what either the person being tested or the person doing the testing was thinking about, maybe even subconsciously, if such a concept is possible?

Most fortunately, right at this time I received a phone call from Dr. Martin Greenberg of the Research Department of the Medical School of the University of California in San Francisco. He advised that some of the people at the medical school there were interested in doing a double blind test on the kinesiological muscle test method, that is, to test the effect of various items on muscle strength where neither the person being tested nor the person doing the testing knew what the item being tested was.

Such a double blind test seemed to me exactly what was needed most, right at this time, and I was both delighted and honored to accept Dr. Greenberg's invitation to come to the Medical School in San Francisco and actually take part in the experiment by doing all of the testing myself. I also assisted in the design of the experiment by eliminating all such items as digital watches, smoke detectors, synthetic materials in clothing, etc. that might have any effect on the final results. Everything was corrected and adjusted to my complete

satisfaction. A location away from the Medical School was selected in order to get away from all the computers, video display terminals and other electronic equipment. This location was, however, about a mile from a large TV antenna complex situated on a hill. I have also wondered for a long time what might be the accumulated effect from the radar units on the Navy ships and other commercial cargo ships on the people living on the hillsides surrounding one of the world's biggest harbors.

I did a number of muscle tests and everything seemed to work all right. We started testing a number of volunteer subjects on the morning of March 28, 1984. The testing continued for three days. At the end of the third day, the results were examined and they indicated that, when everybody knew what type of light or material was being tested, the results were very consistent and my scoring came very close to 100 percent in determining that such items that were thought to cause muscle weakness, in fact, actually did so. However, in the double blind portion of the test, the score for the muscle testing was only 53 percent, which is what might be expected from just flipping a coin. These results were certainly very surprising to me but figures don't lie.

This new finding—that the power of thought has such a direct major effect on muscle strength—opens vast new opportunities for further research. Such subjects as the power of suggestion, hypnosis, meditation, faith healing, and self-imagery move right into the position of front and center along with what I consider more solid physiologic subjects such as light and radiation. There also seems to be a connection here with the placebo problem in research, wherein controlled studies show that as high as around 26 percent of subjects have the same positive reaction to a placebo as those receiving a test drug.

Dr. Greenberg is currently writing a complete, detailed report for publication. It is felt that more double blind testing is needed.

APPENDIX II

MONEY IN THE BANK: A NEW TEST PARAMETER

It is a basic law of physics that all chemicals and minerals have what is known as a maximum wavelength absorption.

Some medications are known to react to ultraviolet light and may cause severe side effects. This is because they have a wavelength absorption in the ultraviolet. Accordingly, when prescribing these drugs for people working indoors in offices all day, it is common practice for doctors to advise their patients to stay out of the direct sunlight. It is then necessary to prescribe much higher doses of these drugs, especially for people working in offices in the North during the wintertime, in order to obtain normal responses when they are, at best, exposed to only a minimal amount of ultraviolet or, possibly, to no ultraviolet at all.

Recently, a friend of mine, quite elderly and hard of hearing, came down to Florida and took a walk in the bright sunlight. He was taking several medications which apparently had a wavelength absorption in the ultraviolet, because he became dizzy, blacked out, and had to be taken to the hospital.

Instead of telling him to stay out of the sunlight, his new doctor cut the dose of his medication way down, and told him to go outdoors and get some more sunlight, but to be careful of getting sunburned.

This new approach to the old problem of the photo-toxic reactions of certain drugs to sunlight worked very well for my friend, and was, I believe, at least partially responsible for the idea of an interesting experiment with chickens.

In days gone by, chickens were raised outdoors. More recently, they have been gradually moved indoors. Originally, some were kept in chicken houses with large open areas, but lately the trend has been toward smaller cages in totally enclosed buildings with, for purposes of economy, very low levels of artificial light that has been switched to fluorescent lighting, which is more efficient and uses less electricity than the older incandescent light bulbs.

I was recently told by the owner of a large poultry operation that in the old days, when chickens were kept outdoors, a laying hen was productive for five years, but that under the new "improved" indoor methods, a laying hen would last only 13 months.

Today, more emphasis is placed on the importance of nutrition. Now, various supplements, including vitamins, hormones, etc., are being added to the chicken feed. All these additives substantially add to the cost of the feed; in addition, some of these additives which have a wavelength absorption in the ultraviolet, react to these particular wavelengths.

Apparently, the basic metabolic life process in chickens reacts to the proper balance between the wavelength absorption characteristics of the various components in the feed they eat and the light to which they are exposed, just like my friend whose medication reacted to sunlight.

The following letter from John Albright, President, Environmental Systems, Inc., an important light researcher, gives further information on the corresponding increase in egg production to a decrease in feed consumption that occurred when radiation-shielded fluorescent fixtures, with a little added ultraviolet light, were installed

in chicken houses on an experimental basis.

Dear Dr. Ott:

This letter will help to put into perspective the value of the Ott certified shielded fixtures in use in poultry houses.

The monies returned in actual savings on an annual basis are as follows:

1. 2% less cracked eggs	\$20,000
2. 8.5% increase in production	39,800
3. Decrease in feed eaten	19,700
4. Shift in egg size	<u>7,800</u>
	\$87,300

5. Add to this that the birds would not have to be debeaked because there is no cannibalism, which amounts to another \$4,000.00, and you have a grand total of \$91,300 savings, or profit, for the farmer.

An additional fact which has not been counted on is that the birds can be molted annually and returned to very profitable production levels. This has now been done two times with the same birds and they are presently in their third year of productive laying. We will just have to wait and see if they will last for five years again. I just don't understand how the industry could be sold this new automated indoor system that made it necessary to replace the hens so much oftener at such an additional major expense.

Each time the birds are molted the farmer doesn't have to buy new birds. This means a savings of \$125,000 on a 50,000 bird house.

Based on these profit numbers, we could see some farmers who are on the verge of losing their farms actually make a hefty profit.

We hope this information will be of interest to you and others.

Sincerely,

John H. Albright
Pres., Environmental Systems, Inc.

Since receiving the above letter I have had further correspondence from John Albright that the results of tests he had done at a nearby regular commercial testing laboratory indicated that the eggs pro-

duced by the hens kept under the new full spectrum lighting with radiation shielding contained 22 percent less cholesterol than eggs produced by hens under ordinary incandescent lighting.

In Chapter 3, "Biological Combustion," I explain how blue light is now being used to treat the jaundice, hyperbilirubinemia, in premature babies. The bilirubin serum in the blood interacts with the particular wavelengths that we see as blue. This interaction breaks down the bilirubin serum so that it can be excreted. It is now known that the wavelength absorption of cholesterol is in the ultraviolet. If chickens (and perhaps even people) do not get any ultraviolet, the cholesterol level builds up just as the bilirubin serum does.

During the winter of 1983-84 a severe outbreak of Avian flu hit the poultry industry in eastern Pennsylvania and several other nearby states, including Maryland and Virginia. Further word from John Albright indicated that in the chicken house where our light studies were being conducted only a very few chickens died as a result of the flu, whereas in nearby chicken houses entire flocks were lost. The situation became so serious that the federal government destroyed approximately 15 million chickens in an attempt to control the epidemic. During this time sample blood tests were taken at random. The blood from the chickens under the full spectrum radiation-shielded lighting showed no trace of the virus, whereas the blood taken from chickens not under this lighting continued to show traces of the virus for a period of months.

This may have an interesting correlation to a serious outbreak of the Hong Kong flu that swept the United States during the winter 1968-1969. In Florida, the Health Department reported 5 percent of Sarasota County—6,000 people—sick with the flu at the same time. Employee illness caused the temporary closing of one supermarket, a social club, and the shutdown of two areas of the Sarasota Memorial Hospital because 61 nurses were out with the flu.

Obrig Laboratories, now a part of Bausch and Lomb, located just north of Sarasota, and one of the largest manufacturers of contact lenses, has approximately one hundred employees. During the entire

flu epidemic not one employee was absent because of any flu-type ailment, according to Philip Salvatori, chairman of the board.

Obrig Laboratories was the first to design a new building using full-spectrum lighting and ultraviolet-transmitting plastic window panes throughout the entire office and factory areas. The added ultraviolet seemed to tie in closely with the results noted at the Well of the Sea restaurant in Chicago. Mr. Salvatori also mentioned that the Obrig employees had not been given any mass inoculation against the Hong Kong flu, although some individuals may have received shots from their private physicians. Mr. Salvatori also commented that everyone seemed happier and in better spirits under the new lighting, and that work production had increased by at least 25 percent.

In May of 1983 a U.P.I. story reported that four out of five patients, ages 35 to 70, with cutaneous T-cell leukemia who were treated with ultraviolet light at the general clinical research center at Columbia Presbyterian Medical Center in New York City, showed significant improvement. Dr. Richard Edelson, associate director of the center, said the patients were given a drug made from celery, parsnips and parsley by mouth two hours before a quantity of blood was withdrawn, and then treated with ultraviolet light. The light activates the drug that destroys the cancer cells, without hurting normal cells and without causing any side effects. The blood is then returned to the patient's circulatory system. Four of the five patients were able to resume normal activity. The fifth had a very advanced case and did not respond. The treatment is still in the development stage.

The Money in the Bank Parameter observed by chicken farmers using the new full spectrum radiation-shielded lighting is quite impressive.

APPENDIX III

THE ULTRAVIOLET CONTROVERSY

Whether ultraviolet light is good or bad for you is a question that seems to grow more and more controversial with each research study that is completed. How can the average layperson know what to do when the experts are so divided in their own thinking on the subject? Increasingly, headlines in both the general media and research journals are proclaiming the possible hazards to the eyes from ordinary sunlight and even dim indoor light. The ultraviolet is usually made out to be the culprit. Perhaps now is a good time to examine what is often overlooked in the fine print.

Much of the medical world seems panicky with fear of the harmful effects of ultraviolet, no matter how minimal an amount it may be. Why? One quite obvious reason seems to be the accelerated method so widely used in research today to test for harmful effects of various substances to one's health, for example, consuming 300 times the normal amount of a cyclamate may cause bladder cancer in rats. Similarly increasing the normal dose of aspirin would mean taking 600 tablets every four hours. To my knowledge, this test has

not been done officially, but would obviously be hazardous to your health.

When it was discovered that the little extra oxygen given to premature babies in their incubators caused blindness, brain tissue damage, deafness and other abnormalities, the practice was discontinued. Fortunately, no one jumped to the conclusion that this proved oxygen hazardous to one's health, therefore, henceforth everyone should learn to live without oxygen. As ridiculous as this sounds it is, nevertheless, exactly what is happening with regards to ultraviolet light. There is no doubt that too much ultraviolet can be harmful, but in so completely protecting ourselves from any trace of it, I believe we are creating a deficiency of important life-supporting energy.

A report of a study done at the departments of biophysics and ophthalmology of the Medical College of Virginia, Virginia Commonwealth University in Richmond, appears to be primarily responsible for the current wave of fear over exposure to any ultraviolet light. This study was reported in an article entitled "Action Spectrum for Retinal Injury From Near-Ultraviolet Radiation in the Aphakic Monkey" by William T. Ham., Jr., Ph.D., Harold A. Mueller, John J. Ruffolo, Jr., Oh.D., DuPont Guerri III, M.D., and R. Kennon Guerri, M.D., and from which the following is taken:

All animals were first tranquilized with an intramuscular injection of phencyclidine HCl, 1 mg/kg of body weight, and the pupils dilated with cyclopentolate HCl. An intravenous injection of sodium pentobarbital, 15 mg/kg of body weight, was used for deep anesthesia. Hypothermia was prevented by enveloping the animal in a thermal blanket controlled electronically by a rectal thermometer. A speculum was used to keep the eyelids open and frequent applications of physiologic saline prevented drying of the cornea.

The article goes on to say that the entire radiation beam entered the dilated pupil of the anesthetized animal using a 2,500-W xenon

lamp equipped with quartz optics. Xenon lamps are extremely intense sources of light, containing high levels of ultraviolet radiation. Exposure times were given as 100 and 1,000 seconds (little more than sixteen minutes). The results showed some retinal damage.

It seems to me that focusing the full beam of such an intense light source directly into the eye of an anesthetized animal with the eyelid secured open and the pupil fully dilated is a totally abnormal and unrealistic condition. In my book *Health and Light* I compare other, similar studies to someone who puts his hand into the furnace jumping to the conclusion that heat is bad for us, therefore, we would henceforth keep our houses at absolute zero temperature.

Though the above deals primarily with the aphakic eye (lenses removed through cataract surgery), other, similar experiments also report injury or damage from ultraviolet in laboratory animals with phakic eyes.

At the Southwest Ophthalmic Dispensers Association annual meeting in Dallas, Texas, where I was giving a seminar, a representative of the manufacturer's research division presented a paper on the relatively new UV 400 lens designed to stop all the ultraviolet. Though specifically recommended for protecting people with aphakic eyes, much of the general discussion insisted that ultraviolet was generally bad for all eyes and that the UV 400 lens represented good prevention against cataracts even for people with normal eyes.

Personally, I would not want to be anesthetized, with my eyelids secured open, the pupils fully dilated, and the full beam from a 2,500 watt xenon lamp equipped with a quartz optic system focused directly into my eyes, even for a second. I simply cannot understand the scientific rationale behind this kind of thinking.

Recently, a person who underwent cataract surgery about six months before we met advised me that he had had ultraviolet transmitting plastic lenses implanted in both eyes. Prior to his surgery, his cholesterol level had been on the high side of normal but was now very much on the low side. He has not changed his diet or done anything else that he can think of that might have caused this

significant drop in his cholesterol. Though this is only an isolated case, it is, nevertheless, an interesting one, in view of what happened when a little ultraviolet light was introduced into the chicken house. This individual told me that he did wear sunglasses in the bright sunlight but that he spent considerable time on a shaded screened porch without them.

APPENDIX IV

PROOF OF THE PUDDING

Throughout my book *Health and Light*, as well as in this one, I have tried to give specific examples of how important the full spectrum of natural sunlight is to human health and behavior. Since this book was first printed, there have been additional examples and further research studies that should be mentioned.

An article entitled, "Malignant Melanoma and Exposure to Fluorescent Lighting at Work" appeared in the August 7, 1982, issue of *The Lancet*, a leading British medical journal. The authors were Valerie Beral, Helen Shaw, Susan Evans and Gerald Milton of the Department of Medical Statistics and Empidemiology, London School of Hygiene and Tropical Medicine, London, and University of Sydney and Melanoma Clinic, Sydney Hospital, Sydney, New South Wales, Australia.

The *Lancet* article indicates that, statistically, people exposed to fluorescent light rather than sunlight get malignant melanoma. Understandably, the article has provoked considerable comment. It represents a complete break from the traditional assumptions about

fluorescent lighting. For example, the fluorescent tubes in the research laboratories, administrative offices, and all other areas of the Bureau of Radiological Health, Division of the Food and Drug Administration, are covered with a special ultraviolet filtering plastic sleeve in addition to the standard ultraviolet absorbing plastic diffusers in every fluorescent fixture. This is done to make certain that no trace amount of ultraviolet is released.

In addition to the malignant melanoma article published in *Lancet*, other articles in various journals specifically relate mutagenicity and malignant transformation in tissue culture studies to fluorescent light. The following titles are listed as examples:

"Mutagenicity and Toxicity of Visible Fluorescent Light to Cultured Mammalian Cells," Matthews O. Bradley (National Cancer Institute) and Nancy A. Sharkey. *Nature*, vol. 266 (April 21, 1977), 274-276.

"Fluorescent Light Induces Malignant Transformation in Mouse Embryo Cell Cultures," Ann R. Kennedy (Harvard School of Public Health). *Science*, vol. 207 (March 14, 1980), 1209-1211.

"Genetic Damage in *Escherichia coli* K12 AB2480 by Broad-Spectrum Near-Ultraviolet Radiation," Robert B. Webb (Argonne National Laboratory). *Science*, vol. 215 (February 19, 1982), 991-993.

"Toxicity and Mutagenicity of Radiation from Fluorescent Lamps and a Sunlamp in L5178Y Mouse Lymphoma Cells," Elizabeth D. Jacobson (Bureau of Radiological Health, Food and Drug Administration). *Mutation Research*, 51 (1978), 61-75.

These articles list numerous other references to similar results obtained by other researchers using fluorescent lights. As a pretty general rule all of the abnormal biological responses attributed to fluorescent lights are blamed on that trace amount of ultraviolet.

My book *Health and Light* (hardcover edition) has an illustration of two pots of bean seedlings grown under fluorescent lights. The

seedlings in the pot placed directly under the ends of the fluorescent tubes where the cathodes are located show a stunted, distorted growth whereas the seedlings in the pot placed under the center of the 8-foot tubes show normal growth development. When a 2½-inch aluminum foil shield was placed around each end of the fluorescent tubes to cover the cathodes, the bean plants still showed the same stunted, distorted growth. When a similar 2½-inch lead foil shield was placed around the ends of each tube, the bean plant showed normal growth development. This would indicate that a trace amount of X-rays was coming from the cathodes, even though none could be measured with conventional X-ray measuring equipment.

The cathodes at each end of the tube are the same as those used in TV picture tubes and X-ray tubes. However, fluorescent tubes operate at a much lower voltage and theoretically should not give off any X-rays. The G.E. publication "Techni Talks" recently published an article stressing their quality control in manufacturing the filaments for high voltage rectifier tubes so that they would be perfectly smooth, as any rough spot could act as a little point emitter and give off electrons that could produce X-rays if they happened to hit a metal target.

One of my time-lapse pictures of a light bulb filament, taken over the full life of the bulb, clearly shows the filament starting out nice and new and shiny and smooth. But as it gets older, the heat of the filament is so great that the metal coils of tungsten soon start to shrivel and get rough, producing many little points that can only be seen with a microscope. Old fluorescent tubes and TV sets seem to give off more radiation than new ones. Many filaments, especially those in fluorescent tubes, are coated with an electron emissive material that further compounds the problem.

Another major problem with all fluorescent tubes is that the full length of the arc gives off a radio frequency emission. However, this can be eliminated by using a simple wire grid radiation-shielding device that is electrically grounded.

All this supports my belief that many of the abnormal biological

effects reported as caused by a virtually non-existent, minimal trace amount of ultraviolet in ordinary fluorescent lights are instead the results of the radio frequency and/or X-ray emissions, usually totally ignored in supposedly controlled research studies.

It could explain the occurrence of malignant melanoma on the parts of the body which, though covered by clothing, would not stop either X-rays or RF radiation. Cathode ray tubes used in computers and word processing office equipment also emit the same trace amounts of X-rays and RF radiation, which compounds the problem, more so in offices than in homes.

The results of the malignant melanoma study also explain another inconsistency in the general assumption of ultraviolet as a major contributing factor in skin cancer. People living under primitive conditions at high altitudes where there is much more ultraviolet have been found to be virtually free of all types of cancer. If ultraviolet light is a contributing factor to skin cancer then those people living at altitudes where the ultraviolet intensities are the highest might be expected to show a higher incidence of skin cancer than people living at sea level who have the advantage of the additional levels of atmosphere, which filters ultraviolet light, reducing its intensity.

The following letter is very much to the point.

September 7, 1981

John, I would like to [tell] you [that] I feel that information I received from you was extremely beneficial in aiding my husband, Alan, and myself in conceiving.

In 1975, Alan and I tried very hard to have a child. We found that nothing was working along conventional methods. I had gone to several physicians and there was really no major problem as to why I couldn't get pregnant.

I then started taking Clomid, a fertility drug. That also did not work. From '75 to '77 I must explain that I spent most of my hours in my office under fluorescent light. My day began at 9:00 in the

morning in the office at my desk and rarely was I home before 6:00 at night. . . . I ate properly, I took vitamins, I did all the things that I was supposed to do.

In January of 1977, we made a major move. We left Delaware, I retired and came to sunny Florida. While in Florida, making this transition, we were very fortunate to find a house right on the Gulf of Mexico. If you recall, John, during that time, we had a chance to get together and have a long conversation at your home in Sarasota. You gave me a great deal of information on full spectrum lighting. You also told me to throw away my sunglasses which of course I wore all the time.

I did spend every day, as soon as I got our two children off to school, out on the beach. I put my bathing suit on, took my sunglasses off and walked the beach. I became a very good shark tooth hunter; as a matter of fact we have over 6,000 in our collection. I would sometimes spend four hours a day on the beach walking, collecting shark's teeth.

March 10, 1977, we flew to Philadelphia to celebrate my birthday with a very good friend of ours, who was also my gynecologist and obstetrician. For a birthday present he gave me an examination and ran a test and told me that I was pregnant. I believe with everything in me that that came about because I stopped wearing my glasses.

Since then I did start wearing sunglasses but I started wearing the full spectrum gray that you had suggested and I wear them only when I need them. Our son was born October 13, 1977. On September 18, 1979, our most recent child . . . was born. Now that I am reaching[a] ripe old age, John, we have decided to go into retirement and there will be no more children. We have a lovely family now.

. . . another reason we decided to move to Florida in the first place is that I was told that I had a disease called Vonrecklinghausen's, which is neurofibromatosis. It's a disease where tumors are formed on nerve endings and, although the disease is rarely fatal, the one time it is, is when the tumors grow on the auditory canal. I was diagnosed September of '75 as having a tumor on the auditory canal. I was told that this type of tumor was inoperable and that unless a laser beam was developed quickly to operate, I would die within two years, five if I was really lucky.

A few weeks ago I was under a doctor's care, not for any symptoms, but simply to have this disease watched. I went to a new ear, nose and throat man, who has run a series of tests and is quite doubtful that I ever had the disease. It doesn't really matter whether I ever had the disease or whether the direct sun was beneficial in eliminating any signs and symptoms, the fact is I have no signs or symptoms now and it does not appear that I am terminal. Who knows, someday I may go back into my chosen profession again.

I wish you well and much, much success with your book.

Dictated on tape by Mrs. Judith Haimes

Following are excerpts from an article that appeared in the *Enterprise Ledger*, Dec. 20, 1982, p. 8, entitled "Former Senator Ends 3,700 Mile Walk to Raise Funds for Cancer Research."

PRATTVILLE, ALA. (AP)—Two years ago, W.G. "Mac" McCarley came out of surgery for stomach cancer. The doctors told him he had three months to live.

Through medical treatment, belief in God and strength of will, he proved them wrong.

On Saturday, the former state senator was honored as he walked the symbolic last mile of his 3,723-mile walk across the 18 U.S. highways in Alabama.

His walk had at least two purposes: to raise money for cancer research at the University of Alabama in Birmingham and to "make the word 'cancer' less terrifying."

The walk, which began on February 1, in nearby Montgomery, ended Saturday in McCarley's hometown with a ceremony at the old Fort Doster Armory.

At the end of the march, McCarley said he no longer had "any illusions about living, nor any fear of dying."

In December 1980, doctors removed about 75 percent of his stomach and 40 percent of his esophagus after they discovered he had cancer. He recalled Saturday that two years ago, he was

lying in the intensive care unit of a hospital.

McCarley said he is "living proof that you don't have to die just because some doctor says you will."

In a phone conversation with Mr. McCarley, he told me he did not wear any eyeglasses or sunglasses, and that while his doctor did give him some suntan lotion, he did not like it and never used it again after two applications. He also said he seldom wore a hat while walking the highways in Alabama.

I have a whole file of newspaper clippings about unusual cases of complete cancer remission, sent to me by people who have either read my book or heard me lecture. These stories and the various treatments involved were all different except for one thing: that whatever the person did basically involved getting away from fluorescent lighting and being outdoors in the natural sunlight.

One story appeared in the *Los Angeles Times*, September 25, 1978. The front page headline reads, "Boy Beats Disease, Party Climaxes Leukemia Battle." While the boy was undergoing extensive chemotherapy treatment the family moved to Sheep Ranch, California, where he spent most of his time outdoors taking care of his horses.

Another story appeared in the *Boston Globe*. Brenda Lee Fortier, a pharmacist in Concord, New Hampshire, had surgery in June of 1979 for what was thought to be a simple ovarian cyst. She woke up to a complete hysterectomy and a diagnosis of cancer. It later metastasized and she underwent an intensive intravenous chemotherapy program in the hospital. She also stopped working all day under fluorescent lights, and going to night school, also under fluorescent lights, and started a self-healing process involving meditation, relaxation, and self-imagery. The self-imagery program consisted of imagining her tumor was a golf ball which she could break apart by kicking it around while wearing white tennis shoes with a big red star on each ankle. Of course, she did this outdoors, and also spent most of the rest of her time working in the garden and

horseback riding.

An article in the *National Enquirer*, July 3, 1979, headlined, "Fred MacMurray, 'I've Beaten Throat Cancer.'" During his interview, Mr. MacMurray stated that he defeated throat cancer through a combination of radiation, natural foods, and the controversial drug, Laetrile. He said that though he felt good enough to return to acting, he doesn't plan to. He says he plans to take it easy and to continue to play golf, work in the garden—that sort of thing.

I have many, many more such stories, enough to fill a whole book. The point is, however, that getting out into the sunlight without overdoing it is beneficial.

APPENDIX V

STOP FIDDLING

So far I have discussed mainly the effects of light and radiation on health. However, their effects on behavior are equally important. Accordingly, I would like to review, through some short excerpts, this part of the story from both *My Ivory Cellar* and *Health and Light*, with the addition of some more recent information.

In *My Ivory Cellar*, published in 1958, I mentioned the work of the late Warden Joseph E. Ragen of the Illinois State Penitentiary in rehabilitating the toughest types of habitual criminals and making them eligible for parole through horticultural therapy.

Other forms of manual therapy, including painting and sculpture done indoors, did not have the same beneficial results as horticultural therapy done outdoors in the natural sunlight. Unfortunately, the results were so startling nobody would believe them.

Health and Light contains the story of the ultraviolet black light tubes that were installed in the Well of the Sea Restaurant located in the basement of the old Hotel Sherman in Chicago. In addition to less absenteeism (no one ever seemed to get the flu), the workers there

Two boys attending the Kansas City Royals Baseball Academy in Sarasota suddenly became extremely uncooperative and aggressive. Their academic achievements went down, their batting averages, etc., fell off to such an extent that it was suspected that they had started taking drugs. However, further investigation revealed that one boy had just started wearing pink sunglasses and the other had put some psychedelic lighting into his room. When these problems were corrected, the boys quickly went back to normal.

Some of the staff at radio station WILZ, near St. Petersburg, Florida, decided to brighten up their surroundings by putting deep pink fluorescent lights in both the studios and control rooms. About two months later they began to have problems. For example, announcers began performing poorly on the air. Everybody became irritable and consistently at odds with management decisions and generally difficult to control. Two employees resigned for no known reason other than general dissatisfaction with themselves and the staff. Finally, someone thought to remove the pink tubes. Within a week, as if by a miracle, tempers ceased to flare, congeniality and the spirit of working together began to redevelop and resignations were withdrawn. Work improved and mistakes were reduced to a minimum.

Another interesting bit of information turned up as a result of a questionnaire given to a group of college students by a professor of psychology. It was found that three of the students constantly wore hot pink sunglasses. A check with the faculty ratings indicated that these three students were considered the most psychologically disturbed in the college, always the most active ringleaders in protest groups or demonstration marches.

Studies done at the Florida State Marine Laboratory showed less aggression and cannibalistic traits in shrimp kept under full spectrum lighting. Similar results were found with rabbits at the Wills Eye Hospital in Philadelphia, and at the Northwood Mink Farms in Crystal Lake, Illinois.

One of the studies done in our own laboratory at the Environmen-

tal Health and Light Research Institute showed that rats placed in front of a television set shielded with black paper first became increasingly hyperactive and aggressive, constantly fighting one another, and then extremely lethargic until, finally, they all died. However, rats shielded with lead from TV radiation, all remained perfectly normal.

A study we did at the Adjustive Educational Center of the Sarasota County School System, a special school for children with learning disabilities and other related problems, showed that all the televisions sets in the homes of these children were giving off measurable amounts of X-ray radiation. When these sets were repaired or discarded, all the children except one were able, within a few months, to return to their regular classes. We found that the one child who showed no response even when her viewing hours were greatly restricted and she was made to sit way back from the set, was sleeping directly on the other side of the wall from the TV set in the living room. Her pillow was actually only a few inches—the thickness of the wall—from the back of the set. An ordinary building partition of this type would give no protection from radiation. When this situation was corrected she, too, was able to follow her classmates back to her regular school.

Then there is the story of the installation of full spectrum shielded lighting in some of the classrooms at another Sarasota school. The improved lighting caused the hyperactive children to calm down, their academic achievement to go up, and resulted in their getting fewer cavities and less tooth decay. Two schools in California and one in Washington State obtained similar results when fluorescent lights were eliminated in the classrooms and temporary incandescent lighting used only when absolutely necessary.

A major study was undertaken during the 1982-1983 school year in Wetaskiwin, Alberta, and supported by the Alberta Education System. To begin with, this study compared ordinary fluorescent lighting and full spectrum fluorescent lighting with added ultraviolet but no radiation shielding. Different colored rooms were also used.

During the experiment the radiation shielding was added to part of the full spectrum lighting system. The results are still being analyzed but as of this writing the preliminary reports indicate that in certain sub-studies the added ultraviolet full spectrum, minus the radiation shielding, clearly produces less absenteeism and a higher academic achievement record compared to the regular fluorescent lighting. When the radiation shielding was added, a significant difference was then noted in the extent in the hyperactivity. Further details will have to await the final report.

I add this hasty review of some of the experiments dealing with the effects of light and radiation on behavior in order to place special emphasis on what I think is an extremely important and urgent subject. To my knowledge there is very, very little research being done on the accumulated effects of low level radiation and distorted light spectrum on biological systems. Meanwhile, we are becoming more and more alarmed over generally lower academic achievement in all our school systems, the increase of crime and violence, and use of drugs. Every day the news weeklies, newspapers, TV and radio report the alarming and appalling increase in the use of hard drugs in every category of society, including top management and white collar workers, industry in general, in financial and investment firms, law offices, among factory workers and office workers. Silicon Valley, the heart of our latest electronic industry, has been singled out especially, and there have been numerous reports from all over the world of more and more so-called unusual situations where pregnant women working with video display terminals are being confronted with the statistics that there may be a risk as high as 75 percent of suffering either miscarriages or giving birth to children with serious birth defects.

From my working involvement with all of these studies (admittedly, some of them are no more than just observations), I see a clear relationship between the accumulated effects of radiation from all the electronic devices in common use today, and stress conditions that cause people to take ever more tranquilizers and medication,

which can ultimately lead to the use of liquor, pot and hard drugs.

Something must be done quickly. "Rome is burning again," and a lot of people must stop their fiddling, especially the responsible government agencies, industry, educational centers and research institutions. Hardly a research laboratory in the country pays any attention to the lighting in its rooms. Lighting is still left up to the janitors as part of routine building maintenance. The light in all laboratories must be considered an important research parameter and I believe a standard should be established as a general procedure.

After over 57 years of taking time-lapse pictures, giving about four thousand lectures, publishing 64 articles and three books, I have now purchased a new set of golf clubs and hope to find a little time to take up the game more seriously.

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APPENDIX

Sources of Information and Lights

Environmental Health & Light Research Institute
Att: Fred Mendelsohn
16057 Tampa Palms Blvd. West / Ste 221
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813-621-0058

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Att: Ken Ceder
306 East Cota Street
Santa Barbara, Calif. 93101
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Berkeley, Calif. 94702
415-845-8535

Designs Division
Att: Herschel Queen
12 Middlesex Road, Box 211
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617-449-2261

ABOUT THE AUTHOR

John Nash Ott, President of John Ott Pictures, Inc., writes and lectures extensively in the field of photobiology, which he first explored for a wide audience in *Health and Light* and *My Ivory Cellar*. After twenty years as a successful Chicago banker, he turned his lifelong interest in timelapse photography into a full-time investigation of the ecology of light.

"I believe," Ott says, "that we need to know much more about natural and artificial light and what it does to us and to the plants and animals sharing our world. Modern technology has made our old ideas about light obsolete."

Ott's research has brought him citations and awards from horticultural, scientific, and medical societies, including an honorary Doctor of Science degree from Loyola University at Chicago. Edward F. Scanlon, M.D., President of the American Cancer Society, 1981, has said of his findings: "The implications for laboratory research are considerable, and greater emphasis needs to be placed on the control of illumination. John N. Ott has been the pioneer in this work."

Dr. Ott makes his home in Sarasota, Florida, where he carries on and directs further research in his field. He is a regular contributor to such journals as *Illuminating Engineering*, *Optometric Weekly*, *Academic Therapy*, and *Let's Live*. His lecture tours and field work keep him in touch with scientists around the world.

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