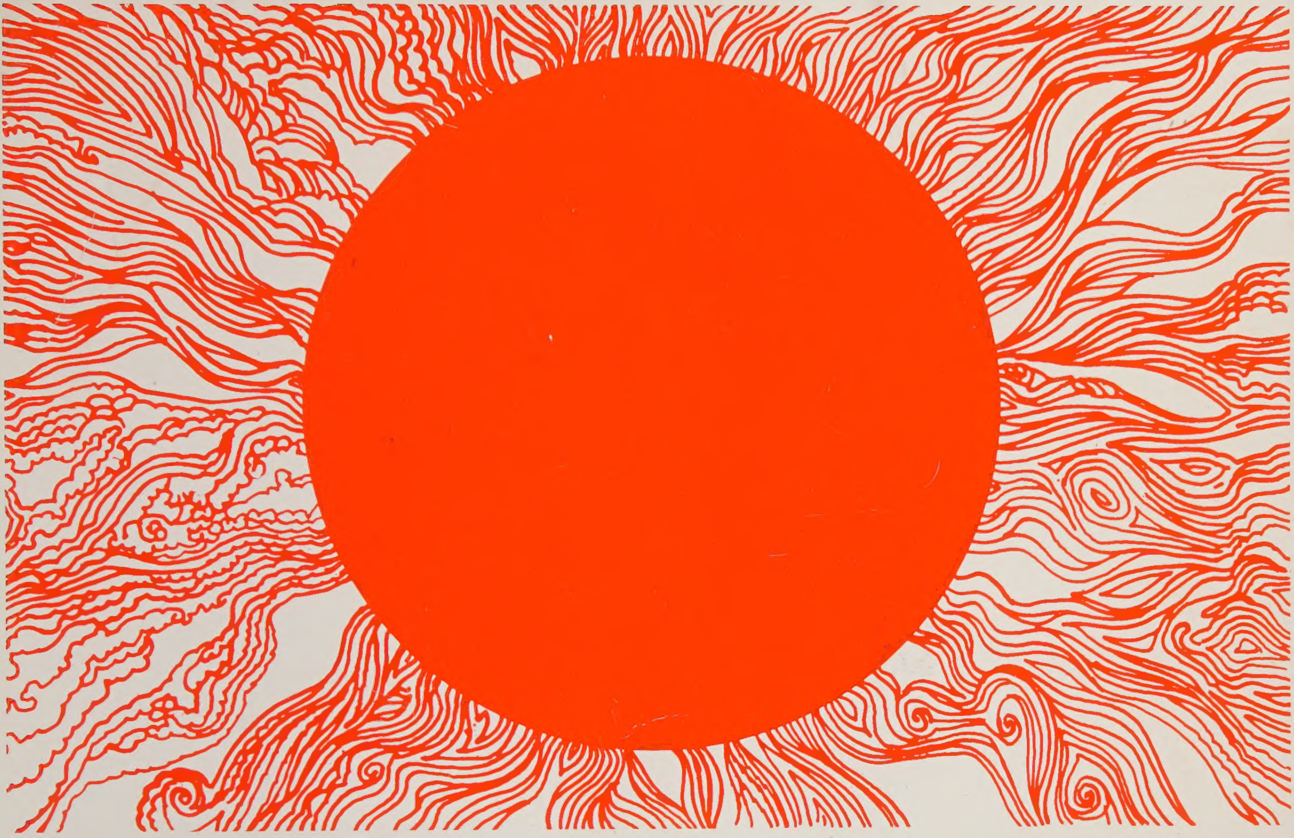

SUNLIGHT

Zane R. Kime, MD, MS

A vital new book on the relationship of sunlight to human health. Studies from the scientific literature are described which demonstrate sunlight's effects on lowering cholesterol, blood pressure and blood sugar; on increasing endurance, sex hormones, and resistance to infection. Crucial dietary suggestions are made to insure a healthy skin when exposed to sunlight.

SUNLIGHT

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Zane R. Kime, MD, MS

World Health Publications
Box Number 408
Penryn, CA 95663

Library of Congress No. 80-51038

ISBN: Hardcover, 0-9604268-0-9
ISBN: Softcover, 0-9604268-2-5

1st Edition
2nd Edition

Designer and illustrator, Donald W. Muth

Foreword

Dr Zane Kime's well documented book on sunlight and health is a helpful adjunct to any good physical fitness program. The latter depends on scientific principles discovered and proved over the years by practical medical and scientific experience, and the sufficient use of the body in the realization of these principles.

Millions of people who "Follow the Sun" for enjoyment, relaxation, and health need the basic information contained in Dr Kime's book, since most summer recreation necessitates considerable exposure of the skin to the sun.

In a way, "Run for Your Life" and "Follow the Sun" are comparable movements. Science has separated to some extent the differential effects of exercise and sunlight, but Dr Kime's thorough research correctly integrates them in wise proportions. Prudent management of the sun by those following the "Dynamic Health" way of systematic exercise will bring enjoyment and all the additional benefits of sunlight into their programs.

The book, *Sunlight,* is excellently written for general reading, and yet is in careful tune with the latest scientific literature in the field. I endorse this book as correlative reading for anyone in an exercise program. Those who read it will find life more interesting and will be motivated to take greater advantage of what nature offers in the creation and maintenance of dynamic health.

— *Thomas K. Cureton, Jr , PhD*
Professor Emeritus, University of Illinois
Urbana, Illinois

Dedication

To my wife Sharon without whose untiring inspiration and enthusiasm this book would not have been possible.

"The doctor of the future will interest his patients in the care of the human frame, in diet, and in the cause and prevention of disease."

— Thomas A. Edison

Author's Preface

At one time or another, on the road of life, all of us have arrived at a crossroads in our thinking. Practicing medicine has brought me there, perhaps an illness will place you there too.

As I have seen the options, we may, on the one hand, choose to respect and appreciate nature. We may see within her a wisdom and intelligence that far surpasses man's greatest technological achievements. We may come to realize that man's best interest is served through obedience and conformity to nature and that sound health is the result of this obedience.

On the other hand, we may choose to believe that we can improve upon nature, that we can manipulate her to our own benefit. We may believe that we are responsible to nothing but our own pleasure, that we may freely violate and disregard natural law and then artificially manipulate the deleterious consequences. We may believe we can eat poorly, sleep rarely, work constantly, exercise sparingly, and avoid any physical consequences by the use of some wonder drug or miraculous surgery. It is evident that this is the road most of us choose, for during the 1900's, the volume of drug business in the United States has increased by a factor of 100. It is estimated that 20,000 tons of aspirin are consumed per year, or 225 tablets per person. Not only is the drug industry booming, but also, as everyone already knows, there has been a tremendous increase in health care costs. To live indiscriminately and pay the price later is easier — for the moment. Maybe that's really why we choose it. It requires no discipline and no sacrifice. It conforms to our cultural pressures.

In my medical practice, I see many whom no drug or surgery will restore to health. The hoped-for escape becomes only a means to muffle the most noxious complaints or a method to prolong a dying existence. For all our advances in science, we still remain humbly, pitifully dependent upon the forces of nature: air, water, food, and sunlight. It seems in fact, the more advanced our technology becomes, the more capable we are of destroying ourselves — not only by a nuclear holocast, but also by more insidious inroads into our health such as the tremendous change that has taken place in the area of food technology. Death has always been easily within man's grasp, while life and health remain the property of nature and her forces. Out of this conviction this book has been written. I believe there is ample evidence in the scientific literature that sunlight, free of technological distortions, is not only beneficial, but necessary for human health.

Zane R. Kime, MD, MS

Acknowledgements

Some gifts can never be repaid in monetary terms. To all the great people who have encouraged me and have contributed to this book in any way, I extend my deepest appreciation. I offer a special thanks to those who have given so unreservedly of their time: to my wife Sharon for her countless hours of help in pulling my notes into a readable manuscript; Leslie Hall and Francis McGrath for their assistance in the initial library research, and to Dr Clyde Bushnell for proofreading assistance.

Nor can I close this note without honoring Drs Chen, Cureton, Hoffman, and Ott for their fine endorsements and commendations.

Contents

Introduction

It has been my privilege to read the manuscript for *Sunlight*, by Zane R. Kime, MD, in advance of publication. As Director (now retired) of the Environmental Health and Light Research Institute, I have been asked in the past on a number of occasions to read and comment on quite a few manuscripts on the subject of light and its biological effects on plants and animals.

As a result of this, plus my own interest in the subject, I have had considerable exposure to the available literature on this subject. Over the past very few years I have been especially gratified with the rapidly accelerating accumulation of information and the trend toward more studies dealing with the different effects on health between natural sunlight and various artificial light sources.

Most of the earlier research was done by scientists using laboratory animals. Like so many new discoveries, this early research met stiff resistance — especially when it came to applying the findings in any practical way to human health. Dr Kime's book, in my opinion, represents the biggest step forward to date in bringing together the scientific data and practical medical application of sunlight to human health. It contains a wealth of information based on his exhaustive search of the medical literature on the benefits of sunlight, not only in this country but also many foreign countries.

Dr Kime also ties in the case histories of many of his patients who have responded to sunlight treatments after all else had failed. The scope of this book is spellbinding, and I strongly recommend it to everybody interested in living longer and enjoying better health.

John Ott, ScD

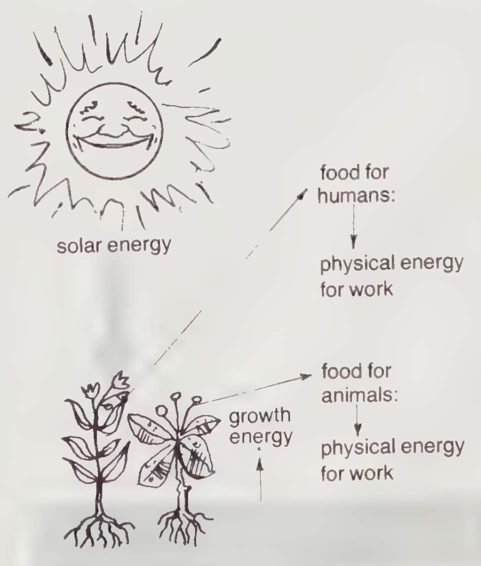
Chapter 1

Sunlight and Health

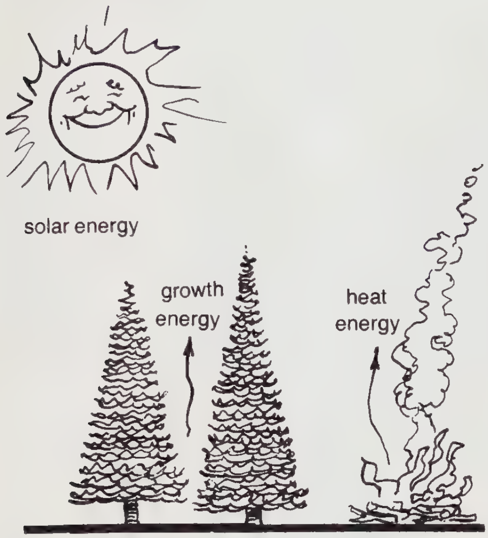
"But may they who love you be like the sun when it rises in its strength."

— Judges 5:31, (NIV)

All life on this earth is dependent upon the sun. It is the source of all light and warmth, and most of the energy on earth comes, or has come, from the sun. The direct rays of sunlight that strike this planet sustain the biosphere in which we live. The sun provides the energy for the plant to photosynthesize the products necessary for growth. This energy is then stored in the plant in the form of carbohydrates, proteins, and fats to be transferred to animals or humans upon consumption. Similarly, the sun provides the energy necessary for the growth of trees, and it is this energy that is released, in the form of heat, upon combustion of the wood. The sun's energy also provides the fossil fuels upon which we find ourselves so dependent. Fossil fuels are formed when decaying plant matter is acted upon over a long period of time by the forces of heat and pressure. The energy from the plants and the



Solar energy is the basic source of energy for man and animal.



Solar energy is the basic source of energy released upon combustion of wood.

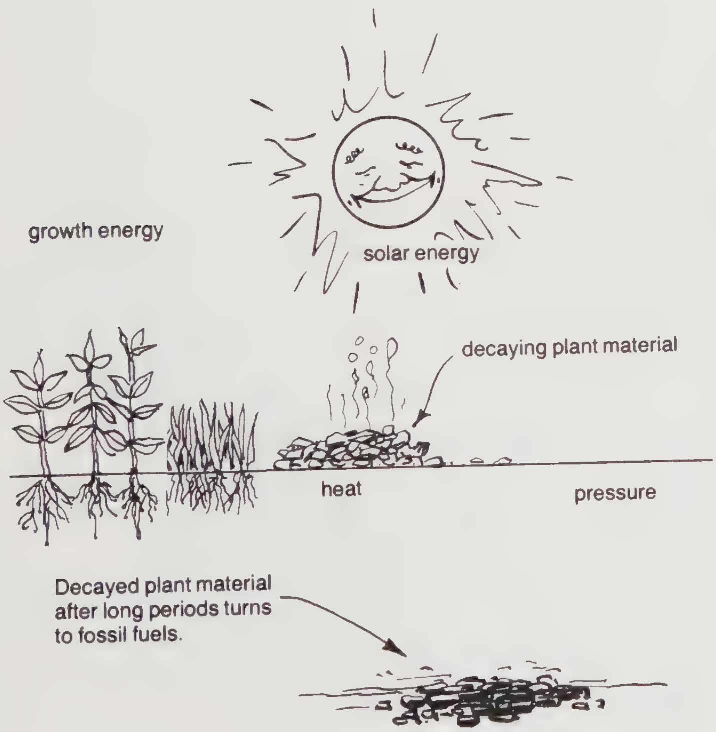
forces upon them is stored in the fossil fuel to be released upon combustion.

Even the energy derived from hydroelectric plants is ultimately dependent upon the sun. Hydroelectricity is derived from the force of large rivers descending from the mountainous areas of lower elevations. The sun is responsible for this, in that air, which has been warmed by the sun, is capable of absorbing water. Sun-warmed air passing over the oceans absorbs water from the oceans. As it passes over the land masses, and moves up to higher elevations, it is cooled. When cooled, air cannot hold as much water, and some of the water will precipitate usually as rain or snow in the mountains. This feeds the rivers which in turn provide hydroelectric power. So, it is apparent that energy, and, subsequently, life, on this planet, are dependent upon the sun.

If the gross biosphere (the area of the planet in which life is sustained) is so dependent upon the sun, what of the more individual sphere of the human body? Is the human physical organism itself directly dependent upon the sun?

Throughout almost all of recorded history, man has lived and worked out of doors with full exposure to the natural sunlight. Pastoral and agricultural activities demanded an outdoor life. This was abruptly changed by the industrial revolution when thousands moved to the cities to work indoors in factories. With the industrial revolution there came also the insidious belief that man was no longer dependent upon the natural world, but was independent of it. Only in relatively recent history, has man been working indoors in factories and offices, or in mines far below the surface of the earth. In our modern day society, we live in a glass jungle, where most of our time is spent behind window glass, which is an effective barrier to the ultraviolet portion of natural light.

Our homes, our transportation, and our places of employment all shield us from the sun. And, since there is such wide usage of fluorescent and incandescent light in offices, schools and factories, it is evident that most people, in

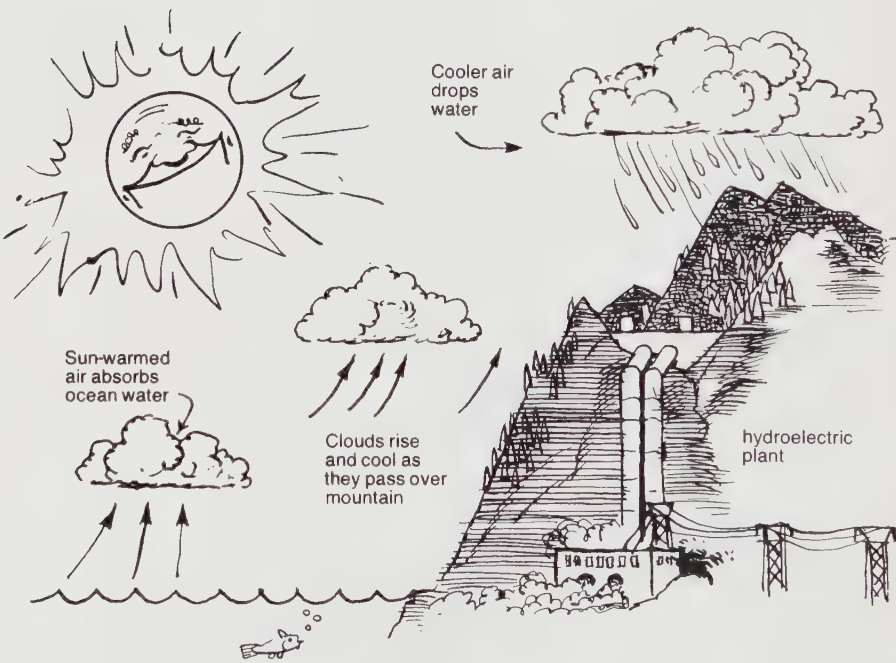


Solar energy contributes to the energy found in fossil fuels.

the present day industrial society, spend most of their waking hours under a light that is entirely different from the kind that comes from natural sunlight.

Sunlight is composed of many different energy levels. This energy is transmitted in the form of electromagnetic waves. These waves vary in length from .00001 nanometer for cosmic rays (a nanometer is one billionth of a meter) to about 4,990 kilometers (3,100 miles) for electric waves.

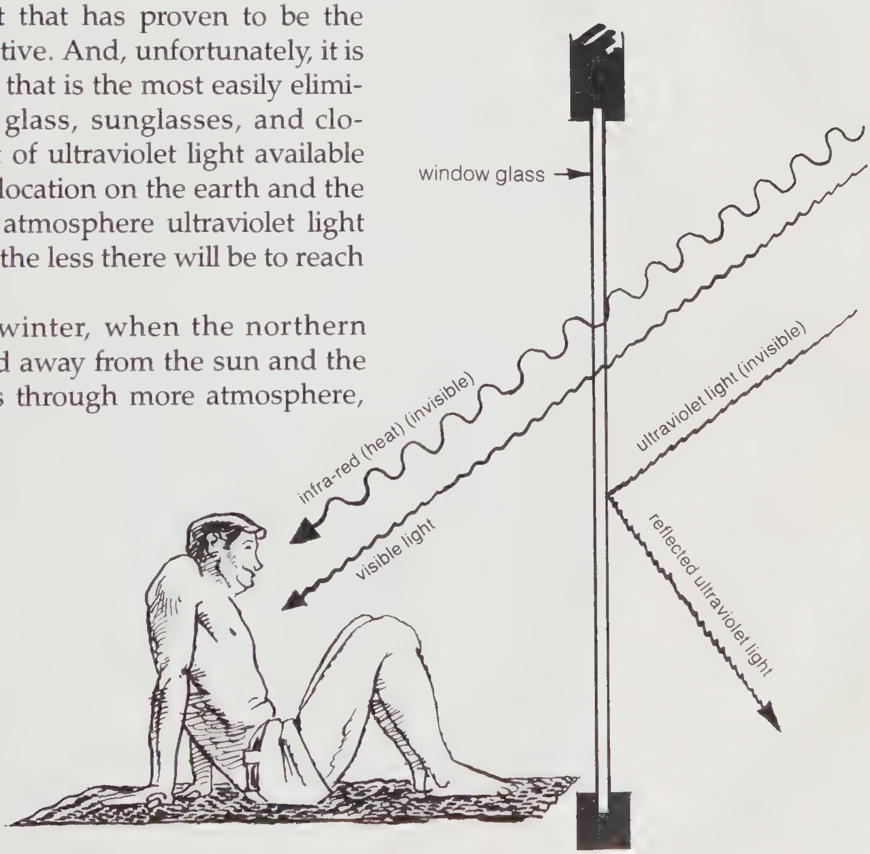
Not all of these energy waves reach the earth's surface. The layers of atmosphere that surround



Solar energy and hydroelectric power.

the earth protect it from absorbing all but a small portion of the wave lengths emitted by the sun (the electromagnetic spectrum). Of the waves that do reach the earth, only a very small portion can be seen by the human eye. It has been estimated that the eye sees only about 1% of the entire electromagnetic spectrum. Ultraviolet and infrared waves reach the earth's surface, but are invisible to the human eye. It is the ultraviolet portion of sunlight that has proven to be the most biologically active. And, unfortunately, it is the ultraviolet light that is the most easily eliminated by window glass, sunglasses, and clothing. The amount of ultraviolet light available depends upon the location on the earth and the season. The more atmosphere ultraviolet light must pass through the less there will be to reach the earth.

This is why in winter, when the northern hemisphere is tilted away from the sun and the sunlight must pass through more atmosphere,



Window glass permits some wave lengths to pass through and reflects others.

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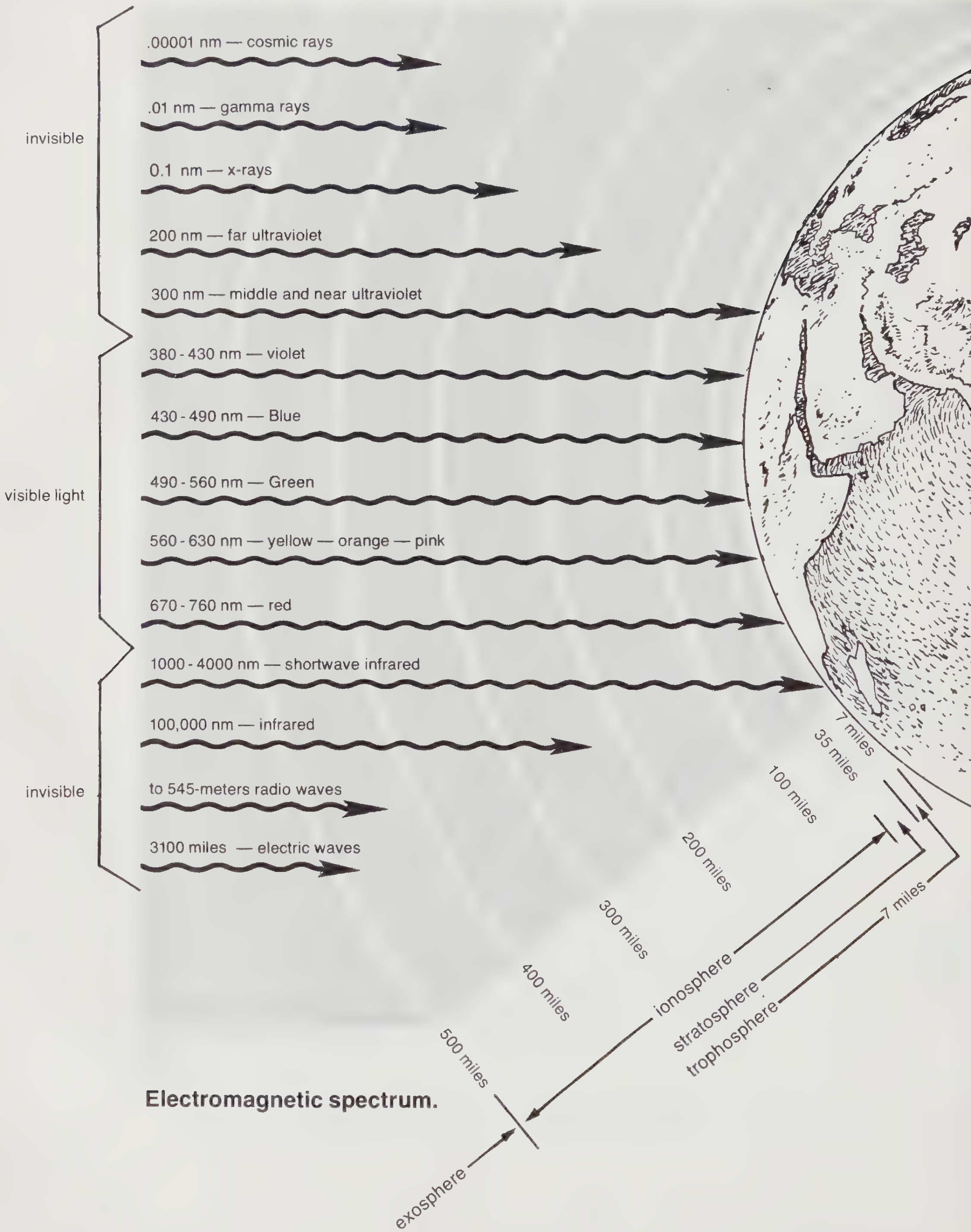
Rays of the sun



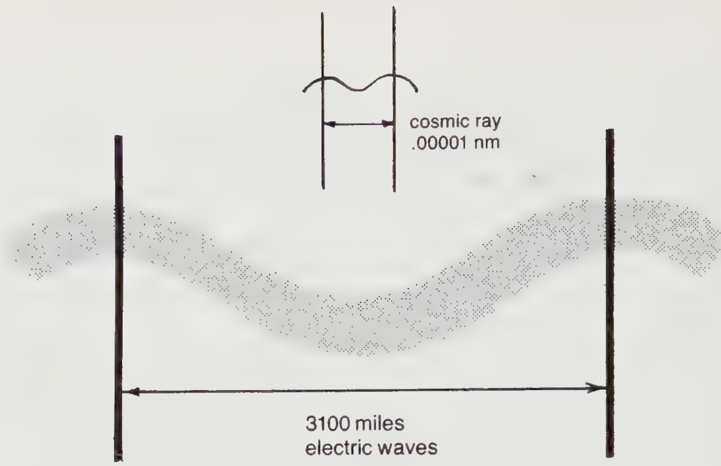
Electromagnetic spectrum.

there is less ultraviolet light available. At 40° latitude, ultraviolet light is available in the winter for only about 4 hours (10 am to 2 pm) while the sun is highest in the sky. In the summer ultraviolet light is available over a longer period of time, from 8 am to 4 pm.

Students of history know that men anciently revered the sun as a life-giving, healing power. From the ancient Greeks down to the beginning of the 20th century, observations were made, and detailed records were kept, that reveal the sun to be a positive factor in the health of man. Downes and Blunt, in 1877, discovered the dramatic ability of sunlight to destroy bacteria. From this point onward sunlight was enthusiastically studied as the only, then known, effective means of treating bacterial infections. Niels Finsen, in 1903, won the Nobel Prize for successfully treating skin tuberculosis with the ultraviolet portion of light. Studies continued which revealed the potent multifaceted effect the sun has on the human body. Single exposures of a large area of the body to ultraviolet light were found to dramatically lower elevated blood pressure (up to a 40 mm Hg drop), to lower abnormally high blood sugars as found in diabetics, to decrease cholesterol in the blood stream, and to increase the white blood cells, particularly the lymphocytes which are largely responsible for the body's ability to resist disease.

The favorable interest of the medical world, in the healing power of sunlight, began to wane when antibiotics were discovered. Since 1939, when Domagk won the Nobel Prize for successfully treating bacterial infections with sulfanilamide, the pharmacologic dominance in

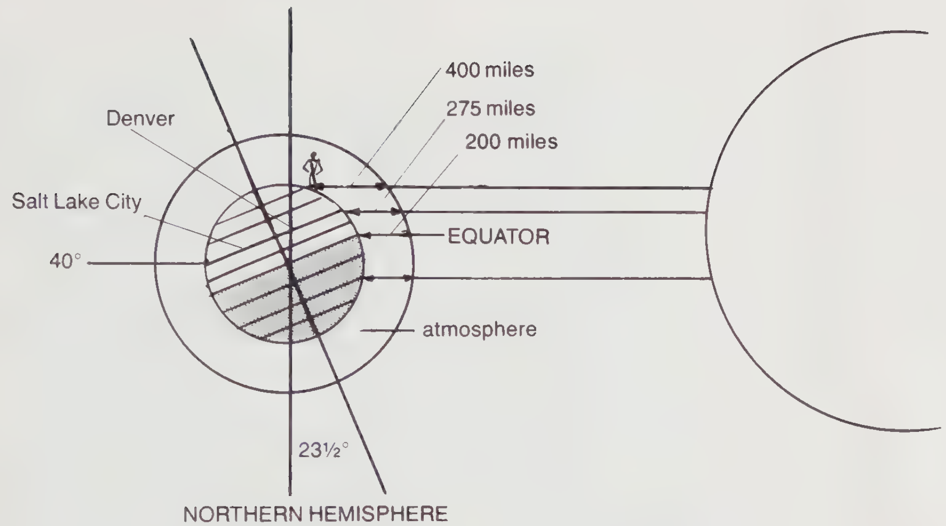
Solar radiation composition reaching earth.



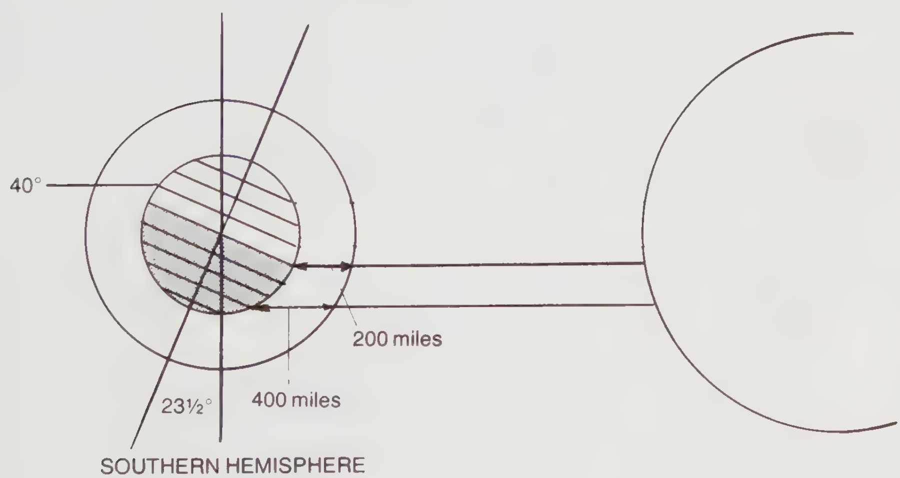
Comparing wave lengths in the electromagnetic spectrum.

medical therapy has persisted. The sun's effect upon human health has come to be regarded as little more than a placebo. The current medical concept pictures a destructive sun, one responsible for aging of the skin and capable of causing skin cancer. Research stemming from this concept provides a rich source of information on the sun and its relation to human health. Undeniably, the sun plays a role in skin cancer and aging, but is it the ultimate culprit? The author became increasingly convinced, as he studied the available research data, that the highly refined western diet plays the leading role, both in the aging process and in the development of skin cancer, and that sunlight seems only to accelerate the problem.

Chemotherapy, in the meantime, is proving to be less than the total answer to human disease that it was at first thought to be. Drug resistant strains of bacteria are developing at an alarming rate. The inability to develop an anti-viral agent has left many diseases uncontrolled. Immunology, set aside since the era of antibiotics, is now

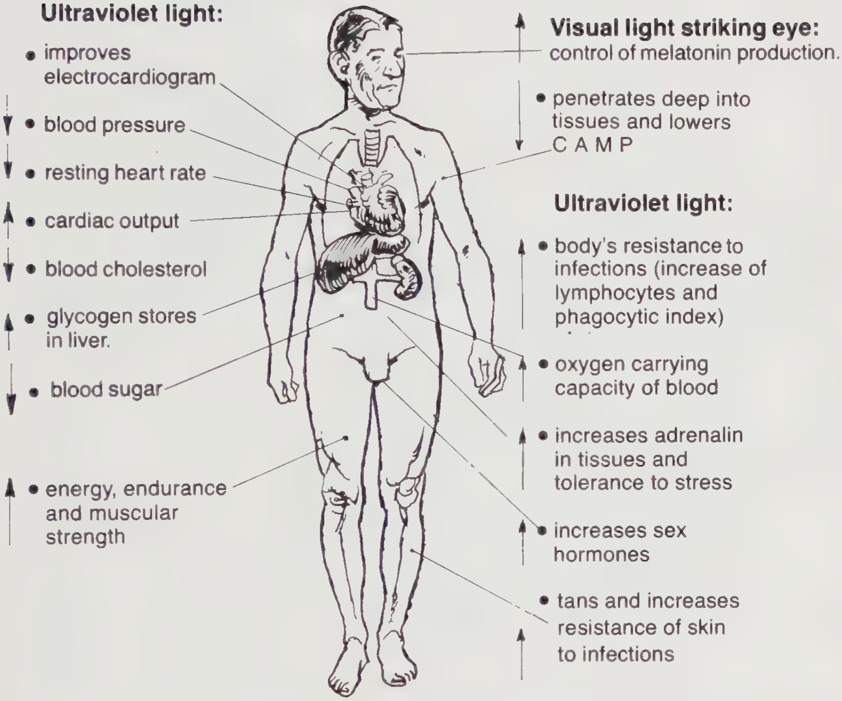


**Atmosphere for ultraviolet to pass through:
Winter for northern hemisphere
Summer for southern hemisphere.**



**Atmosphere for ultraviolet to pass through:
Summer for northern hemisphere
Winter for southern hemisphere.**

gaining prominence in medical research and thinking. And if developing the immune response of the individual assumes its proper emphasis in medical thinking, sunlight's contribution to that goal will be recognized. With advances in state health laws and sanitary measures, our major problem today is not one of infectious disease, but of chronic degenerative disease. And it is in this area, as well as in the realm of antibacterial activity, that the sun's effects are most striking. It becomes obvious when the data are studied that the main chronic degenerative diseases are the very diseases most benefited by exposure to sunlight. The author suggests that the sun continues to be the potent, life-giving, health-dealing force for modern man that it was intuitively recognized to be by primitive man, and that separation from sunlight will result in disease just as surely as will separation from fresh air, food and/or water. To explain and support this premise is the aim of this book.



Summary of systemic effects of sunlight.

Chapter 2

Sunlight and Physical Fitness

"[illegible] the Sun."

— James Elroy Flecker

Before the time of Christ, men such as Herodotus and Antyllus believed in the beneficial effect of sunlight in promoting physical fitness. They believed that "the sun feeds the muscles." The Romans made use of the sun in training their gladiators, for they knew that sunlight seemed to strengthen and enlarge the muscles.

There seems to be conclusive evidence that sunlight produces a metabolic effect in the body that is very similar to physical training. Tuberculosis patients being treated by sunbathing have been observed to have well-developed muscles with very little fat, even though they have not exercised for months.

Beneficial effects which are apparently the same as those of an endurance exercise program can be achieved by a series of exposures to sunlight.

Resting heart rate decreases

It has been demonstrated that after a patient has been on a good endurance exercise program for several months, his resting heart rate begins to decrease (1); it has also been demonstrated that a patient's resting heart rate will decrease and will return to normal much more rapidly following exercise, if he includes sunbathing in his physical fitness program (2).

Respiratory rate decreases

Similarly, a patient's respiratory rate not only decreases following an endurance exercise program, but it also decreases following sunbathing, and the patient's breathing is slower, deeper, and seems to be easier (3).

Respiratory rate decreases following sunbathing.

Lactic acid decreases

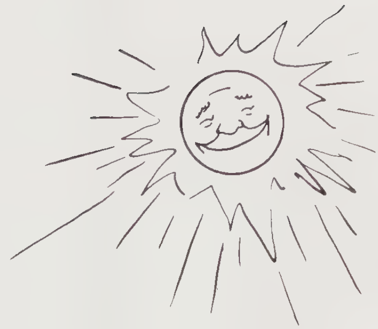
Again, less lactic acid accumulates in the blood during exercise following sunbathing (4) (another effect which usually follows a course of physical training).

Cellular oxygen increases

The ability of the lungs to absorb more of the inspired oxygen (and the ability of the muscle cell to utilize more oxygen) comes as the result of endurance exercises continued for at least several weeks. This means that more oxygen is available for delivery to the muscles while exercising, and to the other body organs while at rest. After fitness has been established through a program of endurance exercises, a marked improvement in the level of energy is noticed. This results in a greatly improved, longer performance in work or play and also allows one to endure stress much better. This whole general improvement in one's physical condition has come about from an improvement in the circulation and its ability to carry life-giving oxygen out into the tissues.

Sunlight seems also to increase the blood's capacity to carry oxygen and to deliver it to the tissues. A striking increase in the oxygen content of the blood has been shown to follow a single exposure to ultraviolet light. This effect lasts for many days (5). Severe, intractable bronchial asthma patients were able to breathe freely and the color of their skin returned to a normal pink following an ultraviolet light treatment (6). The blue color of a seriously ill patient suffering from peritonitis, paralytic ileus, and bronchial pneumonia, returned to a normal pink following an ultraviolet light treatment (7).

The mechanism whereby sunlight increases the oxygen content of the blood and its utilization in the tissues may not be the same mechanism by which exercise accomplishes this same goal; but one thing becomes very clear at this point: both exercise and sunlight increase the oxygen in the tissues.



Respiratory rate decreases following exercise.

Energy and endurance increase

Fatigue is a common complaint today, but contrary to feelings, more rest may not always be the best answer. As stated previously, a good exercise program decreases fatigue and increases the capacity for work. Marked improvement in one's endurance and working capacity has also been found to follow sunlight treatments (2). The fact that sunlight seems to increase oxygen in the tissues undoubtedly contributes to this effect. Another factor may be that glycogen (stored energy for the body) is increased in the liver and the muscles following sunbathing (8). This would allow for the increased endurance observed.

Sunlight increases testosterone in the male sunbather.

Muscular strength increases

Sunlight seems, also, to increase the blood supply to the deep internal organs and muscles (9). The skeletal muscles underlying the skin get an increased amount of blood when exposed to the sunlight (10). This is important in helping to develop muscular strength and will also help to prevent sore muscles when a new activity is undertaken.

Another interesting point, relating to sunlight's effect on muscular strength, is the relation sunlight has to the male hormone, testosterone. The Greeks had an unusual practice called *arenation* —exercising nude on a warm sandy beach. The reason the location was a sandy beach is that sand has a good reflective surface. This practice, they believed, developed the muscles to their maximum potential. It may well have, for as sunlight strikes the male genitals it stimulates the production of the male hormone, testosterone (11). Testosterone is responsible for the secondary male sexual characteristics: lowering of the voice, growth of the beard, and muscular development of the male physique. Its effect on muscle development and bulk has been recognized by athletes for years. They have periodically experimented with it in hopes of increasing the size and strength of their muscles. Sunlight striking any part of the male body stimulates the production of testosterone. It is when sunlight strikes the male genital area, however, that the greatest production of testosterone is realized (11).

Recently a young male patient consulted me about his elevated cholesterol. Being a muscle builder, he was on a high protein diet and had always believed that a high carbohydrate diet would not provide the building blocks his body needed. When he was told that the ideal diet, for lowering the cholesterol, was a diet low in fat and protein and high in complex carbohydrates, he seemed rather shocked. He expressed his fear of not being able to continue on his muscle building program with this new diet. I told him about sunlight and its cholesterol lowering effect, and how it has been known for centuries to have a muscle building effect. The diet, high in complex carbohydrates with legumes and grains, would have all the protein his body could use in a muscle building program. When I saw this patient several months later and checked his cholesterol, it has fallen by over 30%. He looked well, tanned, and happy, and was enthusiastic about the progress he was achieving with his muscle

building, for his muscles had increased in strength and bulk on the new program. He was particularly pleased with the fact that he had lost subcutaneous fat and now each individual muscle could be seen clearly under the skin.

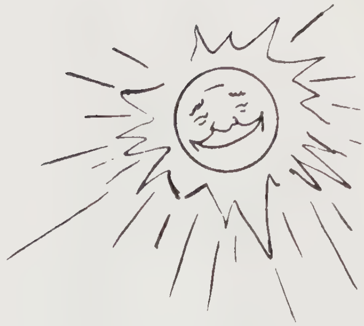
Blood pressure decreases

Exercise can be of great benefit in lowering the blood pressure. In one study, twenty-three men who had high blood pressure were given a moderate exercise program. They did twenty minutes of calisthenics and thirty to thirty-five minutes of jogging twice a week. After six months on this program, they averaged an 8% drop in their blood pressure (12). In another study, six hundred and fifty-six men who had high blood pressure were given a more vigorous program of exercise. It was found that these men had an average reduction in their blood pressure of 15% (13).

A study done at Tulane University, on the effect of ultraviolet light on blood pressure, showed that men, who had normal blood pressure, had a slight lowering that lasted one or two days following a single exposure. At the same time, a group, that had high blood pressure, had a marked lowering of the blood pressure, that lasted five or six days (14).

It would seem that a good exercise program, combined with a sunbathing program, would go a long way towards eliminating hypertension in this country.

High blood pressure is lowered following sunbathing.



The heart's efficiency increases

A good endurance exercise program will not only lower the pulse rate, but will also increase the efficiency of the heart, allowing it to pump more blood at each beat, and also allowing the heart more time to rest between beats.

Sunbathing can also increase the efficiency of the heart. In one study, the output of blood from the heart was increased by an average of 39% in the group of patients studied. The increased output continued for five or six days following a single ultraviolet light exposure (14).

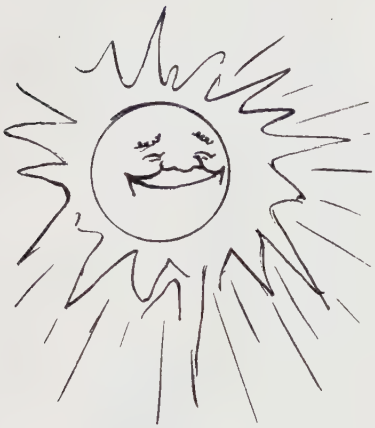
Physicians use drugs to stimulate the heart, causing it to pump more blood. These drugs could possibly be eliminated in some cases if the patient were to follow an active exercise program out-of-doors in the sunlight.

High blood pressure is lowered following exercise.

Blood sugar decreases

Exercise will lower the blood sugar in a diabetic and enable the diabetic to require less insulin or medication (15). Exercise also helps those with hypoglycemia by stabilizing their blood sugars and keeping them from dropping to the point where they experience alarming symptoms.

Exposure to sunlight appears to have an insulin-like effect in that it causes a lowering of the blood sugar. This is minimal in normal individuals, but dramatic in diabetics (8, 16). When the blood sugar drops in diabetics, it is manifested by a reduction of sugar in the urine. Blood sugar is lowered by a process in which some



sugar is removed from the blood and is stored in the muscles and liver as glycogen, thus by increasing its glycogen stores, the human body can reduce its blood sugar.

$$\uparrow \text{Glycogen storage} = \downarrow \text{blood sugar}$$

This process can apparently be achieved by the sun's stimulating enzymatic reactions in the body. Initially, the sunlight stimulates an increase of the enzyme phosphorylase. Phosphorylase decreases the amount of stored glycogen. After a few hours an enzyme called glycogen synthetase starts to increase. This enzyme increases glycogen storage in the tissues while decreasing blood sugar levels. This effect continues and reaches its maximum level in about ten hours (17).

Immediate reaction

Sunlight $\rightarrow \uparrow$ phosphorylase, therefore, $\downarrow$ glycogen

Delayed reaction

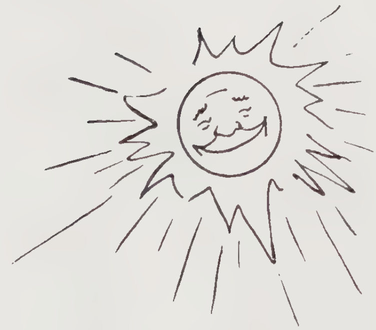
Glycogen synthetase starts to increase two hours following sunlight exposure and has its maximum effect at ten hours.

Sunlight $\rightarrow \uparrow$ glycogen synthetase, therefore, $\uparrow$ glycogen $\downarrow$ blood sugar

High blood sugar is lowered following sunbathing.

A high level of glycogen means that the body has enough reserves of energy to supply prolonged physical exercise. From this it can be seen that it would be best to take part in strenuous exercise on the day following exposure to the sunlight. A single suberythema dose (before reddening of the skin) of sunlight produces this effect and it may last several days.

Because of this dramatic effect, a diabetic may need to adjust his insulin dose when he is following a sunbathing program. A friend of mine who has diabetes ended up in the emergency room of a hospital with severe hypoglycemia, because he had overestimated his insulin need and then had taken a long sunbath. Because sunlight combined with insulin can have a very powerful hypoglycemic effect, a diabetic must sunbathe with caution. By gradually increasing the exposure to sunlight and decreasing the dose of insulin, one may avoid a hypoglycemic reaction. A diabetic who chooses to sunbathe should always keep in touch with his physician, who can best determine his need for insulin.

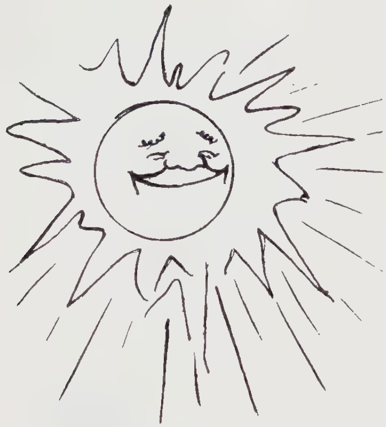


Tolerance of stress increases

Does exercise help us to cope with stress? Under stressful conditions, adrenalin is released in our bodies, which may, or may not, be beneficial, depending upon all conditions at the time. Dr. Selye once subjected twenty rats to loud noises, electrical shock, bright lights and general harassment. Half of the rats were exercised vigorously and were in good health at the end of ten months. The other ten rats which had not been exercised had all died (18).

High blood sugar is lowered following exercise.

The psychological effects of training and exercise are beginning to find a prominent place in scientific literature. One study of sixty middle-aged men, showed that after an intensive, four-month physical fitness program, most were



Tolerance to stress is improved following sunbathing.

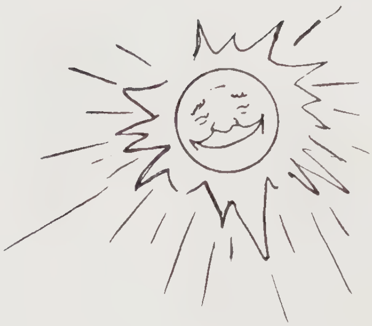
significantly more emotionally mature, less guilt-prone, more self-sufficient and more imaginative. Others have reported increasing self-confidence and self-image, ability to tolerate the stresses of daily life, mood elevation, and ability to sleep and relax. Introverts turned into extroverts; personalities changed; and with this change, came the ability to overcome faulty living habits such as alcoholism and/or cigarette smoking (15).

Those who have had experience with the beneficial effects of sunlight, say that it not only improves the general health, but it also stimulates the appetite, gives a feeling of well-being, and enables one to sleep at night. Somehow, exposure to sunlight has a more relaxing effect upon patients than simply lying down and resting (19). Animals that have been exposed to sunlight have been found to have more adrenalin in their adrenal glands. Researchers have assumed that this is beneficial in helping the animals overcome stressful situations (20).

One very nervous patient of mine had tried everything to calm her nerves: tranquilizers, vitamins, minerals, and meditation. Nothing seemed to work. I informed her of the relaxing benefits associated with sunlight and suggested she try sunbathing following moments of emotional trauma. When next I saw her, she was delighted with the wonderfully relaxing effect of the sunbaths, which far surpassed any benefit she had found from other modes of treatment. She continues to be an advocate of the tranquilizing effect of the sun.

In Maxcy's textbood of *Preventive Medicine and Public Health,* an interesting experiment was reported. Dogs were given a medication that would increase stomach acid and then were divided into two groups; one group was exercised and the other was not. The dogs that did not exercise developed ulcers while the ones that exercised did not. Other researchers have described improvement in ulcer symptoms in patients after they were placed on an exercise program (15).

Sunlight seems to have a relaxing and soothing effect on the stomach and intestines. A research report from Russia shows that duodenal ulcers are greatly improved after a course of sunlight treatments and can also be prevented from reoccuring (21).



Sunlight and exercise better than exercise alone

The fear of heart disease may be the major motivating factor in stimulating people to exercise – and for good reason. It has been known for some time that exercise "converts abnormal electrocardiograms to normal ones" (22, 23). And a study of the results of combined sunlight and exercise, showed that a group that was getting the sunlight treatments with exercise, had improved almost twice as much, as shown by their electrocardiograms, as had those who only exercised, even though both groups were on a general health resort treatment program (24).

Tolerance to stress is improved following exercise.

Exercise is vitally important for the maintenance of good health. One of the greatest causes of sickness of both mind and body can be found in continued inactivity. Whenever muscles are not used, they gradually decrease in size and strength. The heart becomes weakened and the blood then flows sluggishly through the tissues. Many are dying, slowly dying of inactivity and indolence, in a diseased condition which no physician can cure. As these persons rob themselves of physical activity, they become susceptible to various diseases. It must be clearly understood that exposure to sunlight should in no way replace a good physical fitness program, but should be recognized as an important adjunct to it!

In one study of college men at the University of Illinois, ultraviolet light treatments were given to half the members of a physical education class. The experiment ran for ten weeks, and at the end of the period, the group that was receiving ultraviolet light had increased their performance on the physical fitness test by almost 20%, while the group that did not receive the ultraviolet light improved by only 1%. There were only half as many colds in the group that was receiving ultraviolet light and their blood pressures showed a distinct decrease. The group taking the ultraviolet light treatments showed a greater interest in their class work and attended more regularly. They generally felt they had received a great deal of help from the light treatments (25).

It has been shown in other studies that a continuous, low-intensity ultraviolet exposure of school children, applied by means of a special ultraviolet illumination system, markedly increased physical fitness scores among the children. This effect was most apparent during the winter and spring months. The children, who did not receive the extra ultraviolet light during the winter time, had significant increases in their physical fitness scores during the summertime when they, too, received more ultraviolet light from natural sources (26).

Contrary to some investigators' opinions, it is not the vitamin D produced in the body by exposure to sunlight that is responsible for the increased physical strength. It has been demonstrated that vitamin D-deficient animals develop muscular strength just as rapidly as animals that are not deficient (27). So it is some, as yet, unknown factor in sunlight that produces the increased muscular strength.

Sunlight is beneficial to athletes in training, for it not only aids in the conditioning program, but it also strengthens the athletes' resistance to disease. Because an athlete in training is stressing his body to its maximum, his resources to fight infections such as colds and flus may at times be small. The maintenance of a strong immune response can be realized during training with consistent exposure to sunlight, as shown in a study done at the University of Illinois (25).

One of my patients, who is a jogger, complained of suffering from one cold after another. He was additionally discouraged with the slow rate of progress he could achieve in increasing his jogging speed and distance. I advised him to start a sunbathing program, and to try an unrefined diet in conjunction with his jogging. Beneficial results were soon noted and, within the last year, he has not had one cold, and has been greatly encouraged by his capacity to continually increase his speed and distance in his running program.

Summary

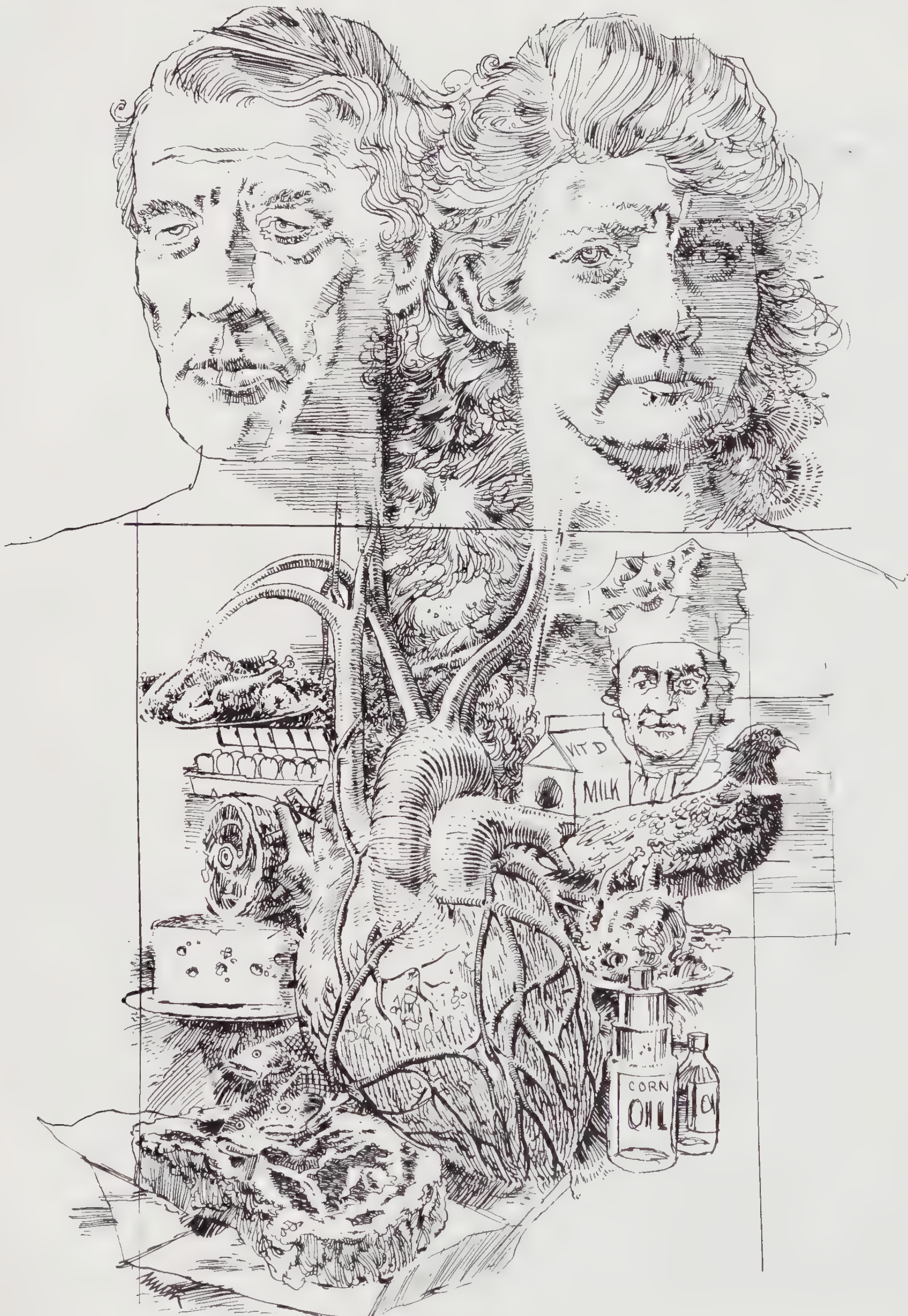
There is conclusive evidence that exposure to sunlight produces a metabolic effect in the body that is very similar to that produced by physical training, and is definitely followed by a measured improvement in physical fitness.

Effects of several months of physical training	Effects of a series of exposures to sunlight
↓ Resting heart rate	↓ Resting heart rate
↓ Respiratory rate	↓ Respiratory rate
↓ Lactic acid in the blood following exercise	↓ Lactic acid in the blood following exercise
↑ Ability of the blood to absorb and carry oxygen	↑ Ability of the blood to absorb and carry oxygen
↑ Endurance, energy, and strength	↑ Endurance, energy, and strength
↓ Blood pressure	↓ Blood pressure
↓ Blood sugar	↓ Blood sugar
↑ Tolerance of stress	↑ Tolerance of stress

It should be emphasized that, in order to achieve the training effect associated with exercise, a gradual and consistent exercise program must be maintained over a period of months. To achieve this 'training effect' from sunlight, a similar gradual and consistent exposure to sunlight must be maintained.

Remember that just as one should check with his physician before beginning an exercise program, so one should also consult his physician before beginning a regular sunbathing program.

There is some evidence in the scientific literature that sunlight can increase the energy level in human cells (28). This could explain some of the increased physical fitness that comes with exposure to sunlight. Certainly sunlight is the source of energy for the entire plant kingdom and man may also derive direct energy from the rays of the sun.


VIT D
MILK
CORN
OIL

Chapter

3

Sunlight and Heart Disease

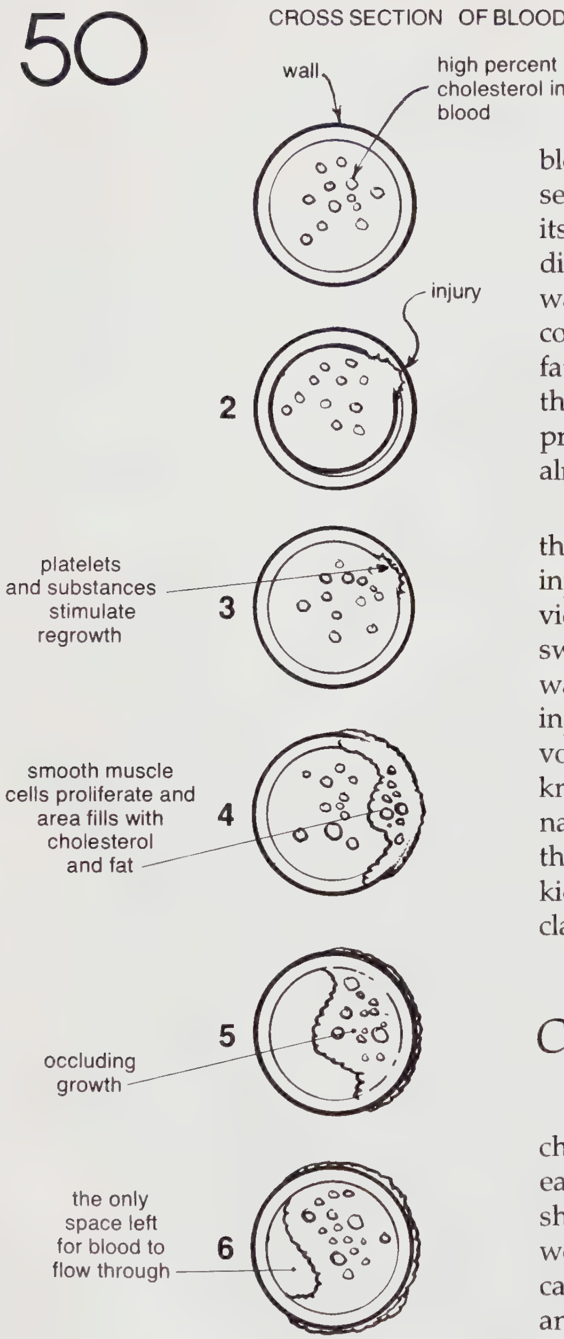
But unto you that fear my name shall the Sun of righteousness arise with healing in his wings."
—Malachi 4:2 (KJV)

Fifty percent of all people in the United States die from hardening of the arteries, heart attacks and strokes, making this group of diseases the leading cause of death. Early signs of heart disease can be detected in the coronary arteries of children as young as five years of age, and by 15 years dangerous lesions are relatively frequent (1). At the age of 16-20, over half the population shows evidence of hardening of the coronary arteries.

In the early stages of heart and arterial disease, individuals usually feel no symptoms of the disease. Although their electrocardiograms are often negative, and test results,revealing the level of fat in the blood, are usually normal for the American population, recent evidence seems to indicate that in many persons, heart and arterial diseases are developing at an earlier and earlier age. Today it is not uncommon for men in their twenties to suffer from heart attacks.

Early onset of atherosclerosis.

Atherosclerotic heart disease is a condition in which a high content of cholesterol and fat in the



The development of atherosclerosis

blood stream injures the lining of the blood vessel itself (2). The blood vessel attempts to heal itself but only complicates and compounds the disease in the process. The muscle cells in the wall of the vessel are stimulated to grow and cover the injury. As they do this, cholesterol and fat from the blood infiltrate the new growth. If the fat content of the blood remains high, this process continues until the blood vessel becomes almost completely plugged.

This process in the arteries takes place all over the body, but some areas are more susceptible to injury than others. Wherever a blood vessel divides or has a lot of curves in it, there is more swirling of the blood, more wearing action on the walls of the vessel itself, and more potential for injury. Depending upon which vital organ is involved in this process of hardening, the disease is known by various names: in the heart – a coronary or a heart attack; in the brain – a stroke; in the kidney – hypertension or even loss of the kidney; in the arteries to the legs – intermittent claudication (pain on walking) or loss of the leg.

Cholesterol

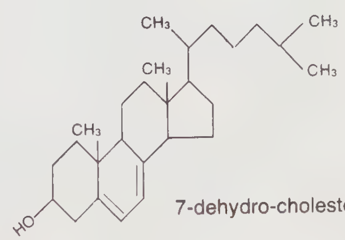
Because the average person believes that cholesterol is in some way related to heart disease, yet understands little more than this, we shall give the subject a bit of attention. First it is well to know that cholesterol is a substance that can only be found in meat, poultry, fish, and animal products such as eggs, milk, and cheese. It is entirely absent from foods derived from the plant kingdom, such as fruits, vegetables, grains, nuts, etc.

Foods that do not contain cholesterol.

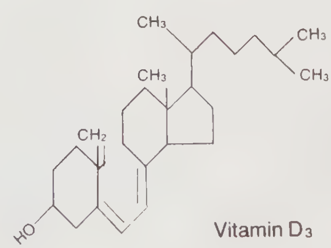
Foods that contain cholesterol.

The human body can manufacture its own cholesterol from fats, oils, sugar, and even protein. Biochemists classify cholesterol as a member of the steroid "family." This family is a group of substances that are similar in their molecular structure, but very different in their effects on the body. Members of this family include cortisone, sex hormones, vitamin D, and cholesterol. It is important to note that cholesterol and vitamin D are related, for when a precursor of cholesterol (7-dehydro-cholesterol) is exposed to sunlight, it will easily be changed to vitamin D and thereby made harmless to the body. Notice how similar their molecular structure is and how little change is needed to transform one into the other.

It was in 1904 that one research scientist discovered that sunlight was able to transform 7-dehydro-cholesterol to vitamin D (3). Human skin has a very rich supply of cholesterol and this cholesterol keeps moving back and forth between the skin and the blood stream. If it is removed from the skin, then the cholesterol from the blood stream moves into the skin to replace the cholesterol that was lost. It has been found that not only does sunlight cause a prompt and

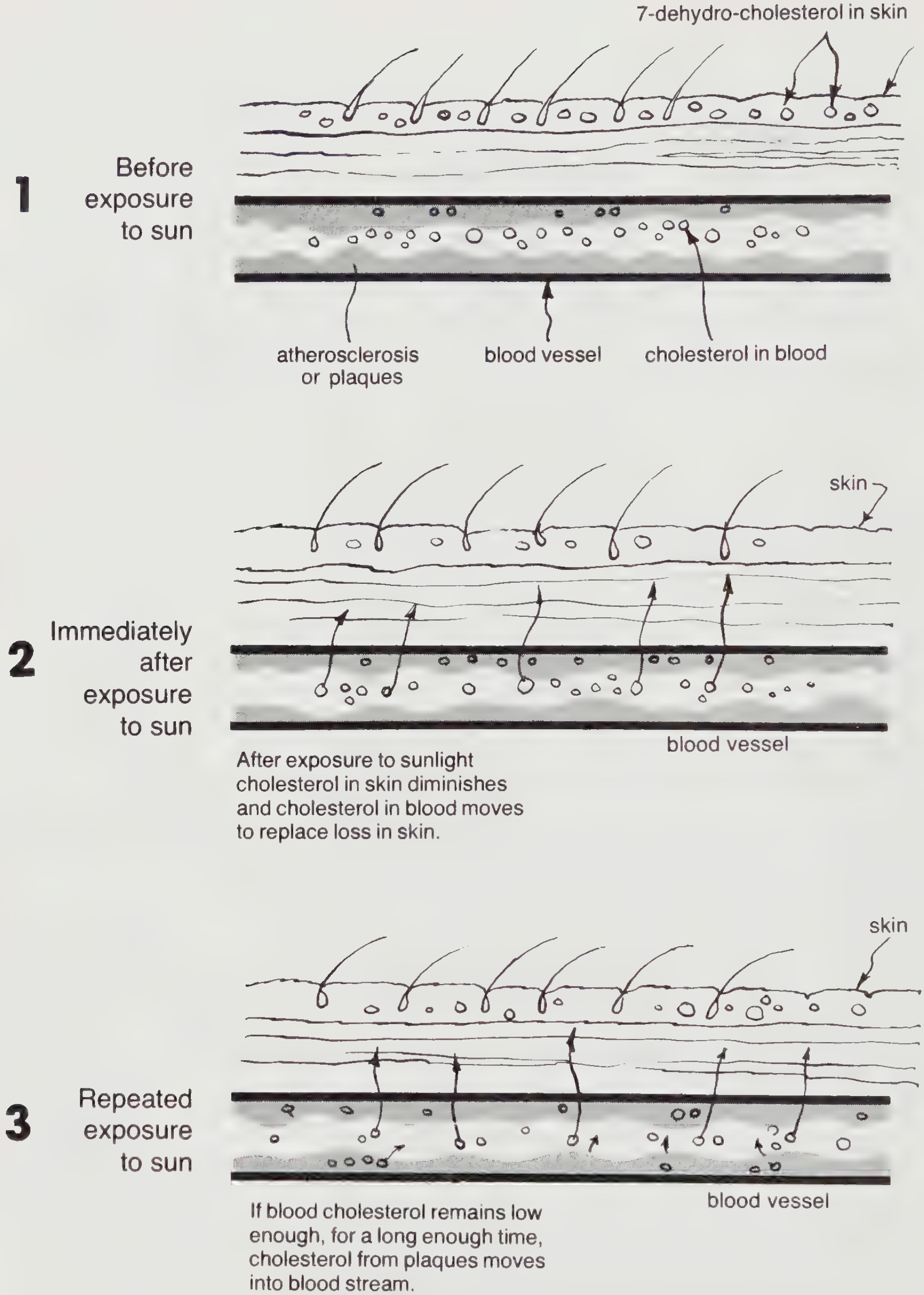


7-dehydro-cholesterol



Vitamin D_3

Structural relation of cholesterol and vitamin D.



Sunlight and the movement of cholesterol.

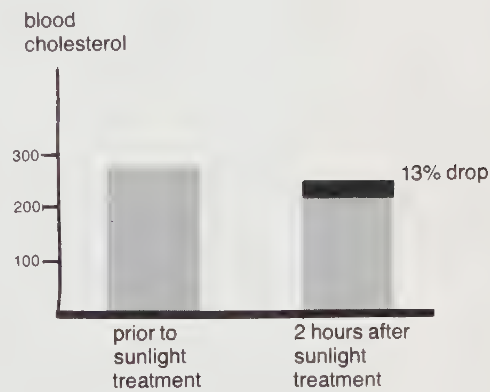
significant reduction in the amount of cholesterol in the skin (4), but that it also affects the overall cholesterol metabolism of the whole body (5). When the skin is exposed to sunlight, cholesterol metabolism is changed so rapidly and to such a great extent that the blood cholesterol is decreased (6).

It has been commonly believed that once cholesterol is deposited on the walls of arteries it is a permanent alteration. However, studies have shown that the cholesterol within the plaques is also exchangeable with cholesterol in the blood (7). This would open the possibility of reducing the storage of cholesterol in plaques if cholesterol in the blood remained low enough.

A study was done using 30 patients who had hardening of the arteries. Each of these patients' blood cholesterol level was taken before a single sunlight treatment. Blood cholesterol levels were taken again two hours after the sunlight treatment. The results showed that there was almost a 13% decrease in the blood cholesterol following the treatment (8). Other studies with larger numbers of patients show similar results (6).

In some patients, I have seen a much more dramatic drop in serum cholesterol and triglycerides, following a series of sunlight treatments. One 65 year old lady was given sunlight treatments for four days in succession. At the start of the treatments her cholesterol was 333 mg/dl and triglycerides 299 mg/dl. Four days later, without any change in diet or exercise, her cholesterol and triglycerides had taken a dramatic plunge to 221 and 197 mg/dl respectively, achieving over a 100 point drop in both indexes.

Animals have been used for many years as

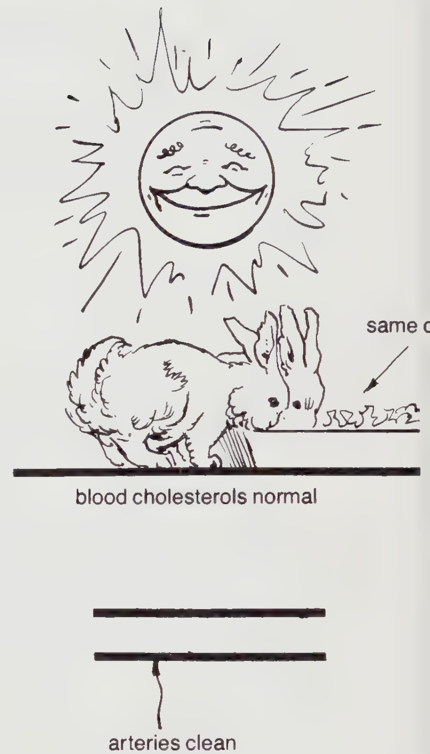


The drop in blood cholesterol effected by exposure to sunlight.

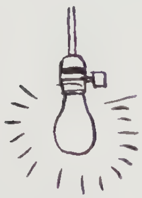
models to produce hardening of the arteries. Feeding them cholesterol and fat has proven a very effective way to cause hardened arteries or atherosclerosis. A fascinating study was done on rabbits which were fed a high cholesterol diet. Half of the rabbits were given sunlight treatments and the other half received only the standard room lighting. The rabbits who got the sunlight treatments did not increase their cholesterol levels while the ones who received the standard room lighting had great increases in their cholesterol levels. At the end of the study the animals' arteries were examined to find out how much the high fat and cholesterol diet had damaged them. The rabbits that had received the standard room lighting had severe cholesterol deposits in their arteries while the ones who were receiving the sunlight treatments had arteries that were clean with little or no damage done to them. The investigator felt that the sunlight treatments not only prevented an elevated cholesterol level, but also prevented hardening of the arteries (9).

Out of Russia comes a report of the effect of using sunlight on patients with hardening of the arteries in the brain. One hundred and fifty patients were studied and numerous laboratory tests were done. Research scientists, after witnessing the patients' much-improved conditions, felt that the sunlight treatments had caused the patients to make a favorable turn (10).

Other Russian scientists are showing how effective sunlight treatments can be in treating hardening of the arteries in the heart. One study showed that by gradually increasing patients' daily exposure to sunlight, abnormal electrocar-



Sunlight and atherosclerosis in experimental animals.



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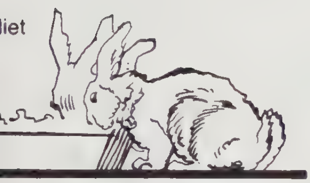


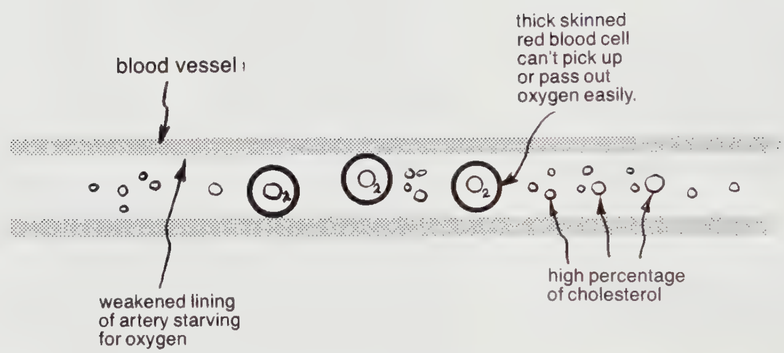
blood cholesterols high

arteries diseased

diograms became normal and cholesterol and triglyceride levels were lowered. Patients who did not get sunbaths did not experience these improvements (11, 12). The Russians have also demonstrated that multiple short exposures are more effective than a single long treatment. The electrocardiograms of patients they studied who were getting the multiple sunlight treatments improved almost twice as mush as those on single exposures (13). Multiple exposures are evidently more efficient at lowering the total body cholesterol.
efficient at lowering the total body cholesterol.

I have seen many patients, suffering from angina (chest pain from coronary artery disease) and other symptoms of hardening of the arteries, make remarkable improvement following the initiation of a natural diet and exercise program. It seems to me that patients, who take regular sunlight treatments in addition, always make more rapid progress. One seventy-year-old man, who was suffering from severe angina, made excellent progress on a natural diet and exercise program alone. He found he was able to walk much farther without the chest pain, and was happy with his progress. His progress seemed to stabilize, though, after a few months with no further improvement in his condition. Some time later he started on a regular series of sunbaths and found that, again, he was able to make excellent progress in the distance he could

1



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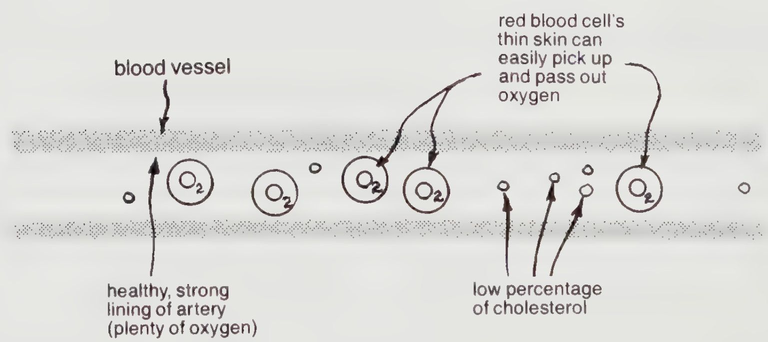


High levels of cholesterol in blood stream inhibit transfer of oxygen to the tissues.

walk without chest pain. In my experience, sunlight treatments in conjunction with an unrefined diet and exercise program achieve faster and more dramatic results than diet and exercise alone.

Oxygen-carrying capacity of blood

A growing amount of evidence is accumulating to show that a lack of oxygen may be a contributing factor in the initial injury to the lining of the arteries that occurs in hardening of the arteries or atherosclerosis. A lack of oxygen appears to weaken the lining of the artery and make it more susceptible to injury. A lack of oxygen also aggravates the injury and prevents it from healing (14, 15). It is interesting to note, from another study, that whenever there is an increased amount of cholesterol in the blood, the cholesterol is incorporated into the wall of the red blood cell, thickening it. This thick wall makes it very difficult to move oxygen from the red blood cell into the tissues (16). In other words, cholesterol makes the skin of the red blood cell "tough" and the oxygen cannot readily pass through it to the lining of the artery. Red blood cells are the main carriers of oxygen to body tissues and if they cannot release this oxygen, the lining of the arteries becomes more susceptible to injury.

It has been shown that ultraviolet light actually increases the oxygen in the blood and its oxygen-carrying ability (17). It also increases the use of oxygen in the tissues (18), which in turn can produce more available energy.

One explanation of how the sun increases the oxygen-carrying capacity of the blood can be found in its cholesterol-destroying ability. As the cholesterol is destroyed in the skin, the cholesterol in the blood stream is transferred to the skin, thereby decreasing the cholesterol in the blood. The red blood cells' membranes become thinner and pass oxygen more readily. Providing an adequate amount of oxygen to the lining of the artery would insure its integrity and resistance to injury.

At least one study has been done showing that oxygen in combination with a low-fat diet would actually effect a regression of atherosclerosis in rabbits (19).

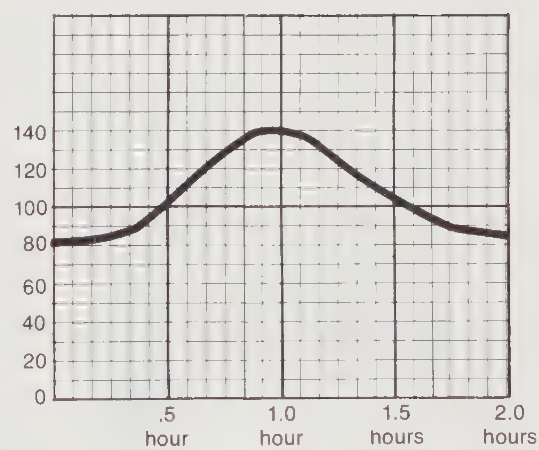
Blood sugar

An elevated blood sugar is an implicating factor in heart and arterial disease. Individuals who have an abnormally high blood sugar suffer twice the number of heart attacks as do those who have a normal blood sugar. They also have an increased incidence of strokes. Gangrene in the lower extremities is 8-150 times more frequent in these individuals than in those with a normal blood sugar. One who has a high blood sugar has a high risk of hardening of the arteries and of high blood pressure. In studying patients who already suffer from a condition known as ischemic heart disease, it is interesting to note that 43-100% display an elevated blood sugar during a glucose tolerance test (20, 21, 22, 23). (Ischemic heart disease is a condition in which the coronary arteries that supply the heart become plugged with cholesterol and fatty plaques.) The blood flow is restricted and the heart is depleted of oxygen. The patient may suffer angina, or he may not. The condition may be detected by a stress test or x-rays of the arteries of the heart, but many people without the aid of such tests suffer from this disease unknowingly.

When a glucose tolerance test reveals that a patient has a high blood sugar, it indicates that his body cannot use the sugars, and the body cells will be hardpressed to find the energy they need. The exact reasons for the correlation between an elevated blood sugar and increased atherosclerosis are unknown.

When a normal individual eats sugar or starch, the body eventually breaks it down into a simple sugar called glucose. The blood then carries the glucose to the cells of the body where, in the presence of insulin and a trace element called chromium, it is transferred out of the blood stream and into the surrounding cells. There it is changed into energy or stored for later use.

In an individual whose body abnormally handles sugar, the process cannot go through to completion. His body still breaks down the sugar or starch into glucose, but it does not have the ability to move the glucose out of the blood stream and into the cells of the body. Therefore, the glucose builds up in the blood stream to an abnormally high level. The cells of the body, feeling themselves deprived, meet their energy requirements by manufacturing energy out of fat and any small amount of glucose that may leak through. There are multiple reasons why an in-



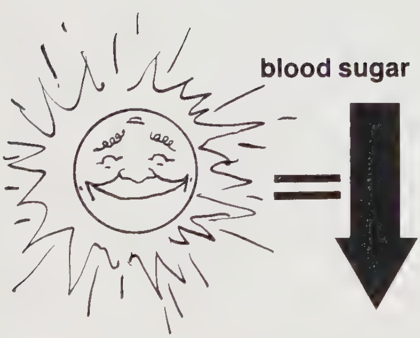
Normal glucose tolerance curve following food or glucose injestion.

dividual may not be able to transfer glucose to the cells of the body: the insulin which facilitates the transfer of glucose from the blood stream through the cell wall and into the cell may be ineffective, or it may be deficient, and chromium which acts with the insulin may also be deficient.

Insulin therapy may be hazardous

Insulin therapy is not without its problems. Insulin itself may be a contributing factor in the development of atherosclerosis (hardening of the arteries) as there is increasing evidence that the arterial wall is insulin-sensitive. It appears that insulin promotes changes in the artery which, in the long term, may progress to atherosclerosis (24).

Sunlight, a natural insulin



Sunlight produces a drop in blood sugar.

The effect of sunlight on the body's sugar metabolism parallels that of insulin. Sunlight facilitates the absorption of glucose into the cells of the body and stimulates the body to convert its blood sugar (glucose) into stored sugar (glycogen). Glycogen, which consists of many glucose molecules hooked together, is stored in the liver and muscles (25). It is the body's energy reserve that can be instantly changed again into glucose to meet demands under normal or emergency conditions. Sunlight removes the sugar in the blood by increasing glycogen levels.

At first, exposure to sunlight seems to stimulate an enzyme called phosphorylase which decreases the glycogen that is stored. Several hours after exposure a second enzyme – glycogen synthetase – is stimulated. This enzyme builds up the level of glycogen (26).

It was found in experimental animals that glycogen was highly elevated in the liver and muscles of those that were given sunlight treatments. Blood sugar dropped after light treatments, but the degree of drop was dependent upon the strength of light and the length of the exposure. The best results were obtained when both the visible and the invisible portions of light (ultraviolet) were combined at a ratio of one part ultraviolet to nine parts visible light. In other words, it was found that light sources very similar to the natural sunlight were the very best for carbohydrate metabolism (25).

When diabetics were exposed to sunlight treatments, their blood sugar dropped and the sugar in the urine decreased or disappeared entirely. The acetone bodies also decreased or vanished. Natural sunlight appeared to provide the best results (25).

However, it cannot be stressed too strongly that the diabetic must only gradually and progressively expose his body to the sunlight. A diabetic who chooses to sunbathe should always keep in touch with his physician. His insulin dosage will have to be regulated, as is emphasized in this book's section on sunlight and physical fitness. See pages 39 to 41.

Blood pressure is directly related to coronary heart disease.

Hypertension (high blood pressure)

What is blood pressure? There are two values used to measure blood pressure. The systolic pressure is the pressure the blood has against the wall of the blood vessel while the heart is pumping or pushing the blood. It is the maximum pressure the blood has on the arterial wall at any one time. The diastolic pressure is the pressure the blood has against the walls of the blood vessel while the heart is resting. It is the constant pressure on the artery, or the lowest pressure on the artery. The values are expressed as systolic/diastolic, or 120/80.

The relationship of hypertension to arterial and heart disease was well demonstrated in the famous Framingham study. It revealed that individuals with blood pressure of 140/90 or above were found to have a substantially increased mortality. Seventy-three percent of the men and 81% of the women who died had blood pressures of 140/90 or above. The higher the blood pressure, the higher the incidence of sudden, unexpected death. In fact, after the age of 55, individuals with hypertension were shown to develop an excessive amount of vascular diseases including three times more coronary heart disease and occlusive peripheral arterial disease, more than seven times as many strokes, and four times as much congestive heart failure. High blood pressure has more impact in causing disease than any other risk factor (27).

It would naturally follow that decreasing the blood pressure of a hypertensive person, should then correspondingly lower the likelihood of his developing vascular diseases. The first partial evidence that treating hypertension can prevent fatal and nonfatal heart attacks, comes from a study done at the University of Göteborg in Sweden. The group of men who were treated with an antihypertensive drug suffered only half the number of heart attacks of those who did not receive the drug (28). It would certainly be a major breakthrough in the prevention of heart disease if we could eliminate high blood pressure and its train of risks.

Antihypertensive agents (drugs that lower blood pressure) are commonly used in the treatment of hypertension, but they are not without their associated adverse side-effects, diabetes and gout being among the most notorious. The problem of handling the treatment of hypertension intelligently is compounded by the fact that 90% of all hypertension is termed *essential,* or of no known cause. Its distribution is of some interest; 20% of the total American population suffers with the disease, with a higher proportion of blacks being affected,(29) perhaps as much as 40% (30).

Epidemiologists report low blood pressures from persons who live in undisturbed and isolated communities in developing countries. For instance, at 65 years of age the natives of New Guinea averaged blood pressures of 130/70 for males and 140/75 for females. They are virtually free of hypertension and its resulting stroke and heart disease (31). The isolated peoples of Africa also fail to show blood pressure increases as they grow older. An example of this is found in the nomadic warrior tribe of Samburu which lives in isolated northern Kenya. The blood pressures of the Samburu men remain low, until the men are drafted into the Kenyan army, and return to their previous low readings when the men are discharged (32). A study done in the United States revealed that even a slightly elevated blood pressure seems to have striking effects on the body. A person with a diastolic pressure of 85 has twice the danger of mortality from diseases commonly associated with hypertension, as does a person with a diastolic pressure of 75.

Perhaps blood pressure values considered normal by most physicians should be reevaluated. Many of our "normals" are more correctly described as "what is usual in a westernized culture". Atherosclerosis and heart disease are more prevalent in our society, but that does not make them normal conditions of the body. Based on epidemiological evidence, a blood pressure of 140/80, regardless of age, would more correctly represent the upper limits of normal.

Contrary to most learned opinions, diastolic blood pressure is, apparently, not more important than the systolic. Systolic blood pressure is believed to normally rise with age. But the famous Framingham study showed that elderly individuals with high systolic pressures had significantly higher mortality rates than their contemporaries with lower systolic pressures (27).

Environmental factors that contribute to high blood pressure

There seem to be many factors that play a role in altering the blood pressure from its normal values. Immediate environmental factors which are suspected to contribute to high blood pressure are:

1 Stress
2 Excessive salt intake
3 Sucrose (table sugar)
4 Fat content of the diet

The concept that sugar may affect the blood pressure is not commonly held, despite the research literature that supports this claim. Notice the interesting comment made in a letter to the editor of the American Journal of Clinical Nutrition: "The reason I remain convinced that sucrose raises the blood pressure is because we have been able to raise blood pressure at will in our own lab by providing simple sucrose to both experimental rats and human volunteers."(13)

The following chart shows just how closely the parallel relationship was maintained in the study. As the sugar increased so did the blood pressure.

Supplemental sucrose gm day	*Diastolic blood pressure, mm Hg*
0	73.4
50	73.3
100	75.4
150	76.5
200	78.2

Fats

In 1975, Dr. Iacono conducted the first study of its kind, done to demonstrate that blood pressure can be lowered by lowering the level of fat in an otherwise normal diet.

He took 21 human subjects between 40-60 years of age and fed them two different diets over two consecutive time periods. The first diet had 25% of its calories in fat, the second had 35%. The usual American diet is 40% calories in fat. While his subjects were eating the 25% diet, there was a significant decrease in the blood pressure. When his subjects were changed to the 35% fat diet, the blood pressure gradually rose. This study suggested that a relationship does exist between dietary fat and blood pressure (34). Independent of dietary changes, the following factors will lower the blood pressure.

Exercise

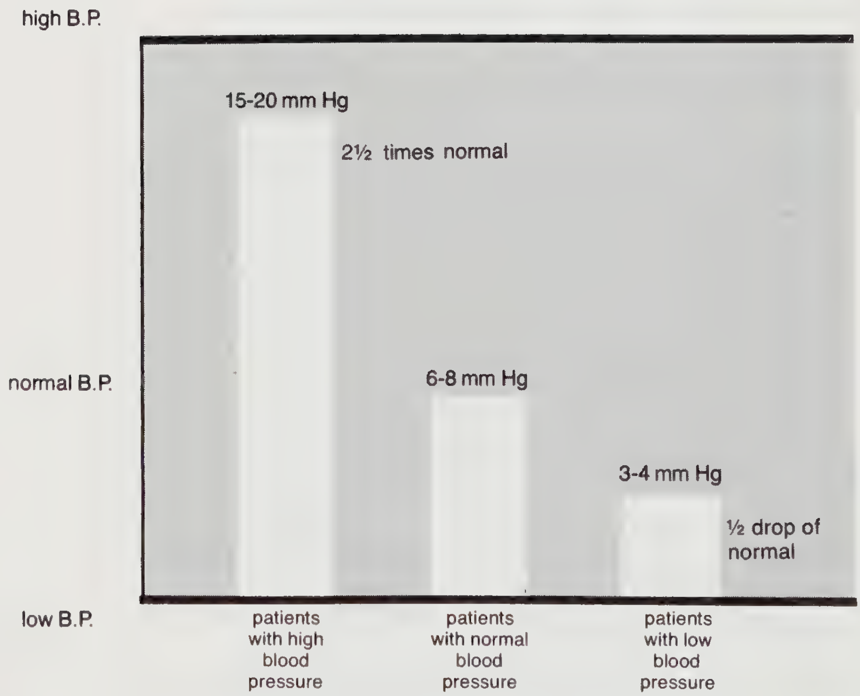
The beneficial effects of exercise on the general mental and physical health of the body are without question. Many have taken up jogging and found the results to be invigorating. The tremendous proliferation of jogging shoes available reflects the honest value the American people have found in an exercise program. Exactly how exercise affects our bodies is still a matter of scientific investigation. That exercise has an effect on the blood pressure was demonstrated in a study of 23 males who had high blood pressure. They were put on a moderate exercise program which included 20 minutes of calisthenics and 30-35 minutes of jogging twice a week. They realized an 8% drop in blood pressure (35). Another study was done which used 656 men with high blood pressure. These men were, by comparison, put on a more vigorous program of exercise and achieved an average drop in the blood pressure of 15% (36).

Sunlight

Unknown to most persons, the sun has a dramatic effect on blood pressure. In a study done on average human subjects, the blood pressure dropped on an average of 6 mm Hg systolic and 8 mm Hg diastolic after a single sunlight treatment. In individuals with high blood pressure, the effect was more striking. Some patients had the systolic pressure drop as much as 40 mm Hg and the diastolic by 20 mm Hg. This effect lasted up to five or six days (37).

The Russians are using sunlight to lower blood pressure at their health resorts and are getting excellent results (38).

There appears to be a sensitivity factor to the effect of the sun, based upon need. Patients with high blood pressure have a drop in blood pressure 2.5 times that of patients with normal pressures. Correspondingly, patients with low blood pressure were only one-half as responsive to sunlight (39).



Blood pressure drop from sunlight.

The above figure shows a normal physiologic mechanism at work trying to normalize the blood pressure. Sunlight acts as any other natural healing factor, in that it assists in restoring to normal any deranged blood pressures.

One 52 year old male patient came to me because of his severe high blood pressure. Despite the fact that he was taking large doses of blood pressure medications, he still had an elevated blood pressure. Working with him on a sunbathing program over a period of several months, we were able to gradually reduce his blood pressure medication until, at present, it has been totally eliminated. His blood pressure without medication has remained a normal 120/70 mm Hg. (Many patients comment on unexpected benefits while following a sunbathing program.) Our main concern for this individual was a lowering of his blood pressure, but along with this, he was delighted to find that he slept more soundly and that his skin was smoother and healthier.

Ninety percent of the cases of high blood pressure in westernized populations have no apparent cause. At the same time, it is a known fact that many primitive people, who live out of doors, have almost no hypertension (31). It is apparent that an environmental factor must be investigated and sunlight may be that factor. The "naked truth" about high blood pressure recently became more apparent when the Maryland Heart Association "uncovered" a group that suffers from hypertension only half as often as the national average – the nudists.

The exact mechanism involved in the sun's effecting a drop in blood pressure is unknown.

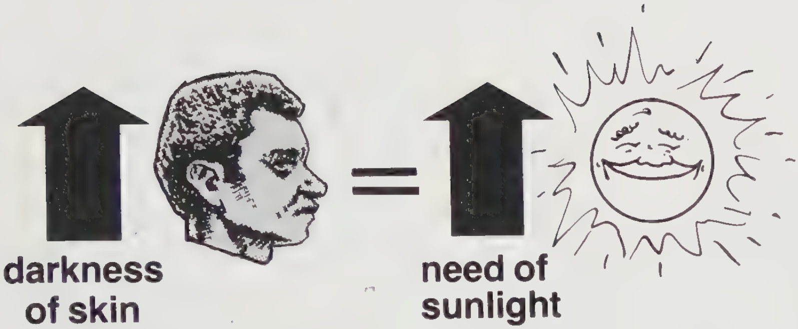
Some researchers feel that following exposure to the sun, a substance is released by the skin that is absorbed into the body and causes the small arteries to dilate, thus reducing the blood pressure (40, 41). The fact that sunning does lower the blood pressure in a high percentage of cases, testifies that sunlight could be used effectively as an antihypertensive agent. Not only does the blood pressure drop following exposure, but also the heart takes advantage of the decreased pressure in the body and starts pumping more blood. The output of blood by the heart has been shown to increase by an average of 39% in over two thirds of the patients tested (37, 42).

Racial differences

Sunlight can decrease cholesterol, high blood pressure, blood sugar, and the incidence of malignant internal cancers. It also builds up immunity to infectious diseases and provides vitamin D. With this understanding, let's look at some differences in human populations.

Research has shown that the darker the skin, the harder it is for sunlight to penetrate. Very little ultraviolet light may pass through dark skin (43). This point came through loud and clear when a disease called rickets was being studied.

Cholesterol turns to vitamin D – a vitamin needed for proper bone formation – when sunlight or ultraviolet light strikes the skin. Without this vitamin the bones do not become calcified and will bend easily. This condition is called rickets. Dark-skinned children, who do not get



The darkness of the skin effects the amount of sunlight needed.

vitamin D in their diet and who do not spend time in the sunlight, are very susceptible to rickets. Before vitamin D was added to milk, Hess made this statement: "*Of all races the Negro is most susceptible to rickets.* This tendency is so marked that it may be safely stated that over 90% of the colored babies have rickets" (44).

To verify this information, one investigator took black and white rats and fed them a diet that contained no vitamin D. The rats were exposed to a very small amount of ultraviolet light and it was discovered that the white rats remained healthy but the black rats developed rickets. The investigator concluded that the dark skin prevented the ultraviolet light from being protective.

> The main distinction is – as demonstrated by the animal experiments – that colored infants require a greater degree of the effective light rays than do white infants. That they possess no racial predisposition to rickets is evidenced by their freedom from this disorder in their native homes in the West Indies. The darkness of the skin is, no doubt, a predisposing factor, also, in the susceptibility of the southern Italian, the Syrian, and other southern races (45).

So many foods are now fortified with vitamin D in the United States that darker-skinned children do not usually develop rickets.

A deficiency of vitamin D in adults causes calcium to leave the bones and they become soft. This adult disease is called osteomalacia, a condition which can be prevented with adequate sunlight. Some countries do not supplement foods with vitamin D, and blacks who do not spend a considerable amount of time out of doors will develop osteomalacia, even in South Africa (46).

The current treatment for jaundice in newborn babies is exposure of the infant to bright lights. Darker-skinned infants, however, have problems in responding to this light therapy. Some have even had to go through the hazardous exchange transfusion to stop the jaundice when the light did not seem to help (47). If sunlight were a cholesterol-reducing factor in heart disease and atherosclerosis, we would expect to see a greater incidence of these diseases in darker-skinned races. Looking at vital statistics, we see there are over 20% more deaths from diseases of the heart and almost twice as many strokes among blacks (48).

Since sunlight can lower blood pressure, we would expect to see more high blood pressure in darker-skinned races. And this is the case, for as we noted earlier in this chapter, as many as 40% of the blacks in the United States have high blood pressure, as compared with 20% afflicted in the total population, and there are almost four times as many deaths among them from high blood pressure-related disease (48). One study showed that the darker the skin the higher the blood pressure even when stress and other factors were taken into consideration (49).

In this book's chapter on skin cancer, it is noted that sunlight apparently has an inhibiting effect on deep-seated cancers. Again we would expect to find more cancer among darker-skinned people living in the United States. In consulting the vital statistics we find this to be true: 20% more dark-skinned people die of cancer than do their lighter skinned contemporaries (48).

Again, in this book's section on infectious diseases, it is shown that sunlight seems to play an important role in preventing and curing infections, even those as severe as tuberculosis. Again we see a much higher rate of infections in darker-skinned people. Their incidence of death from influenza and pneumonia is almost double that of lighter-skinned people, and nearly five times as great in case of tuberculosis (48).

As discussed earlier in this chapter, sunlight will lower elevated blood sugar levels. There are twice as many deaths from diabetes among dark-skinned people (48).

Environmental stress may, assuredly, be a factor in the development of certain diseases among the darker-skinned races (50), but it would not seem to be a factor in the noted resistance to light therapy given the jaundiced newborn or the increased incidence of rickets among black children.

Surely, sunlight is a source of energy and life, and affects every system in the body. Certainly other factors are involved in the development of the various diseases we have considered, but a lack of sunlight has a strong demonstrable effect and should not be overlooked as an important contributing factor.

4

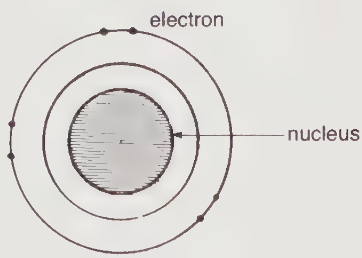
Sunlight and Aging

"Light is sweet, and it pleases the eyes to see the sun."
— Ecclesiastes 11:7, (NIV)

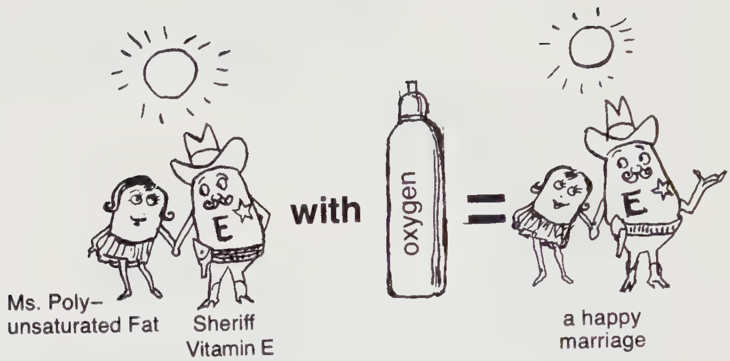
The culprits: free radicals

When I mention the term free radicals to lecture groups, some at first think I have switched topics and am speaking about "wayout" political groups. Understanding free radicals, in depth, requires a good understanding of chemistry and would be beyond the scope of this book. In simple terms, our tissues are made up of atoms which combine to form molecules. Electrons, which are part of the atom, orbit around the center of the atom, much as the earth orbits the sun.

When atoms combine, to form molecules, their electrons usually group together in pairs. If one of the electrons is lost, the molecule becomes a free radical. In the presence of oxygen, free radicals form spontaneously in the tissues from certain substances, mainly polyunsaturated fat.



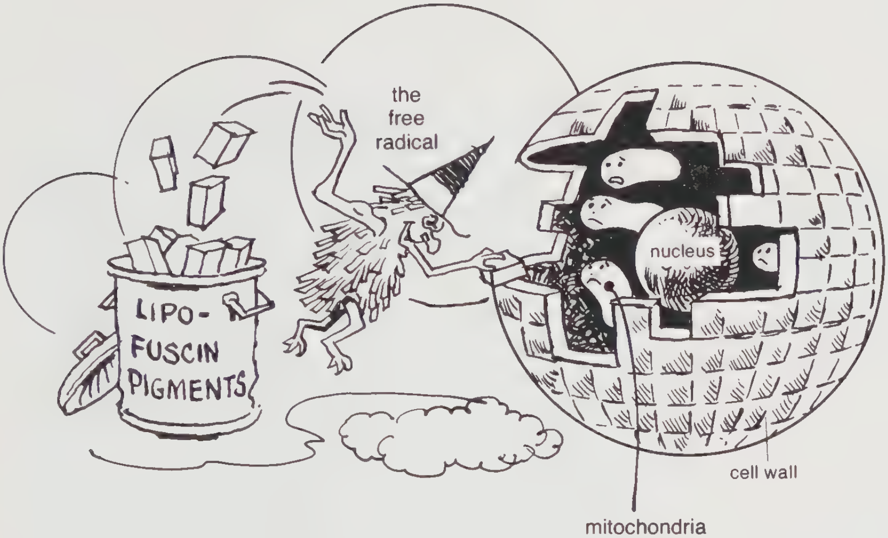
Oxygen atom



Vitamin E protects against formation of free radicals.

This free radical formation is a commonly observed phenomena when fats or oils turn rancid when exposed to air. This process is accelerated by sunlight. Free radicals may form in the oil itself while it is still on the grocery shelf (dark glass containers for oil delay the effect of light) or they may form in the tissues once the oil is eaten.

Unpaired electrons are very unstable. They react abnormally with almost anything close by, and can damage nearly every system in the body. When the fine structures and molecules of the cell are damaged, the remnants persist as intracellular accumulations called lipofuscin pigments. These lipofuscin pigments, which can be



The destructive free radical's attack on the cell .

seen with a microscope, increase with age, and so may be regarded as an indication of the age of tissues.

Both unsaturated and polyunsaturated fats seem to be the main contributors to free radical formation. Because of this, most investigators in the field of aging, believe a high fat diet to be the major cause of aging (1). As the unsaturated and polyunsaturated fats increase in the diet, they also increase in the tissues. The same is true of saturated fats; as they increase in the diet, so they do in the tissues. In other words, the kind of fat that one eats is subsequently found in his tissues.

One can distinguish between the different types of fats by noting what form they are in at room temperature. Saturated fats are solids at room temperature, while unsaturated are thick liquids, and polyunsaturated are thin liquids.

Some investigators are alarmed at the greatly increased consumption of polyunsaturated fats today. This increase has only become possible in the last 70 to 80 years as man has learned to extract the oil from corn, beans, and seeds. For thousands of years prior to this, man had only small amounts of olive oil, a neutral fat, and saturated animal fat.

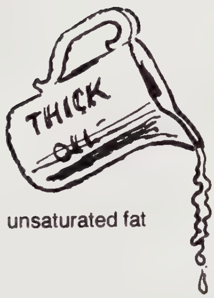
There is no proof that great benefit may be derived from using liberal quantities of polyunsaturated fat. Many nutritionists and other authorities, however, have been urging the general public to use polyunsaturated corn or safflower margarines, mayonnaises, dressings, and oils. But because polyunsaturated fats increase in the tissues with their increase in the diet, they are much more available for free radical formation, and one could expect increased aging of tissues, including the skin, with their liberal use.

Dr. Pinckney, writing in the American Heart Journal, states, "...it was found that of those who deliberately forced polyunsaturates, 78% showed marked clinical signs of premature aging (and in addition they looked much older than their chronological age)" (2).

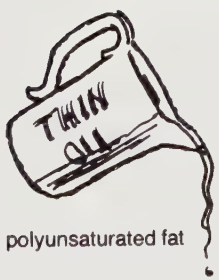
As a body ages, tissue function decreases. Tissues are unable to maintain and replace themselves due to the damage done by free radicals. This is true of nerve tissues, glandular and hormone-producing tissue, antibody-producing tissues, and enzyme-producing tissues. This can certainly be seen in the aged, for as their hormones, enzymes, and antibodies decrease, they become more susceptible to the many afflictions of old age (3, 4, 5).

solid

saturated fat



unsaturated fat



polyunsaturated fat

Physical characteristics of different fats.

Sunlight, oxygen, and polyunsaturated fats all seem to play a part in this aging process. Then should man stay out of the sunlight, avoid polyunsaturated fats, and avoid deep breathing, to delay the aging process? We believe there is a better answer.

Only in the last few decades, has the accelerated aging of the skin become so noticeable, especially since Americans have increased their intake of polyunsaturated fat. This increase in polyunsaturated fat has been in the form of refined oils and not in the natural food products that contain polyunsaturated fats. Certain vitamins and minerals that prevent free radical formation are found in abundance in the natural foodstuffs. These vitamins and minerals are

natural foods

refined, polyunsaturated fat diet

Food makes a difference.

The whole corn contains:
- corn oil
- carotene
- fiber
- vitamin E
- minerals
- starch

whole food

largely removed when food is refined. As an example: oil, when it is removed from its natural state in the wheat, corn, or peanut, etc., is devoid of the vitamins and minerals that would normally accompany it if the whole food were eaten.

The vitamins and minerals protect the oil from free radical formation, and are called antioxidants. Examples of antioxidants are vitamins C and E. A mineral called selenium has been shown to be protective. Carotene, the precursor to vitamin A, has also been shown to stop free radical formation. An antioxidant functions in one of two ways. It either prevents free radical formation, or it inhibits the free radical once it is formed, thereby preventing damage.

Are we getting enough of these vitamins and minerals that protect against free radical formation and aging in the tissues?

Can vitamin C help?

The Food and Nutrition Board of the United States has set the recommended daily allowance of vitamin C at 60 mg per day for adult males and 55 mg for females. These levels are not met by many people. According to surveys, including a recent National Nutrition Survey (6, 7, 8, 9), from 10 to 13% of infants, children, and adults are borderline or below suggested intakes of vitamin C. The steady drop in the average daily intake of vitamin C during the past 30 years in the United

States is of real concern (10). The allowance set by the Food and Nutrition Board (11) as stated in the introduction to their bulletin, is "not necessarily adequate to meet the additional requirements of persons depleted by disease, traumatic stress, or prior dietary inadequacies." Because vitamin C protects against free radical formation of polyunsaturated fats and also protects vitamins E and A from being destroyed, it would be wise to keep the tissues well saturated.

Guinea pigs are used in research with vitamin C because they, like humans, need vitamin C. A guinea pig, to be in good health by any standard, needs enough vitamin C in the diet to keep its tissues saturated. Although it can get along with less vitamin C than is necessary to saturate its tissues, and still not develop scurvy, yet it will run into real trouble with any unexpected stress or injury.

Humans who have their tissues saturated with vitamin C, apparently are in a good position to avoid free radical formation and accelerated tissue aging. However, those who have just enough vitamin C to prevent the symptoms of scurvy may not be protected.

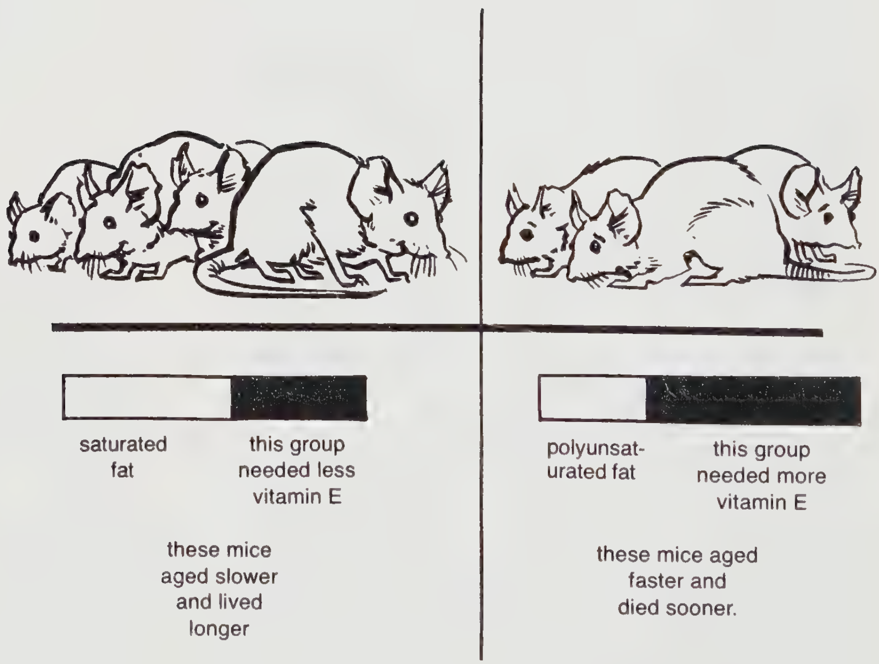
Human tissues can be saturated with vitamin C if one consumes a diet abundant in fruits and vegetables, especially if these are eaten uncooked (12).

A substantial vitamin C level can help protect the tissues from free radical formation when sunlight strikes the skin. There is no evidence in scientific literature to suggest that smaller amounts of vitamin C will give this same protection.

Sources of vitamin C

Poor sources:
- Dried fruits
- Grains
- Nuts

Good sources:
- Oranges
- Strawberries
- Tomatoes
- Grapefruit
- Dark green leafy vegetables



Polyunsaturated fat and aging of experimental animals.

Can vitamin E help?

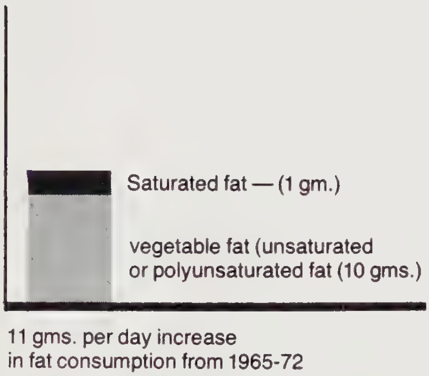
Another vitamin that has been shown to be highly efficient in protecting against free radical damage is vitamin E. The symptoms of vitamin E deficiency are noted in experimental animals and man. However, the amount of vitamin E needed to prevent free radical formation and subsequent aging, and the amount needed to prevent a deficiency, may be different.

In one study, mice were tested for longevity while being fed diets containing either saturated or polyunsaturated fat. Each was given more than enough vitamin E to prevent a deficiency. The mice on the polyunsaturated fat diet required, and were given, more vitamin E. As the years went by, it became very apparent that the mice being fed the polyunsaturated oils were dying sooner, of old age, than the mice on the saturated fat diet. Though none of the mice developed signs of vitamin E deficiency, the ones on the polyunsaturated fat were aging more rapidly (13).

Humans, with their longer lives, may accumulate the aging damage done by free radicals over many years and yet show no signs of vitamin E deficiency.

As the level of unsaturated fat increases in the tissues, more vitamin E is needed to protect the unsaturated fat from the attack of free radicals. Tissues that accumulate more unsaturated fat, such as the testes, are the first to be damaged by these free radicals when the diet is deficient in vitamin E (14).

Since 1909 the per capita consumption of unsaturated (vegetable) fat in America has greatly



Increase in vegetable fat consumption.

increased. From 1965 through 1972, the total fat consumption increased by 11 grams per person, per day. Ten of the 11 grams were vegetable fat. One was in saturated fat (15). Americans consume more polyunsaturated fat now than they did in 1900, yet they get proportionately less vitamin E (16).

The Food and Nutrition Board's recommended dietary allowances suggests an adult vitamin E requirement of 12 to 15 mg per day. The average American however takes in only 7.4 mg per day (17).

Recent British studies have shown that the vitamin E content of the average Englishman's diet is less than that recommended by the British health authorities (18).

Sources of vitamin E

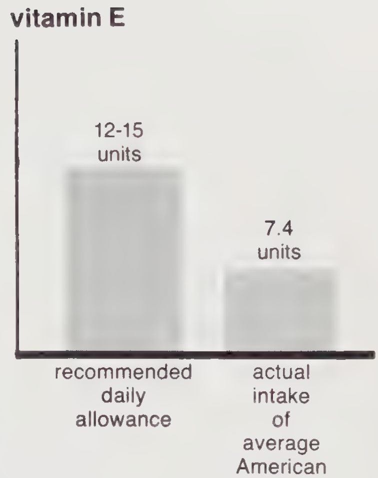
Poor sources:
- Animal products
- Processed refined foods

Good sources:
- Whole grains
- Fresh vegetables
- Whole nuts and seeds

After being processed and refined, vegetable oils have lost much of their vitamin E. The by-products of the refining and purification process are sold for human and animal supplementation and serve as a source of natural vitamin E.

Whole wheat is an excellent source of vitamin E until the germ is removed and the remaining wheat flour is bleached. One should be aware that considerable vitamin E is lost also during the processing, storing, packaging, and freezing of food.

A great deal of vitamin E can be obtained from natural foodstuffs – fruits, grains, vegetables, nuts, and seeds. There need be no concern about free radical formation in the tissues from unsaturated fat if that fat is eaten in its natural form rather than as free, refined oil. The natural foodstuffs that contain large amounts of vitamin E give man protection from the sunlight by preventing free radical damage.

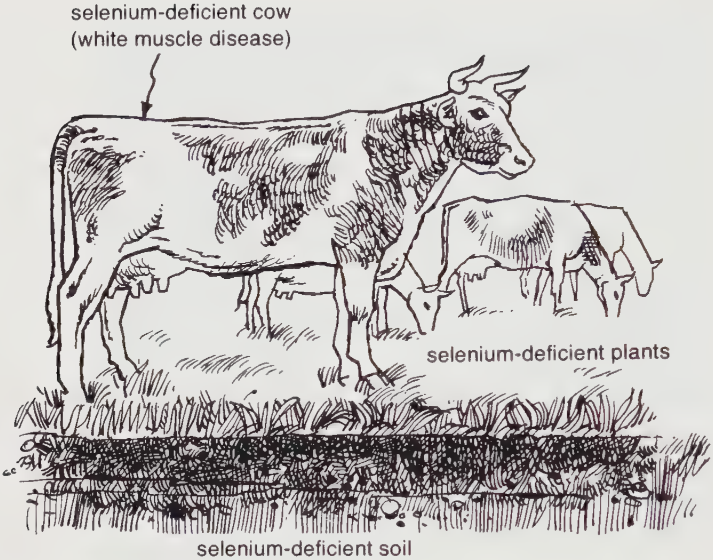


Recommended and actual intake of vitamin E.

Can selenium help?

Selenium is a trace mineral that has been shown to help in preventing free radical damage. It is able to substitute for vitamin E in certain deficiency problems. Vitamin E *keeps* free radicals from forming; while selenium hinders the free radicals from doing damage *after* they have been formed.

With an adequate amount of vitamin E, the need for selenium in the diet can be decreased considerably. With the use of refined, polyunsaturated fat, the need for vitamin E will increase proportionately and can cause an increased need for selenium. If the vitamin E prevents the free radicals from forming in the tissues, it can be readily seen that the need for selenium would not be great, as there would be no free radicals to destroy.



Selenium-deficient soils produce diseased cattle.

Many areas of the world have soils deficient in selenium, and food crops grown on these soils contain only traces of this mineral. If there is a wide distribution of food that is grown on soil containing an adequate amount of selenium, there will be no selenium deficiency problem. A problem exists when a population lives on the food grown in an area where the soil is deficient in this mineral.

There are large areas in the United States and other countries where the soil is so deficient in selenium that farm animals develop a type of muscular dystrophy called white muscle disease. These animals can be cured by injections of selenium and vitamin E. A person living in one of these areas and eating products grown exclusively in the local area should consult his physician about supplementing his dietary selenium.

Can vitamin A help?

Vitamin A is not found in the plant kingdom, but its precursor, carotene, is. Carotene can be broken down in the body to form vitamin A or it can be stored as carotene in the tissues. Large amounts of carotene may be consumed and stored in the tissues without any toxic effect, while vitamin A, taken in large amounts, may be toxic.

Recently, carotene has been shown to play a major role in preventing free radical damage. This was first discovered in a study of plants, by scientists who found that chlorophyll could undergo free radical formation with resulting damage to the plant tissues. Carotene was found to be the agent in the plants that protected them against free radical attacks (19). When investigators gave experimental animals extra carotene, they discovered that it also had a major protective effect against free radicals in animal tissues (20).

Many people in the United States do not get enough vitamin A or carotene. A ten-state nutrition survey by the center for Disease Control, Department of Health Education and Welfare, discovered a marked deficiency in this country (21).

Sources of vitamin A or carotene

Poor sources:
- Grains (except corn)
- Processed refined foods – white flour, sugar,
- Vegetable oils (almost no vitamin A).
- Muscle meats
- Nuts
- Common vegetables

Good sources:
- Carrots
- Sweet potatoes
- Melons
- Squash
- Apricots
- Peaches
- Corn
- Bananas
- Pumpkin
- Dark green leafy vegetables

Many fruits, such as oranges and bananas, and dark green, yellow or orange vegetables are rich sources of carotene. Carotene gives the bright color to carrots, sweet potatoes, melons, squash, pumpkin, apricots, peaches and yellow corn. Very little vitamin A is lost during their cooking and processing. There is little excuse for developing a vitamin A deficiency when a wide choice of foods is available from the grocer the year around.

Grains (except for yellow corn), white flour, sugar, and vegetable oils have almost no vitamin A. Muscle meats, nuts, and many of the more common fruits and vegetables such as beans, potatoes, pears and apples have only minor amounts of vitamin A.

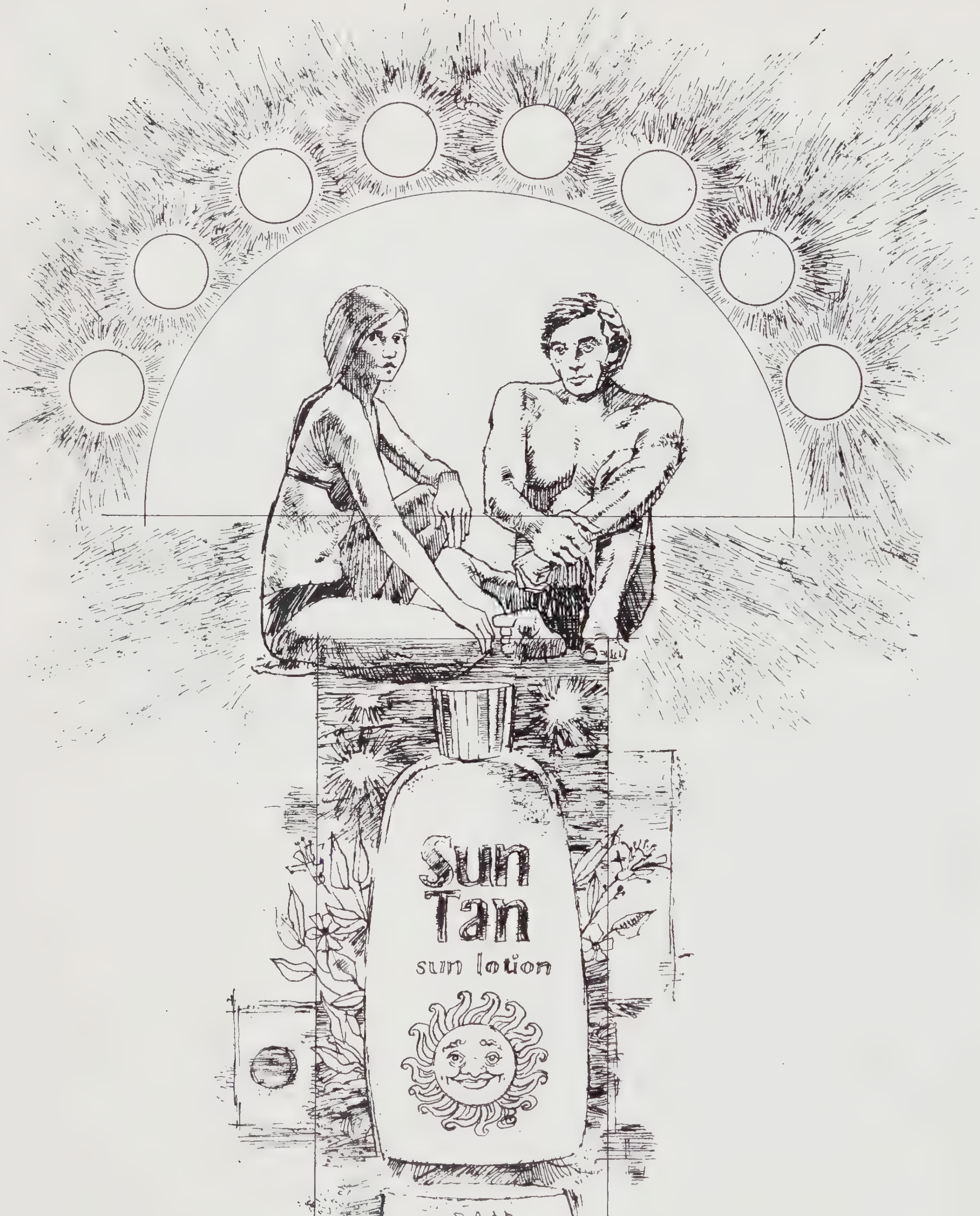
All work together

There are many vitamins and other substances in unrefined whole foods that can protect us from free radical formation and its aging effects. Sunlight can influence the formation of free radicals and accelerate aging of the skin only when the tissues are deficient in the protective vitamins and natural substances. The blessings of younger-looking skin and of longevity are both at stake here. One study showed that older persons who had low blood levels of vitamins A and C had a higher mortality rate than did persons with higher A and C levels (22).

Sunshine brings beauty

With a natural diet (eating the food as grown), the tissues will be packed with the proper vitamins. Sunlight can then bring a healthy glow, and at the same time keep the skin soft and flexible. Dr. Robert Bradley, writing in his book, *Husband Coached Childbirth,* makes the point that women who sunbathe nude have more flexible skin and do not need to be cut in order to prevent tearing at childbirth. He states, "I have had the privilege of acting as obstetrician for professional nudists, and from the physical standpoint, I could not argue with those sun-tanned-all-over mothers. Their skin is more flexible, less brittle."

If too much sunlight is received, it can have a drying effect, and one may occasionally have flaking, dry skin. Exposure to the sun should be progressive, beginning with only a few minutes a day. Skin that does not get sunlight has a pale, pasty, unhealthy tone and no amount of cosmetics can mimic the healthy glow that the sun can give. If the tissues of the skin are saturated with the necessary vitamins, the sun will not age the skin, but enhance its beauty.


Sun
Tan
sun lotion

Chapter 5

Sunlight and Cancer

"In the heavens he has pitched a tent for the sun, which is like a bridegroom coming forth from his pavilion, like a champion rejoicing to run his course."
— Psalms 19:4, 5 (NIV)

There are several good arguments to support the view that sunlight may be one of the factors that contribute to the development of skin cancer. It is clearly established that skin cancer occurs most often on those areas of the body exposed to sunlight such as the head, neck, arms, and hands. Races of people with darker skin develop less skin cancer than the lighter skinned races. Among the light-skinned races, those who work outdoors or live in areas of the world where more sunlight is available, may get more skin cancer.

Many animal experiments have been done that show ultraviolet light to be a factor in skin cancer. When epidemiological and animal experimental data are considered together, there can be no question: sunlight is a factor in causing skin cancer.

burning → ↑ free radicals → ↑ skin cancer

Burning may be involved

The exact mechanism of how sunlight contributes to skin cancer formation is unknown! Chronic sunburn may be involved. To induce skin cancer in experimental animals, larger-than-normal doses of ultraviolet light are given over short periods of time, burning the animal. There is some experimental evidence that the same amount of ultraviolet light given over a longer period of time may not be as effective in producing skin cancer (1).

Some humans are very sensitive to sunlight and will burn easily. Blond and red-haired persons seem to be most troubled with chronic burning. Skin cancer patients appear to be very sensitive to sunlight. They sunburn more easily, and the burned area takes longer to heal. They tan less easily than healthy control groups (1, 2).

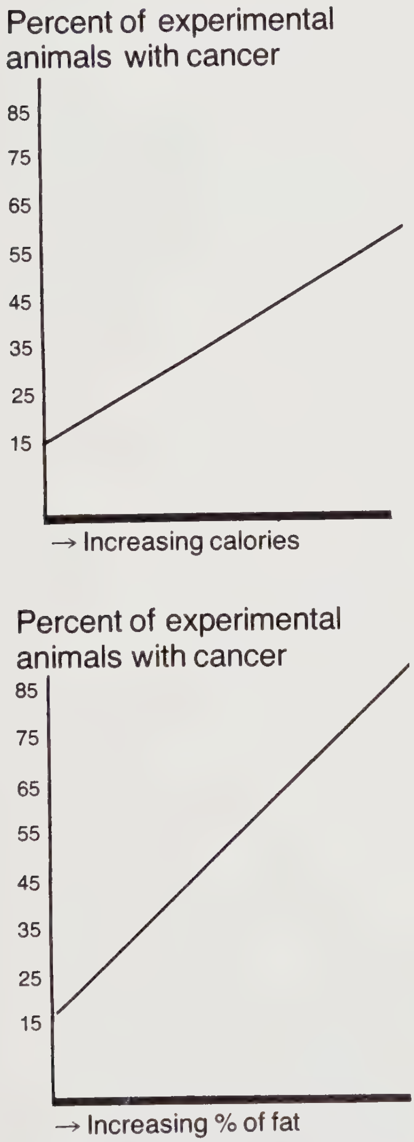
When burning takes place in the skin, free radicals are formed (3). In reviewing the chapter on aging, we can see that it is the free radicals that do the damage in the aging process. Free radicals are also responsible for the damage involved in sunburning. The amount of free radicals formed in the skin when it is exposed to sunlight, and the tendency for that skin to burn, are directly related. In other words, if you can stop free radicals from being formed, you can significantly reduce sunburning. This has been shown in a number of experiments involving both humans and animals (4, 5).

Sunlight may change cholesterol into a cancer-producing substance

When ultraviolet light strikes the skin, cholesterol may be changed into many different products. One of these products, cholesterol alpha-oxide, is known to act also as a free radical and can cause cancer. As noted in the previous chapter, free radical formation apparently can be inhibited by certain nutrients in the diet.

Fat of the land

There is little doubt, in the research literature, as to whether or not a high fat diet promotes a higher and earlier incidence of skin cancer due to ultraviolet light (6, 7, 8). Not only skin cancer, but breast and colon cancer as well, seem to be increased by a high fat diet. Increasing the calories in the diet of experimental animals will increase the incidence of cancer; and when the same number of calories are fed to all experimental groups, the animals receiving the most fat, develop the most cancer. Fat seems to have a specific effect in stimulating cancer formation (9).



Increased calories and fat affect cancer incidence

When one eats a refined diet from which much of the bulk, fiber, and water content have been removed, it is very easy to get too many calories and run the risk of increased incidence of cancer and of obesity. If the bulk and fiber are left in the food, a sensation of fullness usually occurs before too many calories are consumed.

It is not only the dietary fat that promotes skin cancer formation, but also fat or oil applied directly to the skin (10). This is why sunbathing lotion, cream, or oil cannot be recommended, for they may stimulate cancer formation.

Polyunsaturated fat.

Not only does saturated fat stimulate cancer formation, but unsaturated or polyunsaturated fat will do the same. In many cases in scientific literature, the polyunsaturated fats are shown to apparently stimulate cancer formation more quickly than do the saturated fats (11, 12). The more unsaturated the fat, the greater seems its ability to stimulate cancer formation caused by sunlight or cancer producing drugs. In one study done at the University of Western Ontario, ten different fats of varying saturation were used to determine which one would produce the most cancers. The saturated fats produced the smallest number of cancers and the polyunsaturated fats produced the most (11).

Notice in the following chart that popular oils like corn, olive and cottonseed each produce a high incidence of cancer.

Reports from other parts of the world are linking polyunsaturated fat with malignant melanoma (13). Although the number of patients studied is small, some feel the public should be made aware that there is some evidence that the use of polyunsaturated fats may promote malignant melanoma (14). The increased use of polyunsaturated fats may be related to the dramatic increase in malignant melanoma.

Diet containing 20% of various fats	Total cancers
Coconut oil	69
Butter	79
Tallow	70
Lard	91
Olive oil	109
Rapeseed oil	62
Cottonseed oil	122
Corn oil	105
Soybean oil	101
Sunflowerseed oil	124

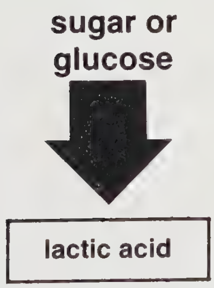
How polyunsaturated fats contribute to cancer formation

The question naturally arises as to why polyunsaturated fat would cause more cancer than saturated fat. There are several mechanisms that may be responsible for the increased incidence of cancer with the use of polyunsaturated fat.

Dr. Otto Warburg, twice winner of the Nobel Prize in Medicine (1931 and 1944), discovered that normal cells in the body obtain their energy by "burning" sugar or glucose to carbon dioxide and water. Cancer cells, however, always obtain part of their energy by changing the sugar only to lactic acid, a relatively simple step, and not continuing the process on to carbon dioxide and water (15). Oxygen is required when sugar is burned to carbon dioxide and water, but is not required when the sugar is changed only to lactic acid. Cancer cells stop with the production of lactic acid, for they have been damaged, and are no longer able to burn sugar efficiently, all the way to carbon dioxide and water. There is a com-

- complex reaction requiring over 30 steps
- oxygen required
- 38 units of energy
- normal cells go all the way to this point.

Metabolism of normal cell



- relatively simple reactions
- requires no oxygen
- two units of energy
- cancer cells stop here

Metabolism of cancer cell

plicated set of reactions between sugar or glucose and carbon dioxide and water; nearly 30 steps are involved. This process can be easily interfered with.

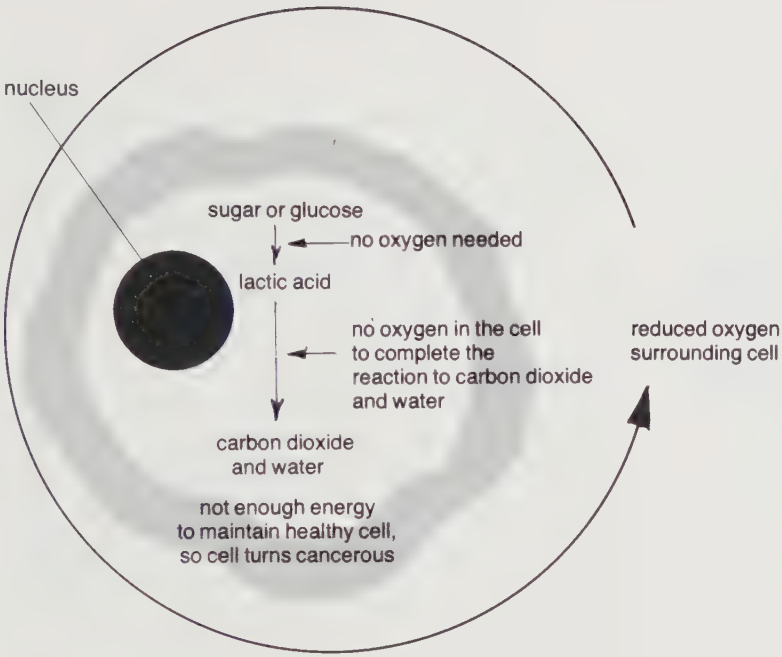
A very small amount of energy is obtained when sugar is merely metabolized to lactic acid in comparison with the amount produced when it is burned all the way to carbon dioxide and water. All cells need this greater energy to maintain normal, internal structures and functions. Cancer cells are thus unable to maintain the normal cell structure and function.

Normal cells communicate with each other through intricate channels and are able to stop abnormal cell division and wild growth. Cancer cells have lost this ability to communicate because of their poor structure and function (16).

Normal cells have been removed from experimental animals and placed in a culture where they will grow and divide. If the oxygen that is available to these cells is reduced, the normal cells will become malignant. If these cells are again placed in the animal's body, they will develop and destroy the animal with cancer (17).

When the oxygen is cut off from normal cells, they are damaged, to the extent that they are no longer able to burn foodstuffs down to carbon dioxide and water, because oxygen is needed for this reaction. The cells then have to depend upon the energy obtained from metabolizing sugar to lactic acid, which does not supply adequate energy to maintain normal structure and function. As a result, the cell turns cancerous.

Dr. Warbury believes that any agent that injures the ability of the cell to burn foodstuffs to carbon dioxide and water is a cancer-producing

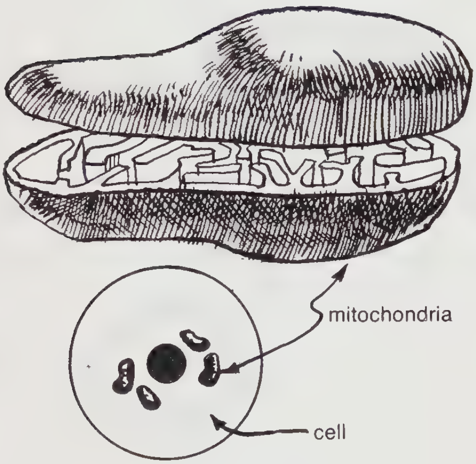


Characteristics of malignant cell.

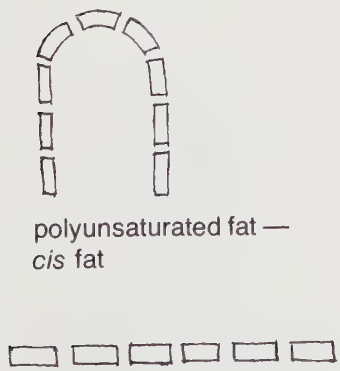
agent (18). Since this reaction requires oxygen, any agent that inhibits or stops the supply of oxygen would be cancer-producing. Any agent that inhibits any of the steps in the complex cellular reaction which ends with carbon dioxide and water would also be cancer-producing.

Oxygen use stopped by free radicals

Inside the cells of the body are tiny structures called mitochondria. Inside these mitochondria the basic foodstuffs are burned to carbon dioxide



Mitochondria — power house of the cell.



Difference between the *trans* and *cis* form of polyunsaturated fat.

and water, producing energy. The mitochondria are the powerhouses of the cell and produce the energy necessary for the functions of the cell.

It is along the fine walls of the mitochondria in the above drawing that the reactions take place which "burn" the food in the presence of oxygen to produce energy. These walls are rich in unsaturated fats and are very susceptible to the disruptive and damaging action of free radicals. When the fine structures are damaged by the free radicals, oxygen cannot be utilized to burn food all the way to carbon dioxide and water (19). Here we have the beginning of a cancer cell that is only able to produce energy by metabolizing sugar to lactic acid, a reaction that does not require oxygen.

Oxygen use stopped by trans fats

A molecule of polyunsaturated, fatty acid as it comes in nature is shaped like a horseshoe. This horseshoe shape is incorporated into the walls of cells and mitochondria as part of the structure.

When the polyunsaturated fat is removed from the natural food, it has to be refined and deodorized and also may be hydrogenated depending upon its intended use. During this process, some of the polyunsaturated fat is changed from the natural horseshoe shape to a straight chain-like structure. The natural horseshoe shape is called the *cis* form; the straight shape is the *trans* form.

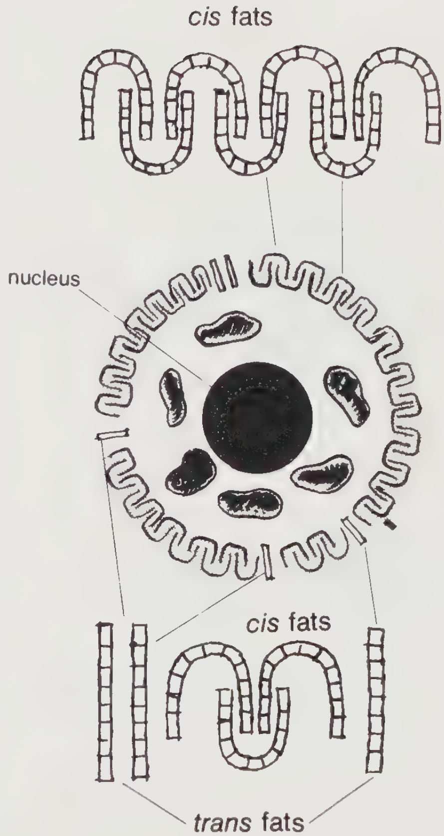
Pure liquid oil may have up to 6% *trans* fats, margarines up to 54%, and solid vegetable shortening up to 58% (20, 21, 22, 23).

Have you ever tried to put together a picture puzzle after someone had mixed another puzzle with it? If you were told to use all the pieces and to fit them in any way that you could, the resulting picture would be strange, indeed.

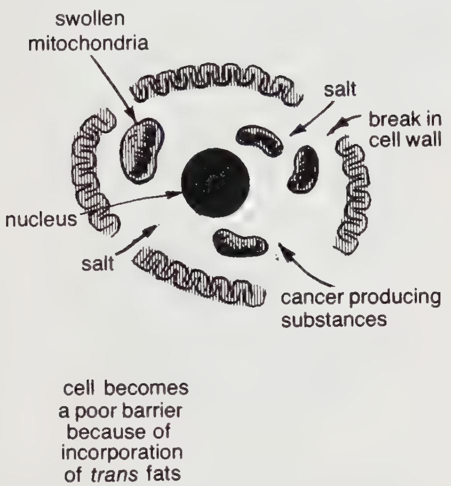
The body has the same problem when we throw the straight *trans* fats in with the natural horseshoe-shaped *cis* fats. The body is very resourceful and will try to utilize all materials available. But when the cells try to build a good wall around themselves and have to use straight chains when the blueprint calls for horseshoe-shaped chains, the wall is not going to be very good. Gaping holes may allow substances that may cause cancer to pass through into the cell, causing real problems.

As an example: Inside the cell, the sodium salt concentration should be low; therefore, the cell works constantly to keep the sodium out. When the *trans* fats are incorporated into the cell wall, sodium is able to move in more readily and the cell has a hard time keeping the sodium level down. It has to work extra hard to move the excess sodium out (24). Increasing the ability of substances to flow into a cell increases the chance of cancer-producing substances moving into a cell (25).

One group of researchers discovered that when they fed an experimental group of animals a diet containing only 4.4% of the *trans* fats, the mitochondria became swollen two or three times their normal size (24). The tissues of these experimental animals contained 13% to 14% *trans* fats. Human tissues also have been reported to contain up to 14% of the *trans* fats (26). The more *trans* fats eaten, the more of these fats will be in



Incorporation of distorted *trans* fats into cell wall.



Result of *trans* fat incorporation into cell wall.

the tissues and the greater effect they will have in altering the normal enzyme activity there (27).

When the *trans* fats are eaten, not only do the mitochondria become swollen but their function is also inhibited. They are inhibited from using oxygen to burn foodstuffs completely to carbon dioxide and water (28). So here we have the basic cancer-producing process going on in the cell. *Trans* fats may be a major contributor to skin cancer along with free radical damage. It is interesting to note that research done 40 years ago used a *trans* fat hydrogenated cottonseed oil to show that increased fat consumption would increase skin cancer from ultraviolet light (8).

Trans fats can be identified by the term *partially hydrogenated vegetable oils* on the labels of commercially processed food. If you read the label, you will find it very difficult to buy a loaf of bread that does not contain *trans* fats. They are common ingredients in canned soups, crackers, pastries and all baked goods, cake and frosting mixes, baking mixes, frozen dinners, sauces or frozen vegetables, and breakfast cereals. In fact, avoiding the use of *trans* fats is virtually impossible if you purchase processed foods.

Many studies have shown that skin, breast, and colon cancer are directly related to the amount of fat, saturated or unsaturated, in the diet. However, evidence is becoming more and more incriminating for refined vegetable fats, especially the *trans* fats.

In Puerto Rico, the breast and colon cancer rate is only 30% to 40% of that in the United States in spite of the fact that Puerto Ricans use considerably more animal fat than Americans use (88% versus 62% of the total fat intake). But Americans use much more refined vegetable fat (29, 30).

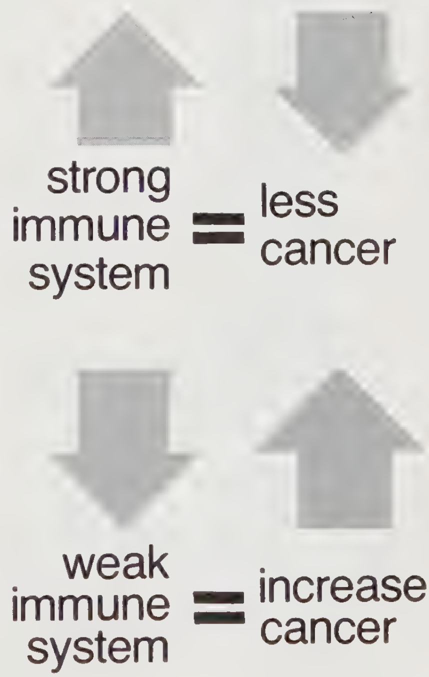
The per capita intake of vegetable fats in the Netherlands is nearly four times that of Finland. The incidence of breast and colon cancer in the Netherlands is almost twice that of Finland (31, 32).

Animal fat certainly is implicated in cancer as various studies have shown (33), but close study of human fat-consumption places the *trans* vegetable fats under far greater suspicion (34).

A weak immune system invites cancer

Kidney and heart transplant patients have to have their immune systems suppressed so they will not reject the donated organ. These patients develop cancer 80 times more readily than the normal population (35, 36). Suppressing the immune system is a dangerous practice as this system detects cells that have become malignant and destroys them.

Skin cancer seems to be the predominant type of cancer that these immuno-supressed patients develop. These tumors appear primarily on areas of the skin exposed to the sun. Thus, we see that suppression of the immune system may be involved in skin cancer that is stimulated by ultraviolet light.



burning → ↑ prostaglandins → ↓ immune system

polyunsaturated → ↑ prostaglandins → ↓ immune system

greatly depressed immune system

Factors that may depress the immune system

When enough ultraviolet light is received by the skin to produce a burning or reddening effect, increased levels of prostaglandins are produced in the skin (37). Prostaglandins are hormone-like substances that are produced from a certain essential unsaturated fat called linoleic acid. Linoleic acid is found in polyunsaturated oils, especially in corn oil. The more linoleic acid in the diet, the more there is in the tissues, and the greater is the production of prostaglandins (38). Prostaglandins are known to inhibit the immune system (39, 40). Therefore, the more polyunsaturated fat in the diet, the more prostaglandins will form when the skin is reddened by the sun and the greater will the depressing effect on the immune system.

It is suggested that one way in which sunburning contributes to the formation of skin cancer is that it, in conjunction with a high polyunsaturated fat diet, depresses the immune system thereby leaving the body unable to check the growth of cancerous cells.

Polyunsaturated fat, itself, has been shown to inhibit the immune system (41, 42). In fact, it does this so well that researchers are now using polyunsaturated fat in the diets of kidney transplant patients and those patients with skin grafts taken from other people, so the patients' bodies will not reject the foreign tissue (43, 44, 45, 46).

Certain diseases may be caused by the body's becoming allergic to itself; that is, the immune system actually begins to destroy some of the body's cells. These diseases are called auto-immune diseases. Polyunsaturated fat has been used to inhibit the immune system in these diseases (47, 48). It is apparent then that the inclusion of polyunsaturated fat in the diet directly inhibits the immune system even without an additional sunburning effect.

Polyunsaturated fat use on the rise

Americans have greatly increased their use of polyunsaturated fats during the past 60 years, and the trend is continuing. During the years 1965 to 1972, the polyunsaturated fat intake climbed by 20% and is predicted to climb much higher by 1985. The intake of salad and cooking oils has increased dramatically since 1909 when oils were consumed at the rate of 1.5 pounds per

Incidence of cancer among those taking immune suppressing drugs.

Increase in vegetable fat consumption.

person per year. By 1972 this figure had risen to 18 pounds. By 1985 it is predicted that the figure will be 25 pounds per person (49).

Several years ago I counseled a 48-year-old female patient who really believed in polyunsaturated fat. She used polyunsaturated margarine, mayonnaise, oils; in fact, almost all food which she cooked or purchased had to contain some polyunsaturated fats. Margarine went on the bread, vegetables, and potatoes; mayonnaise went on all salads and sandwiches. She considered oil to be a medicine, and, therefore, almost everything had to have a generous helping of polyunsaturated fat. This lady looked older than her stated age, and she had many physical complaints, but her overriding concern was her constant weakness and lack of energy. I advised her to remove all refined, polyunsaturated fats from her diet. She was allowed to use natural foods that contain polyunsaturated fats (olives, avocados, nuts and seeds), sparingly. Lean white meat was also allowed, but only 3-4 oz a day. All other visible animal fats, including butter, were restricted. After several weeks, I saw her again, and the change in her was significant. She appeared cheerful and energetic, and with a smile on her face, she told me how well she was feeling. This is not an isolated incident, but is the usual result seen in a patient who has removed refined, oily and greasy products from his diet.

The use of margarines with their high percentage of *trans* fatty acid has increased. Between the years 1950 and 1972, the consumption of margarine rose from 6 pounds per person per year to 11 pounds per person (49).

Because of the problems of free radical formation, inhibition of oxygen utilization by the cell, increased cancer production, and depression of the immune system, polyunsaturated and *trans* fats are heavily implicated in the epidemic of skin cancer. Reports now estimate that new cases of skin cancer are in the neighborhood of 300,000 per year and rising rapidly. From 1963 to 1973, the reported incidence of skin cancer doubled (50).

Polyunsaturated fat still being pushed on the public

There are those who still urge the public to use more polyunsaturated fat despite the fact that most persons have already tremendously increased their vegetable fat intake. Unfortunately, this recommendation is made with the promise that heart disease may be prevented or treated.

It is true that exchanging polyunsaturated fat for saturated fat will cause a slight decrease in serum cholesterol levels, but this has never been proven to prevent or treat heart disease.

In fact, the National Heart and Lung Institute admits that any relationship, between diet (insofar as saturated vs polyunsaturated fats are concerned) and heart disease, is strictly "intuitive" and based only on personal impressions and fragmentary conclusions rather than on scientific proof (51). The Food and Drug Administration has gone on record as saying that it is a violation of the law to make any claim that polyunsaturates can prevent or treat heart disease (52, 53).

Despite all the extra polyunsaturated fat in the

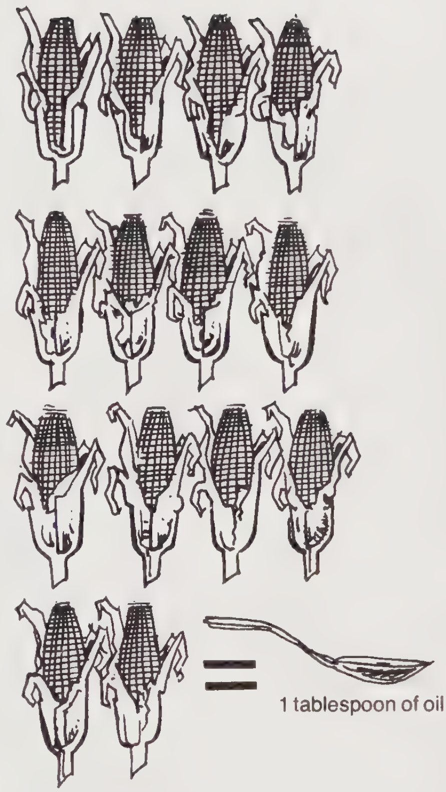
Incidence of skin cancer doubled from 1963 to 1973.

American diet, the epidemic of atherosclerosis with all of its clinical manifestations – plugged arteries and sudden death – continues unabated (54, 55). This epidemic continues despite indications that mortality from coronary heart disease in the United States has dropped slightly since 1968 (56). This may possibly be due to the valiant efforts made to decrease hospital and prehospital deaths.

Dr. Nemat Borhani, dean of epidemiologists in the United States, says this: "The association between the level of serum cholesterol and the incidence of coronary heart disease forms the basis for the lipid hypothesis that cholesterol-lowering measures (dietary or otherwise) will lead to a reduction in the incidence of this disease. Unfortunately, the lipid hypothesis has not been tested adequately to the satisfaction of the medical community. All primary and secondary intervention trials conducted thus far have reported negative or equivocal results. Further, most of these trials suffer from inadequate numbers, lack of randomization or other serious methodologic shortcomings" (57).

Cancer prevention

A diet that consists largely of whole food (food as grown), in as fresh and unprocessed a state as possible, insures all the bulk, fiber, vitamins, and minerals necessary to maintain healthy tissues. Whenever a food is refined, it is devoid of its unique composition of nutrient components for its optimum absorption and utilization. Corn as a whole food has much fiber, bulk, vitamin E, carotene, and minerals. Refined corn oil, on the other hand, is virtually a pure chemical, a triglyceride, robbed of its associated nutrients. In this state it can easily be eaten in excess. For example, 12-18 ears of corn are used to produce 1 tablespoonful of corn oil. When one eats mostly refined foods, the diet not only contains too much fat, but also contains much less of the vitamins, minerals, bulk, and fiber than are needed each day. A diet that is high in refined fat is a depleted diet. A depleted diet cannot maintain healthy tissues. The vitamins normally associated with polyunsaturated fat, as it is found in its natural state in the whole food, are the very vitamins that offer striking benefits in skin cancer prevention.



It takes 12-14 ears of corn to produce 1 Tablespoon of refined oil.

Sunburning, as discussed previously, is directly involved with free radical formation. If free radical formation can be slowed or eliminated, the skin of either humans or animals will not burn as easily (4, 5). This helps to prevent skin cancer. Cholesterol alpha-oxide, the substance produced when sunlight strikes the skin, is also a free radical, and may contribute to skin cancer. The question then is how *to interfere with free radical formation.* The formation of cholesterol alpha-oxide has been shown to be inhibited by vitamins E and C (58). Vitamins C, E, carotene and the mineral selenium have all been shown either to prevent free radical formation or to prevent damage from free radicals already formed. This is discussed in detail in the chapter on aging.

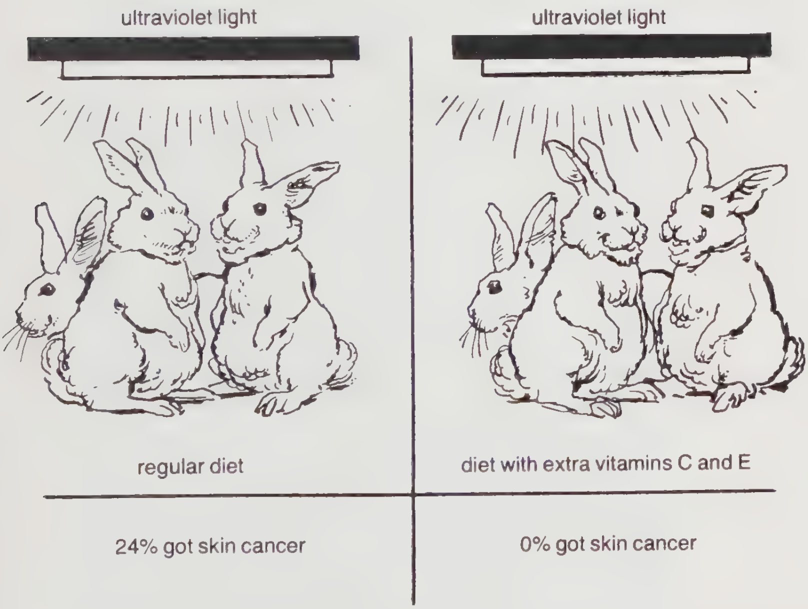
Carotene, in particular, has been shown to prevent sunburning. It was shown to be even more effective than vitamin E (59). Not only does carotene help prevent burning but it also delays the appearance time of skin cancer produced by ultraviolet light. Carotene also decreases the *growth rate* of skin cancer (60), a very important aspect when one is considering cancer treatment. Many patients complain about how easily they burn when they are out in the sunlight. After they begin a program which includes a natural diet, rich in carotene and vitamin E, they are almost invariably surprised at the amount of time they can spend in the sun without burning.

Skin cancers other than those produced by ultraviolet light, are inhibited to an amazing extent by the presence of carotene (61). Other types of cancer, such as sarcomas, also seem to be greatly affected by carotene. In one study, sarcoma was induced in experimental animals and half of these animals were given carotene. The group that was getting the carotene lived over 55% longer than the group not getting the carotene (61). The fact that low vitamin A and carotene levels were found in over 50% of patients who had cancer also gives evidence that increased amounts of vitamin A and carotene in the diet may protect against cancer formation (62).

Although carotene can be broken down to vitamin A in the body, it may have a different function as carotene. Vitamin A may be helpful in stimulating the immune system in the body to reject cancer cells (63, 64), and carotene may act to stop free radicals from doing damage that predisposes to skin cancer.

A study at Baylor College of Medicine examined the protective effect of vitamins C, E, and similar agents. Two groups of experimental animals were given ultraviolet light treatments. The animals in one group received a regular, balanced diet while the others were given more of the protective vitamins. At the end of 24 weeks, 24% of the animals on the regular diet developed skin cancer while no skin cancer was found on the animals that received the extra vitamins (65).

Here we have evidence that the "normal" and "adequate" amount of vitamins contained in a regular diet may not be enough to prevent cancer formation. Diets vary widely for laboratory ani-



Diet affects incidence of skin cancer in experimental animals.

mals, but most contain the recommended daily allowance of vitamins and minerals, which is enough to prevent deficiency symptoms, but may not be enough for the prevention of cancer.

As we pointed out in the chapter on aging, many Americans are not getting the recommended daily allowance of vitamins C, E, A, or carotene. It could very well be that this is one factor involved in the more and more common occurence of skin cancer.

Sunlight inhibits cancer

There is evidence in the scientific literature to show that white people living in areas of the world that get more sunlight develop more skin cancer. From the previous discussion we would expect that populations eating high fat diets and not taking in adequate amounts of dietary vitamin E, C, and carotene would develop more skin cancer when exposed to the sunlight.

On the other hand, studies show that as the amount of available sunlight increases, the incidence of internal cancer decreases. The total cancer deaths of the various American states and Canadian provinces are shown to fall with increasing available sunlight and as more people are exposed to the sun. Dr. Frank Apperly, the author of one report, suggests that "we may be able to reduce our cancer deaths by inducing a partial or complete immunity by exposure of suitable skin areas to sunlight" (66).

This theory has been tested in a number of other studies. In one study it was found that the more light that groups of rabbits received, the less cancer they developed. The rabbits given extra light, that did develop cancer, had fewer deaths and fewer metastases (67, 68). Researchers from Russia have shown that 50% less malignant cancer growths developed when experimental animals were given sunlight treatments (69). A study done involving the U.S. Navy showed a high incidence of skin cancer, but a less than average amount of all other cancers in navy personnel. The author of the study felt that exposing these young men to strong sunlight may have saved the lives of some who would have died from cancer otherwise (70).

The incidence of breast cancer in mice has been cut in half by exposing them to ultraviolet light (71). Using a strain of mice that usually develops a higher incidence of lung cancer, another investigator found that the mice developed skin cancer when they were repeatedly exposed to ultraviolet light; but he also found less lung cancer among the mice that were getting the ultraviolet light treatments. The investigator was rather surprised at the results of his study and tried to explain them in several ways. One thing seems certain; the ultraviolet light had inhibited the formation of the lung cancer – an important discovery (72).

Several years ago, a 41-year-old patient had a breast removed because of cancer and was given chemotherapy treatments, because the cancer had moved into her lungs and bones. The physicians treating her gave her no hope. When she consulted me, I told her I would not treat her cancer, but would be glad to work with her on a program to improve her general health. I removed the refined polyunsaturated oils and fats

from her diet and asked her to eat only whole foods, nothing refined. I also told her about some of the research that had been done with sunlight and cancer. She really took this information to heart and spent a great deal of time out-of-doors in the sunlight. Prior to starting her sunbathing she had progressively lost weight, but after several weeks on the new program, her weight leveled off and she began to notice she had more energy. As the months went by she felt so much better that she returned to work, and has been working during the past several years, with no apparent symptoms of her widespread cancer.

How does sunlight inhibit cancer?

It becomes clear that sunlight can help to prevent cancer when we understand how it stimulates the immune system, increasing its efficiency. As noted previously, inhibiting the immune system increases cancer formation. While the general population's immune systems are decreasing in effectiveness with every year of age, the sunlight devotee will maintain a strong,

↑ oxygen in tissues + ↓ blood pressure = ↓ cancer

active immune system which will not only help to prevent cancer, but to ward off many other diseases as well.

Sunlight increases the use of oxygen in the tissues (73). This can be very important in stimulating the immune system especially in the production of antibodies (74). Many types of cancer cells do not like oxygen and when exposed to high concentrations, they will begin to slow their growth and division, finally stopping altogether (75). In this indirect way, sunlight may be able to fight against cancer by stimulating the immune system and increasing the oxygen in the tissues.

There is a direct relationship between an elevated blood pressure and an increased incidence of cancer. An interesting study was done several years ago on a large group of men with high blood pressure. Researchers hoped to determine what the cause of death would be among them. With all the other variables controlled (age, serum cholesterol, and cigarettes per day), they discovered that a high percentage of these men developed cancer (76). The exact relationship between the elevated blood pressure and cancer is not known. What is known is that with an elevated blood pressure there is an increased incidence of cancer. Since sunlight can dramatically lower the blood pressure, as discussed in the chapter on heart disease, this could be another indirect way that cancer growth could be inhibited.

It should not be surprising to find that a cancer-producing agent can at times be used as a treatment for cancer. X-rays have long been known to cause cancer and yet they are widely used today as a treatment. Chemotherapy is used to treat cancer, yet there are strong indications that it causes cancer, especially leukemia (77). (Unfortunately, these drugs are also used to treat other nonlife-threatening diseases such as lupus erythematosus, kidney diseases, arthritis, and psoriasis. There are numerous reports of leukemia following these treatments.)

Closing suggestions

If cancer is detected by biopsy, the only effective proven means of treatment known at the present is surgery, radiation, or chemotherapy. There is no evidence in the scientific literature that diet alone will eliminate a malignant growth.

On the other hand, improving the health of the entire being, including the skin, with the use of an unrefined diet consisting of plenty of foods rich in vitamins C, E, and carotene, will be the greatest step taken in the prevention of skin cancer. Under this regimen there will be:

1. protection against free radical formation and damage, and
2. cholesterol will not be changed in the skin into cancer-producing substances;

3 fat consumption will be reasonable and will not stimulate cancer formation, and

4 the immune system will not be depressed by the use of refined oils.

All these factors work to protect a healthy skin, and the sun may then be enjoyed for its very remarkable positive contributions to health.

However, if you have been diagnosed as having cancer, or if you are suspicious that you may have it, or if you feel healthy, and you are just beginning a sunbathing program, remember that it cannot be stressed too strongly that you should be under the guidance of your personal physician. He alone is able to give you the personal evaluation and attention you need to ensure the wisest course of action for your health.

Chapter 6

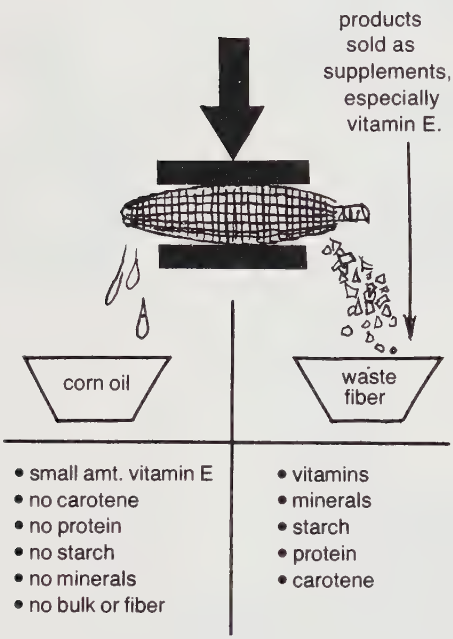
Sunlight and Nutrition

"Pleasant the sun when first on this delightful land he spreads his orient beams on herb, tree, fruit, and flower."
— John Milton

Nutrition and sunlight are intimately related. By striking the skin, sunlight can produce certain hormones and nutrients like vitamin D. Unless one has a proper diet, sunlight has an ill effect on the skin. This must be emphasized: sunbathing is dangerous for those who are on the standard high-fat American diet or do not get an abundance of vegetables, whole grains, and fresh fruits. Those on the standard high-fat diet should stay out of the sun and protect themselves from it; but at the same time they will suffer the consequences of both the high-fat diet and the deficiency of sunlight.

The recommended diet

The most healthful diet consists almost entirely of food eaten in its natural, as grown, state.



refined food

Why? Because when a food is fractionated or refined, several things occur:

1 Nutrients, in conjunction with one another in a food, protect or aid the metabolism of the food. When they are separated from one another the intended protection or benefit of the combination is destroyed. An example of this is the fact that in a natural food, such as corn, vitamins E, C, and carotene are combined with oils or fats to keep the oils from being oxidized or turning rancid. In a natural food such as sugar cane, chromium is combined with the sugar because chromium is necessary for the utilization of sugar in the tissues.

2 The bulk and fiber are removed, thus encouraging the easy consumption of highly concentrated, high calorie foods. For example, as previously mentioned it takes 12-18 ears of corn to produce a tablespoon of corn oil, and so overeating is to be expected, for without the volume of the many ears of corn and only the calories, the sense of fullness in the stomach does not occur.

3 To recombine the components of food (carbohydrates, proteins, fats).in proper proportion, once they have been fractionated, would require a great deal of computation for every individual at every meal. In the western diet, in which a great deal of refined food is consumed, the percentage of fat and calories is totally out of balance with what it would be if the food were eaten in its natural state.

So for the purposes of this book we shall define natural food as food the way it is grown, including the bulk, fiber, vitamins, and minerals that nature has provided, nothing added and nothing taken away. A refined food, on the other hand, is a food that has been denuded of its bulk, fiber, vitamins and minerals.

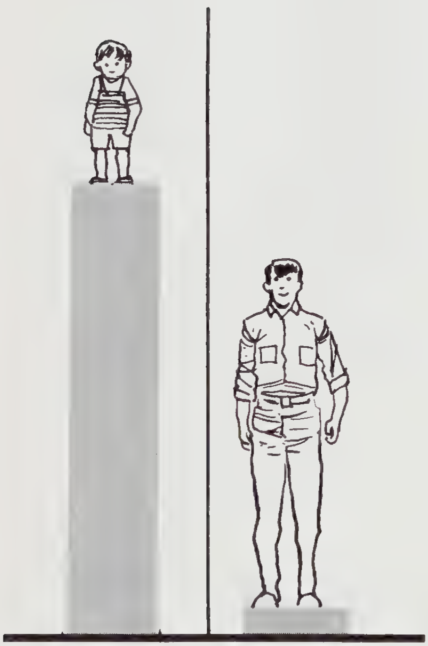
Sugar, a refined food

An example of food that we do not consider to be natural, is white, granulated, table sugar. The bulk, fiber, vitamins, and minerals have been removed from the natural food (sugar cane or sugar beets), and the result is a pure, refined, simple carbohydrate. In this state, it lacks the vitamins and minerals necessary for its efficient metabolism by the body, and hence the body's stores of these missing elements must be depleted in order to utilize the refined food.

Notice how refined sugar has been increasing in the western diet over the past 150 years. This increased consumption of sugar would undoubtedly have an effect on health in the western countries. A number of books have been written upon the subject of sugar's harmful effects upon the body. (Please see the list of books recommended for further reading.) Some authorities, in the field of nutrition, believe that sugar has contributed to a rise in cardiovascular disease, to elevated blood fat levels, and to an increase in the incidence of diabetes, cancer, hypertension, dental decay, and obesity. Because sugar has been so effectively discussed in other books, we will give just one example of the detrimental effects it has on the body.

Per capita sugar consumption in the U.S.

1822	8.9 lbs.
1835	14.1
1845	18.7
1855	29.8
1870	34.1
1880	42.6
1885	49.6
1900	65.3
1913	89
1929	119
1939	110
1949	110
1959	106
1965	114
1970	121
1971	122
1972	124
1973	126



Chromium stores depleted with age due to highly refined foods.

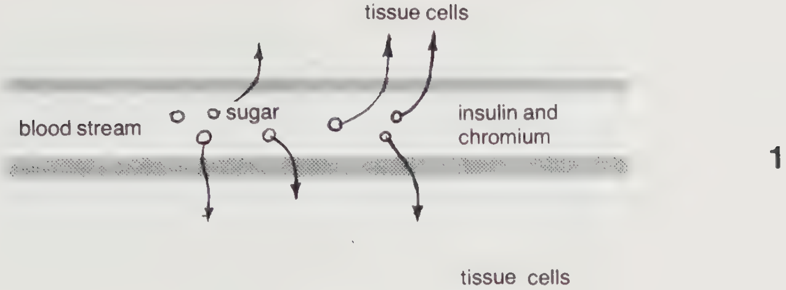
When sugar is eaten and absorbed into the blood stream, it requires insulin and a trace element called chromium (the element that makes automobile bumpers shiny) to move the sugar from the blood stream into the cells where it can be burned for energy.

In the diabetic the insulin is missing; therefore, sugar piles up in the blood stream and cannot move into the cell.

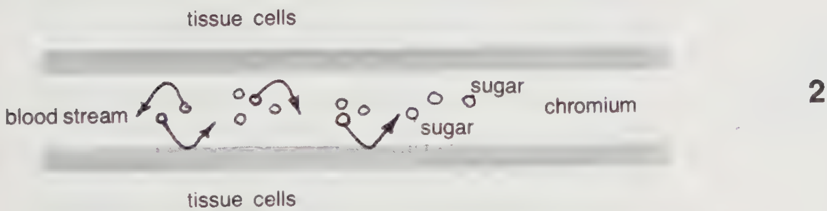
When insulin is given, the sugar is able to move into the cell and the sugar level will drop in the blood stream. If chromium is missing, the blood sugar will rise again, for the sugar is still not able to enter the cell.

Interestingly enough, fat and the amino acids also need chromium in order to move out of the blood stream into the cell where they can be utilized. When chromium is given to a person who is deficient in this element, his blood sugar, fat, and cholesterol all drop (1). Chromium may also help to prevent cholesterol from being deposited in our arteries (2).

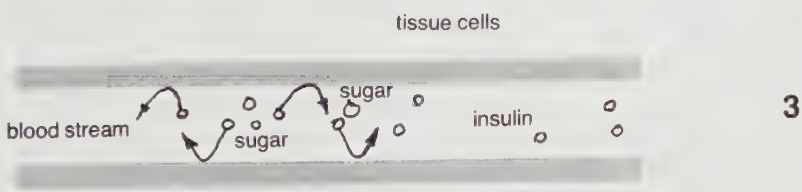
Chromium is available in many natural foods but most of it is removed when foods are refined. Because of this, chromium is woefully lacking in the average American diet. Babies are born with a fairly good supply of chromium but gradually lose it as they get older until they are deficient. Why is this happening? When purified sugar is taken into the system, it requires chromium to be utilized. If none is taken in with the food, chromium from the body stores, if still available, has to be used. Thus chromium is gradually depleted and disease is invited.



Both insulin and chromium are necessary for the transfer of sugar in the blood stream to the tissue cells.



Without insulin, sugar builds up in the blood stream.



Without chromium sugar, builds up in the blood stream.

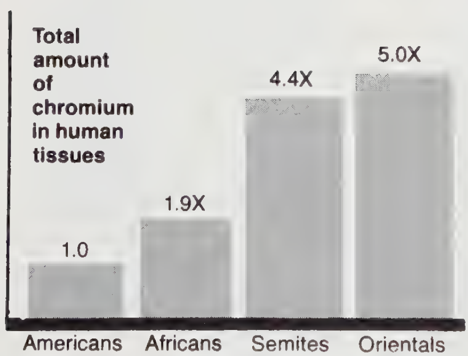
When compared to the people in many developing countries that do not use refined food, Americans are very low in tissue stores of chromium (3).

Sugars that haven't gone through the refining process when eaten in the context of a natural food, come supplied with all the vitamins and minerals necessary to metabolize them, and no trace mineral or vitamin deficiency will occur in those who consume them.

Oils and fats are refined foods

Americans are using an ever increasing amount of unsaturated or polyunsaturated fat in their diets. In the years from 1909 to 1972, the vegetable fat consumption dramatically increased.

The above figure shows a pure, refined substance called a triglyceride or oil that has had all of the bulk, fiber, minerals, and vitamins removed. The sunbather should remember that all fats seem to be specifically involved in the increased incidence of cancer. Saturated or animal fat, as well as oils, can apparently accelerate cancer formation. Dr. Ernst Wynder, President of the American Health Foundation, testifying before the Senate Select Committee on Nutrition, said that the incidence of cancer seems to be related as much to unsaturated as to saturated fats. Because of this, a low-fat diet (low in polyunsaturated fats as well as saturated fats) is recommended when one is exposed to sunlight. Experimental animals develop relatively little skin cancer, even when exposed to extreme



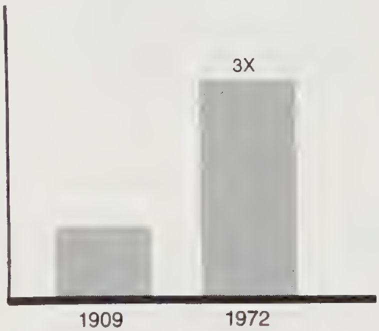
Comparative amounts of chromium in human tissues.

amounts of ultraviolet light, if they are fed a low-fat diet. When the fat or oil is increased, the incidence of skin cancer is accelerated.

The ways in which fats increase the incidence of skin cancer are varied. We will discuss just two possible mechanisms.

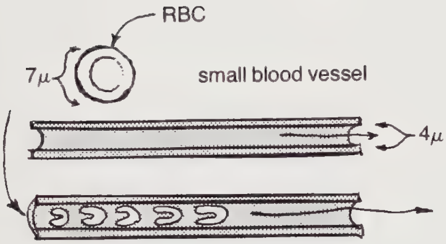
Free radicals

As discussed in the chapter on aging, free radicals, that form when polyunsaturated fat oxidizes, do tremendous damage to the tissues of the skin leaving them vulnerable to cancer development. If the oxidation of the polyunsaturated fats can be prevented, the damage which free radicals cause could be prevented also. Antioxidants are substances that prevent the oxidation of polyunsaturated fats. Vitamins E, C, carotene, and selenium all serve as antioxidants, and these are always found in natural foods that contain polyunsaturated fat. *(The refining process removes the antioxidants).* All antioxidants except a small amount of vitamin E are removed from oil during the purification process. The vitamins, so removed, reach the market as supplements sold for human and animal use (4). When most of these vitamins are removed, as in the refining process, polyunsaturated fat easily turns rancid, creating the problems associated with free radical formation, such as aging and the increased incidence of skin cancer. For this reason, we again emphasize that refined oil should be particularly avoided by the sunbather.

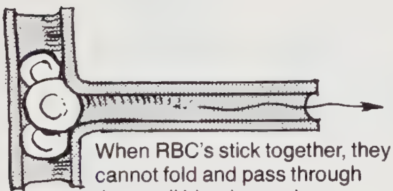


Vegetable fat consumption.

Increase in consumption of vegetable unsaturated oil.



7μ RBC's fold to pass through 4μ blood vessels

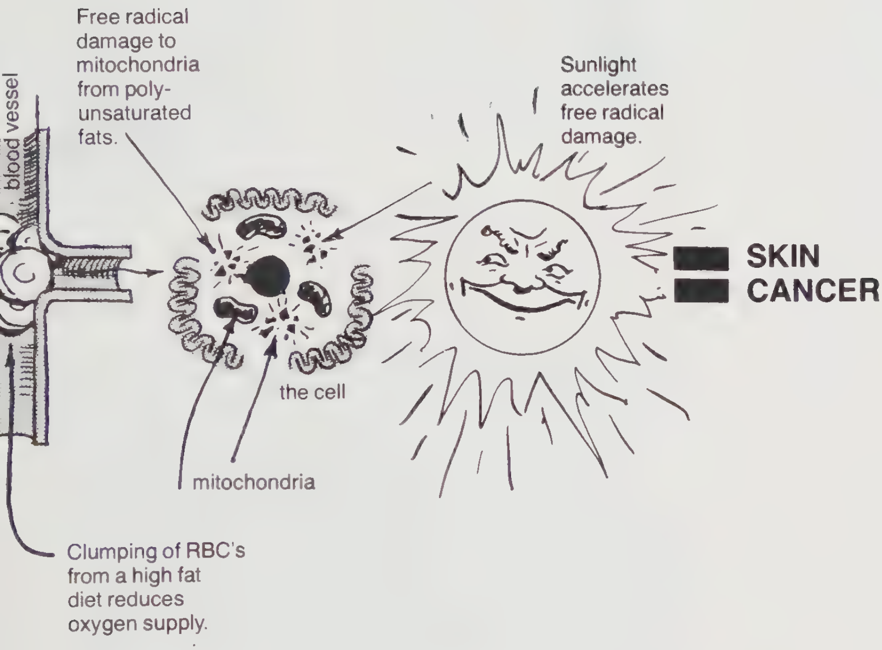


When RBC's stick together, they cannot fold and pass through the small blood vessel.

Decreased oxygen supply

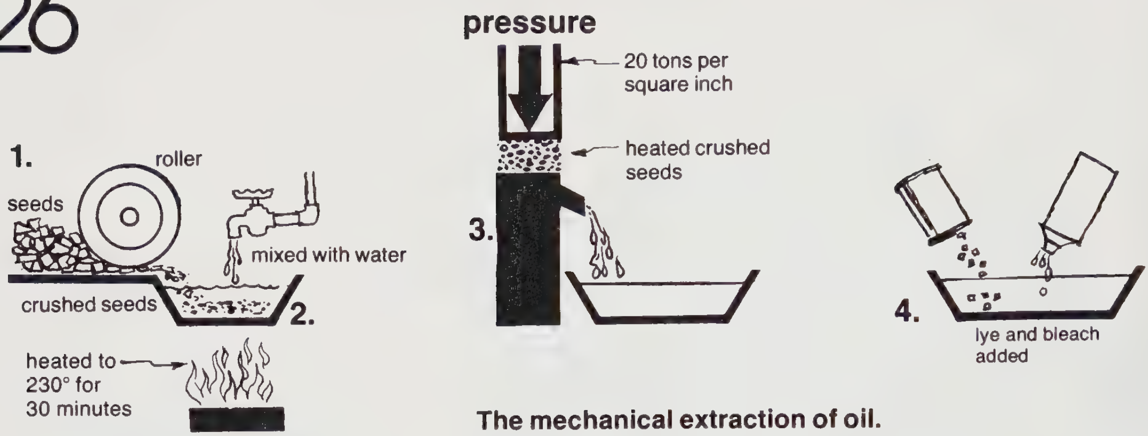
One should remember that a reduction of the oxygen available to the tissues may be one of the contributing factors in the incidence of cancer. Saturated fats have been shown to cause the red blood cells to stick together so that they cannot pass through the tiny blood vessels. Normally, the oxygen-carrying red blood cells are about 7 microns in diameter while the small blood vessels that they have to pass through are only about 4 microns in diameter. The red blood cells have to fold over to pass through the small blood vessels and release their oxygen into the tissues. When the red blood cells stick together, it is impossible for them to move through the small blood vessels, leaving the tissues deficient in oxygen. In certain heart-attack-prone persons, this can have serious consequences.

Dr. Meyer Friedman, in a report in the Journal of the American Medical Association, showed that the blood of heart-attack-prone patients clumped just as badly when they used unsaturated fat as when using saturated fat. He states, "If such interference in flow also occurs in the critically important collateral vessels of the coronary circulation in cardiac patients, then the ingestion of unsaturated fats could lead to disaster as readily as ingestion of saturated fats. This possibility particularly looms as a potential danger in view of the fact that the contemporary clinical fashion is not to advise the reduction of all fats in the diet but only the substitution of unsaturated fats in the diet" (5). As decreasing the oxygen supply to the tissues may also contribute to cancer formation, the knowledge that both



unsaturated and saturated fats decrease that supply is especially important to sun bathers.

It is apparent then that one cannot advocate the liberal use of polyunsaturated fats! If free radicals damage the mitochondria so that the cell is not meeting its energy requirements, (see chapter on cancer) and the red blood cells are incapable of supplying the cells' need for oxygen because they are clumped together, the exposure of the skin to sunlight may well be the last step needed for the development of skin cancer.

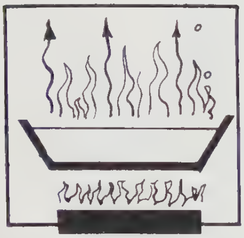


The mechanical extraction of oil.

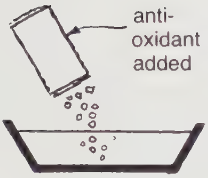
Methods of refining oil

Refined, purified, polyunsaturated oil is, to many minds, a staple, wholesome, healthful, desirable part of the modern western diet. It is certainly true that polyunsaturated fat is needed in the diet, and nature has supplied an abundance in the natural grains, seeds, nuts, vegetables, and certain fruits. Consequently, additional refined fat, then, is not needed. This must be understood, because many persons are using refined vegetable oil as though it were a medicine.

The natural oil that is found in seeds like soybeans, corn, cottonseeds, rapeseeds, and peanuts, has to be extracted mechanically or by chemical solvents. To obtain the oil mechanically, the seed is crushed and mixed with water, then heated to 230°F for half an hour. Following this, the crushed seeds are run through a press that exerts ten to twenty tons pressure per square inch. The result of this great pressure is that the crushed seeds are exposed to great heat.



oil heated to 330°-380°F under vacuum for 12 hours to deodorize it.



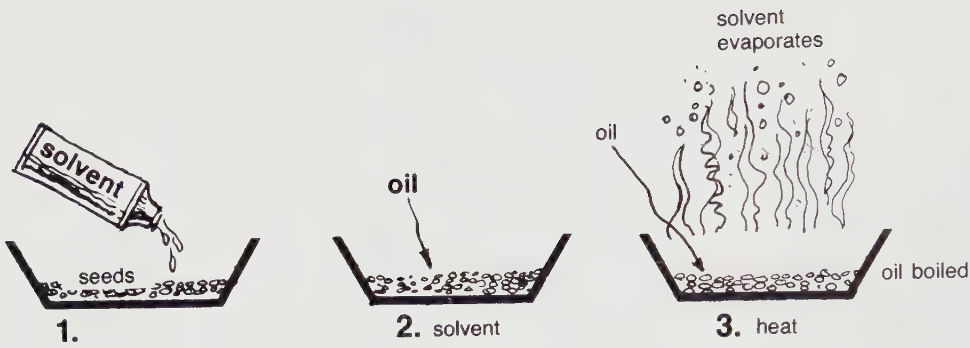
6.

The chemical extraction method is most commonly used, as it removes most of the oil from the seed. The chemical solvent used to extract the oil is usually hexane. An oil with a desirable, natural flavor, as olive oil, for instance, is not extracted by the chemical method, because the removal of the solvent, from the oil and solvent mixture, is accomplished by boiling so that most of the solvent may evaporate. This removal of the solvent also removes most of the flavor components.

Most oils extracted by the chemical method *still* have "commercially undesirable" colors and odors because they *still* contain natural oil pigments, such as, carotene, chlorophyll, and gossypol,so are bleached and deodorized after extraction.

Bleaching may be accomplished by various means as heat bleaching, steam distillation, and the addition of adsorbents, such as fuller's earth and charcoal, which are later removed by filtration.

The oil is usually deodorized by blowing steam through the hot oil under a high vacuum.



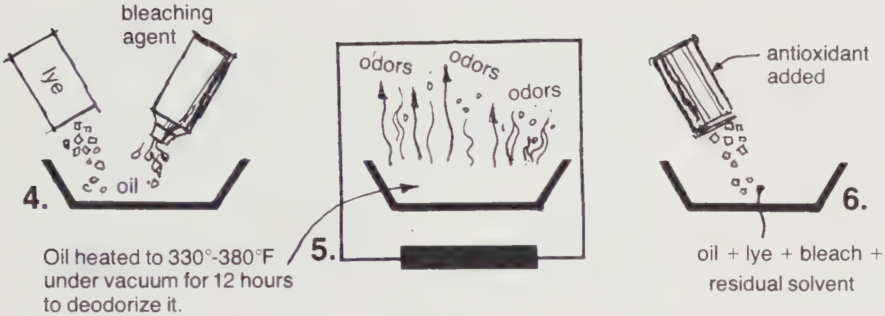
The chemical extraction of oil.

Crude oils may contain a large number of fatty compounds other than those wanted in a high-quality, finished oil. Some of this material, referred to as gums, can be washed and filtered out with water. Gums become crude lecithin on being dehydrated.

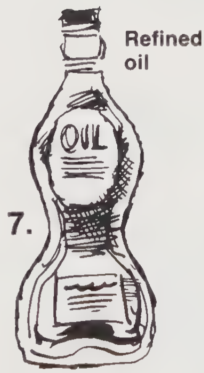
The crude oil may also be washed with strongly alkaline water solutions. The amount of caustic used is proportionate to the free fatty acids in the crude oil. These free oils are neutralized by the caustic and form soaps which are insoluble in the oil. The soaps are centrifuged out, and then the oil is washed with water, centrifuged again, and then dried under a vacuum.

The complete refining process results in a clear, nearly tasteless, quite stable, refined oil, very different from the natural oil, as found originally in the seed. The carotene (mentioned in the chapters on aging and on cancer as necessary for the prevention of free radical formation and for the promotion of healthy skin) has been destroyed along with other natural pigments.

Since most of the natural antioxidants have been destroyed, a chemical antioxidant, usually butylated hydroxyanisole, is added to retard rancidity.

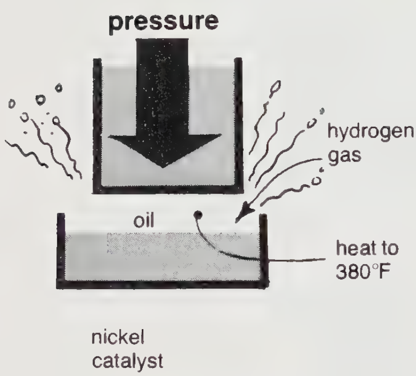


If the oil is going to be used for margarine or shortening, it has to go through another process called hydrogenation. This means that hydrogen is added to the unsaturated part of the fat. If the process is carried far enough, the fat becomes saturated and is no longer a polyunsaturated fat. To start the hydrogenation process, the oil is mixed with a nickel catalyst and then hydrogen gas is passed through the oil under pressure. Much heat is produced during this process and the temperature generally stays around 380°F.



The oils that go through this process, even if only partially hardened or hydrogenated, have their natural structures completely disorganized. The carbon chains that make up the natural polyunsaturated fat are horseshoe-shaped; after the hydrogenation process, they are straight, and known now as *trans* fats. Also, the unsaturated part of the chain migrates up or down during this process, which totally changes the structure of the natural fat.

Does the heating process that the polyunsaturated oil goes through in processing, refining, and cooking cause any problems? Several researchers feel that it may cause increased atherosclerosis (7, 8).



The hydrogenation process

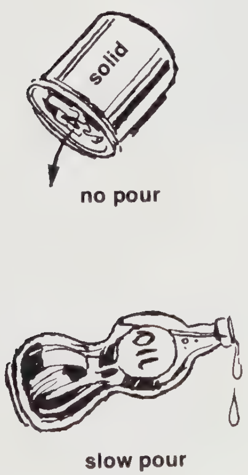


Figure 12

The result of hydrogenation.

How do these unnatural polyunsaturated fats act in the body? Very little information on their action is available. Americans have unknowingly been the subjects of experiments with these *trans* fats as well as with other unnatural fats. For many years, nutritionists and medical scientists have recommended these unnatural fats while ignorant of the effects that refined processed fats have upon the body.

White flour is a refined food

We lose valuable nutrients, especially carotene and vitamin E, when flour is refined. During the milling process the wheat germ (that part of the wheat which contains the major portion of vitamin E) is removed. When the flour is bleached, most of the remaining vitamin E and carotene are destroyed (9). This is just another example of how the nutrients are removed from our food, leaving us unprotected.

Specific recommendations for sunbathers

A sunbather, when planning his daily diet of natural foods, should be careful to include foods that are rich in the antioxidants (vitamins C, E and carotene) found in the highly colored green and yellow vegetables. Obtaining these necessary vitamins in their natural state is preferable to supplementing the diet with vitamin pills. If large amounts of vitamin A are taken in pill form, toxic symptoms may result. Strangely enough, the symptoms of such an overdose are similar to the symptoms of vitamin A deficiency. Vitamin A itself is not found in natural food, but its precursor, carotene is. Carotene has seldom, if ever, been shown to be toxic even when eaten in very large doses. So, obtaining nutrients from natural foods is usually safer than trying to obtain them all from supplements.

A good source book for one interested in the nutritive values of foods is the US Department of Agriculture Handbook, No. 8: Composition of Foods – Raw, Processed, Prepared, 1963. Below are some tables showing the vitamin content of various foods that are important for sunbathers. Tables I and II have been adapted from the above-mentioned source.

Table I is a list of the recommended foods that are high in vitamin A activity and carotene. We should choose some from this list every day, noticing how rich in carotene some of the fruits and vegetables are. Many of them are also good sources of vitamins C and E.

Table I

Vitamin A Activity and Carotene Content*

Food	Size of average serving	IU per serving
Carrots, deep color	⅔ cup, diced, cooked	10,500
Apricots, dried	½ cup, cooked with juice	4,200
Sweet potatoes deep color	1 medium, baked	8,910
Green leafy vegetables	½ cup, cooked	7,870
Fresh fruit:		
Persimmon, Japanese	1 medium	4,550
Apricots	2-3 medium	2,700
Nectarines	3 medium	1,650
Peaches, yellow	1 medium, large	1,330
Cherries	15 large	1,000
Watermelon	1/16 of 10 x 16″ melon	2,530
Squash, winter, boiled	½ cup	3,500
Cantaloupe, deep color	½ melon	6,800
Broccoli	⅔ cup cooked or 1 large stalk	2,500
Lettuce, green leaf	2 large or 4-5 small leaves	950
Pumpkin	½ cup cooked	3,840
Prunes, dried	4 medium, cooked	510
Tomatoes	1 medium size	1,350
Asparagus, green	6 stalks, canned	900

*Vitamin A and carotene are not destroyed by cooking, but some of the vitamin is lost when foods are dried.

Table II gives a list of foods that are high in vitamin C. We are almost entirely dependent on fruits and vegetables for the vitamin C in our diets.

Table II

Vitamin C Content of Fruits and Vegetables*

Food	Size of serving	Milligrams vitamin C
Strawberries, raw	1 cup	88
Oranges, raw	1 medium navel	85
Grapefruit, raw	½ medium	37
Cantaloupe, raw	½ melon	90
Honeydew, raw	1/10 melon	34
Pineapple, raw	1 cup	26
Avocados, raw	½ avocado	16
Blueberries, raw	1 cup	20
Bananas, raw	1 medium	12
Apricots, raw	3 medium	11
Cherries, raw	1 cup	12
Peach, raw	1 medium	11
Kale leaves, cooked	1 cup	102
Turnip greens, cooked	1 cup	100
Peppers, green	1 medium	210
Broccoli, cooked	1 cup	140
Brussels sprouts, cooked	1 cup	135
Spinach, cooked	1 cup	50
Cabbage, raw	1 cup	42
Asparagus, cooked	1 cup	47
Chard, cooked	1 cup	23
Beans, lima, green	1 cup	29
Beans, snap, green	1 cup	15
Peas, green	1 cup	32
Tomatoes	1 medium	21
Squash, cooked		
summer	1 cup	18
winter	1 cup	27
Potatoes, baked	1 medium	31
Sweet potatoes	1 medium	25

*Cooking does destroy some of the vitamin C, but drying food causes even greater losses.

Table III gives the vitamin E content of various foods. The vitamin E indicated is for alpha tocopherol, the most active form of vitamin E for the prevention of some of the symptoms of vitamin E deficiency, but not necessarily the most active for the prevention of free radical formation. Some of the other forms, such as gamma tocopherol, may be more helpful in this regard, but a list of foods with the available amounts of other forms of vitamin E is not readily available.

Table IV suggests the foods which a sunbather should avoid, limit, or use freely. Please study *this* chart especially.

Table III

Vitamin E Content of Foods*
(Alpha tocopherol)

Food	IU/100 grams
Almonds	27.0
Peanuts	10.0
Barley	0.5
Corn	0.6
Oats	0.5
Rice, brown	0.3
Wheat	1.4
Peas	0.5
Asparagus, fresh	1.8
Carrots, fresh	0.5
Beans, dried	0.1 to 0.7
Mangoes	1.0
Potatoes	0.1
Green leafy vegetables	1.0 to 10.0
Fruit, fresh (most)	0.1 to 1.0
Muskmelon	10.0
Tomatoes	18.0

*Freezing can readily destroy most of the vitamin E in food.

Note: This chart is adapted from references (10) and (11).

Table IV

Food groups	Use freely	Limit	Avoid
Meat[1]		Lean beef or hamburger, trim all visible fat	Lunch meats Fatty hamburgers Marbled and other fatty meats Pork and all products Lamb Organ meats: liver, kidney, sweetbreads, etc.
Poultry[1] and poultry products		Chicken Turkey Eggs[2]	Turkey, ground Duck
Milk and dairy products[3]		Cottage cheese Cream Whole milk Low-fat and skim milk Yogurt	Vitamin D supplemented products Chocolate milk Cheeses — all except cottage and cream cheeses Ice cream Buttermilk Non-dairy cream substitutes butter
Nuts and seeds[4]		All varieties (peanuts, especially, should be used in limited amounts)	
Legumes	Beans, dried, all varieties Limas, green Snap or string, green Lentils	Soybeans	
Vegetables	Vegetables, all varieties		
Fruit	Fruit, all varieites	Olives[4] Avocados[4]	

[1]A vegetarian diet is the best for one who is a sunbather, but if meat, poultry, or fish is used, limit choice to only 3 oz, once a day. Poultry or fish are preferable to meat.

[2]Eggs should be limited to a maximum of 3 per week including those used in cooking.

[3]Preferably skim milk products should be used for weight control, and all dairy products combined should not exceed 12 oz a day. Almost all dairy products are laced with vitamin D, and one should try to obtain milk from sources that sell natural unadulterated products.

[4]Vegetarians can be more liberal with the nuts, olives, avocados, and seeds as they are not getting the extra fat from the meat, poultry, and fish. Those who are not vegetarians should limit nuts, olives, avocados and seeds more severely.

Table IV (Continued)

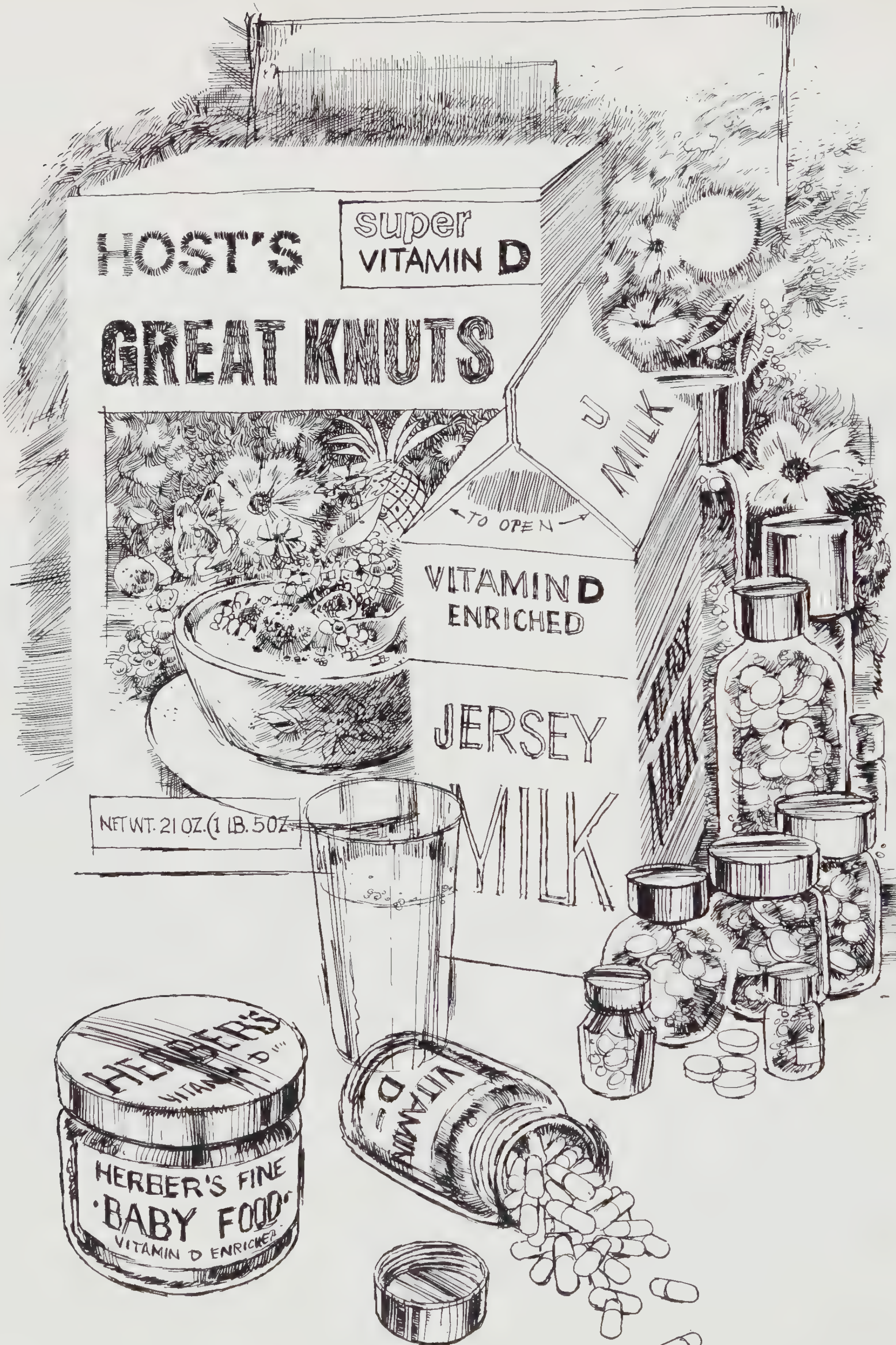
Food groups	Use freely	Limit	Avoid
Grains, cereals and breads	Whole grain cereals, hot, with no sugar, all varieties Breads, whole grain with no shortening or oil, especially partially hardened oils. No sugar or honey Whole wheat pasta or noodles Whole grain dry cereals with no sugar or added vitamin D	Partially refined flours or cereals	Refined, bleached, white flour Pastries with shortening, oil, or sugar, such as cakes, pies, cookies, donuts, candy, sweet rolls, and crackers
Fats and oils			Butter, margarine. Lard, and all meat fats. All oils and shortening.
Desserts	Fruit, fresh Canned, without large amounts of sugar or syrup	Fruit, dried Dates	All desserts with sugar, shortening, fats or oils Chocolate Gelatin desserts
Beverages		Fruit juice with no sugar	Tea, coffee Decaffeinated coffee Chocolate drinks Alcohol Soft drinks
Seasonings		Salt, use sparingly	Sugar Vinegar Highly spiced foods

The above chart is designed for those who have no serious disease, and who require only a balanced diet that will supply the protective elements necessary for one who is on a regular sunbathing program. This diet also will help to protect against chronic, degenerative diseases. If one has a chronic degenerative disease like heart disease, he may require a more strict diet for a few months. By eliminating meat, poultry, fish, eggs, dairy products, nuts, seeds, avocados, and olives for a short time and using an abundance of vegetables, fruits and whole grains, a therapeutic effect often may be obtained.

When one eats more of the natural plant foods, he can be less concerned about dietary fat. These foods are usually low in fat, and also contain protective vitamins and minerals to aid in the prevention of rancidity and in the prevention of free radical formation.

No between-meal snacks are allowed as these will keep the blood sugar and fat elevated all day, and a constant elevation of the blood sugar and fat may contribute to an increased amount of hardening of the arteries. It has been shown that between-meal eating can contribute to hardening of the arteries, and it becomes important to understand that "not only what we eat as is now generally accepted but how and when we eat it, merit consideration in studying the etiology of atherosclerosis" (12).

Learning to be a label reader is also vitally important, because large quantities of sugar, shortening, and various other ingredients can be hidden in processed foods. It would be well if the label on any packaged and wrapped food included a complete list of ingredients.


HOST'S
super
VITAMIN D
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MILK
HERBER'S FINE
·BABY FOOD·
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Chapter

7

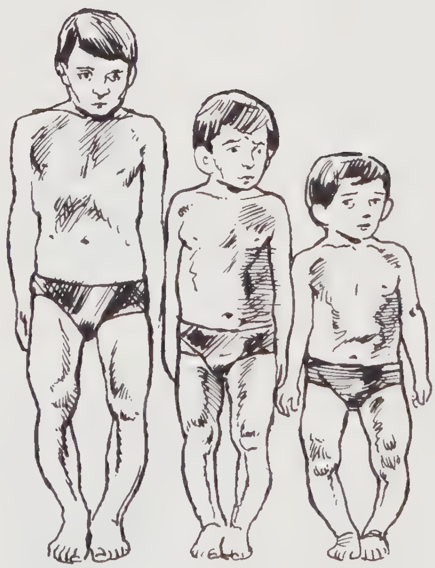
Sunlight and the Vitamin D Mania

"The feeling of health, the full-noon trill, the song of me rising from bed and meeting the sun."

— Walt Whitman

The first evidence, in modern times, that sunlight is an important factor in the health of man, was discovered when sunlight was found to have an effect upon the incidence of a disease called rickets. Rickets manifests itself as a deformation in the developing bones of young children. Although it had been described since 500 BC, it came to greater attention in the 1800's in England. During the 1800's, England experienced the industrial revolution and thousands of people migrated to the cities. Following this migration, living conditions deteriorated as people crowded into the dark tenements of the cities and pollution increased. Children reared in these conditions commonly developed rickets, which became known as the "English disease."

It soon was observed that a lack of sunlight was common to all those who developed rickets. In fact, one investigator noted the incidence of rick-



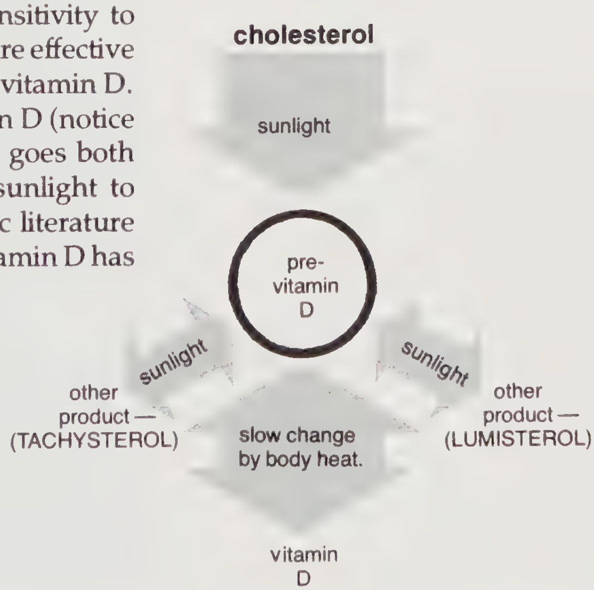
Children with rickets.

ets in the different European countries and in each county of each country, and found that as sunlight increased (southern vs northern, country vs city), the cases of rickets disappeared. It was not until the 1890's that sunlight was proved to be the specific cure for rickets. The reasons for its effect were not understood until the 1920's when vitamin D was discovered. A man by the name of Mellanby, who resided in London, provided the first experimental proof that rickets was a deficiency disease and could be cured by feeding cod liver oil to the children with rickets. The 1920's saw a flurry of discoveries of elements essential to the human diet. These elements became known as vitamins. Vitamins were described as organic compounds (other than proteins, fats, or carbohydrates) which were necessary in small amounts in the diet for normal growth, good health, and reproduction. In cod liver oil, a substance was found that was necessary to prevent rickets, so that substance was labeled a vitamin (vitamin D).

Since the 1920's much study has been devoted to vitamin D. It is now known to be almost totally absent in vegetable foods, occurring only in fatty foods of animal origin such as egg yolk, butter fat, fatty fishes and liver (the organ in which vitamin D is stored). Even in these foods, vitamin D is limited and varies according to the diet of the animal and how much exposure to the sun it has had. By drinking a pint of unenriched milk, and eating 3 tablespoonfuls of butter and an egg, one would receive only 65 of the 400 IU/day that is recommended. Because of the scarcity of vitamin D in food, it appears that nature intended that man should generate most of his vitamin D from exposure to sunlight.

How the sun generates vitamin D

As sunlight strikes the skin it initiates a delicate multiphased process. Cholesterol concentration is higher in the human skin than in other organs. When sunlight strikes the skin, cholesterol can be changed into a substance called previtamin D. Previtamin D stays in the skin where the sunlight continues acting upon it, turning it into two other products (1) that may be important in forming hormones or other products needed by the body. Previtamin D is not changed into vitamin D by the action of sunlight but is slowly changed into vitamin D by the normal heat of the body. It takes about 24 hours for 50% of the previtamin D, not changed by sunlight into other products, to form vitamin D by the body heat (2). Since vitamin D can be toxic in large amounts, its slow release by the body, and its sensitivity to change by sunlight to other products are effective ways of preventing a large buildup of vitamin D. Excess vitamin D reverts to previtamin D (notice that the arrow in the diagram below goes both ways) and this can be changed by sunlight to other products. No report in scientific literature has ever shown that a toxic dose of vitamin D has been obtained from sunlight.



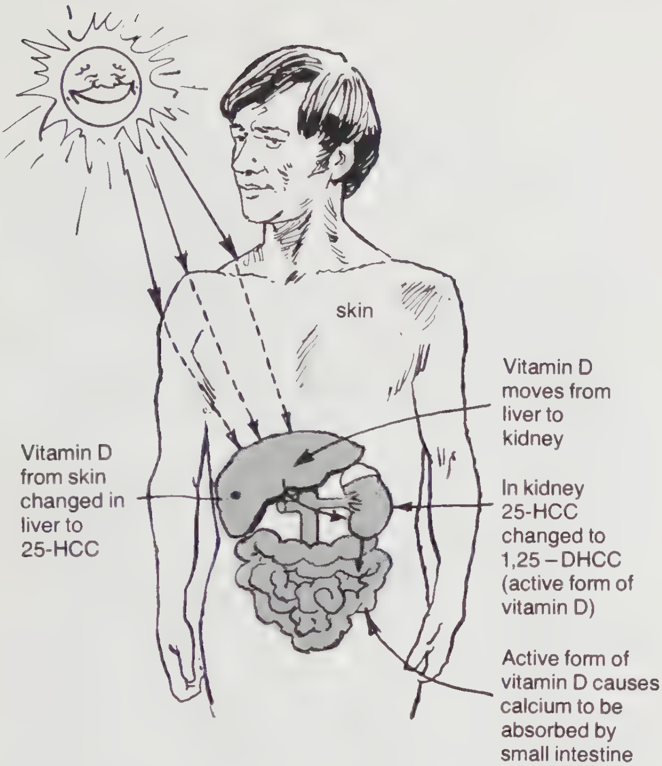
How sunlight generates vitamin D.

The vitamin D that is formed in the skin is then absorbed into the blood. Once absorbed into the blood, it is carried to the liver where it is changed into a more active form called in short 25-HCC; it is then transported by the blood to the kidney where it is changed into an even more active compound called 1, 25-DHCC. This is the form of vitamin D that is potent enough to carry out its beneficial activities.

The exact role of vitamin D in the body has, in recent years, been revealed through some exciting discoveries. From the time it was first identified, vitamin D has been known to be necessary for the absorption of calcium in the intestines. Vitamin D appears to be involved in the formation and development of calcium-binding proteins in the intestines, proteins that are essential for calcium absorption and transportation. Furthermore, vitamin D appears also to be essential for the production of two enzymes which are involved in calcium transport and collagen formation in the bones, and it also participates in the regulation of amino acid levels in the blood (preventing a loss through the kidneys) and in citric acid levels in tissues and bones.

Vitamin D deficiencies

If vitamin D is absent, calcium, which is vital for normal bone growth and development, will not be absorbed from the intestinal tract, and the bones will become deformed. In children the condition is termed "rickets," in adults, "osteomalacia." Either of these disease conditions can occur if calcium and phosphorous are defi-

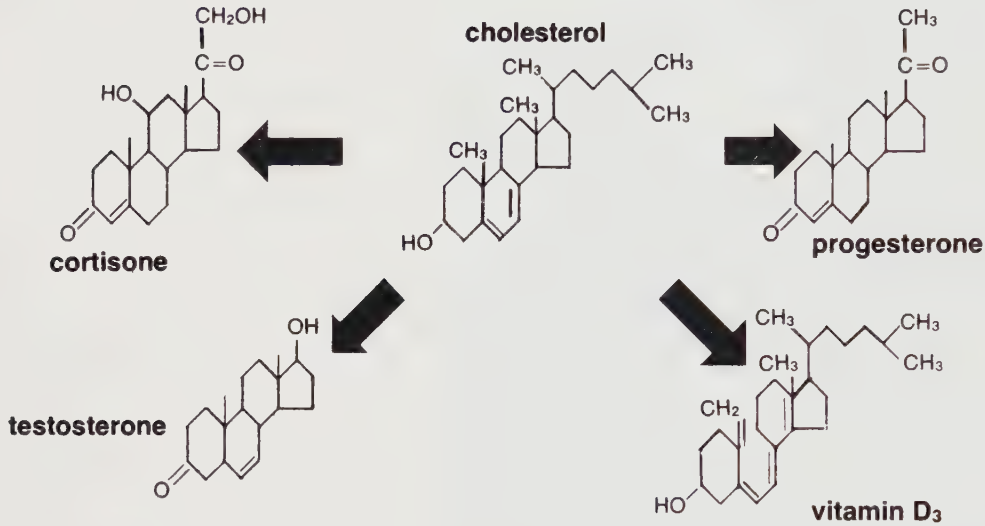


Sunlight and the production of vitamin D

cient in the diet, or if the minerals are present but vitamin D is absent. Healthy bones, then, are dependent upon a supply of calcium and phosphorous, the absorption of which, is dependent upon the presence of vitamin D which, in turn, is dependent upon one's exposure to the sun.

Not a vitamin but a hormone

Recent discoveries reveal that vitamin D is not as much a vitamin as it is a hormone. The metabolically active form 1,25-DHCC has all the

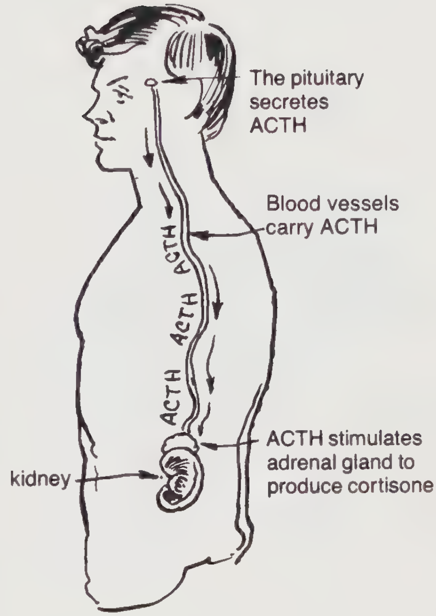


Structural relationship of cholesterol to common hormones.

characteristics of a hormone. Hormones can be described as chemical agents which are synthesized by definite parts of the body and are carried by the blood to another part of the body where they produce specific changes in certain tissues and organs. 1,25-DHCC fits this description, for it is made in the body by the kidney and transported by the blood to certain target tissues and cells in the intestinal tract. Vitamin D, then, is really more closely related to the hormones than to the vitamins. It is produced from cholesterol just as are the other major steroid hormones. Notice the similarity of the chemical structure of vitamin D to the structure of other steroid hormones.

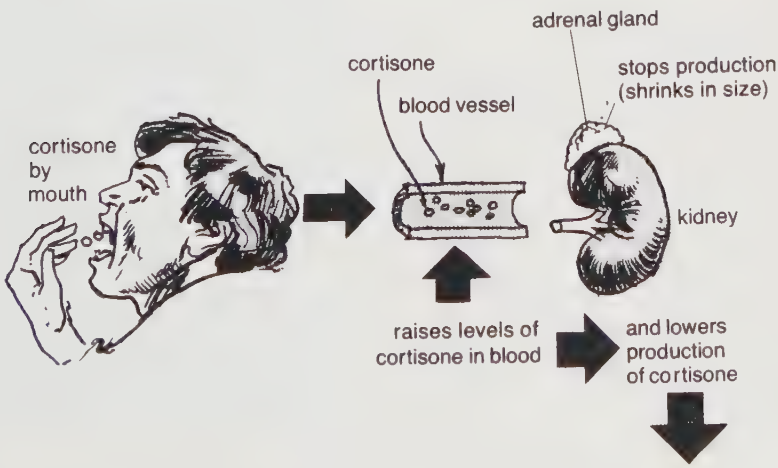
Hormones are regulated by delicate balances in the body. The hormone cortisone provides a good example. The level of cortisone in the blood is regulated by several glands that work in concert. If the level of cortisone gets too low, the pituitary gland (a gland found near the brain) is stimulated to produce a substance called ACTH. ACTH flows into the blood stream and upon reaching the adrenal gland, stimulates the gland to produce more cortisone.

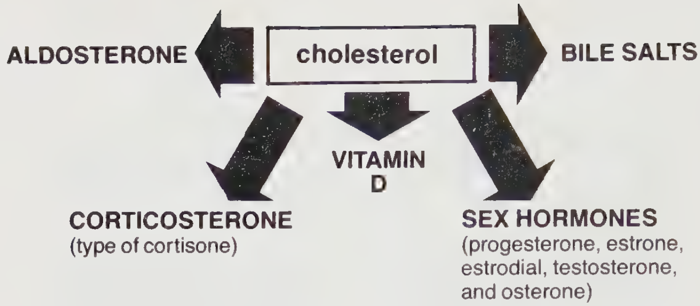
When cortisone is taken by mouth, the blood level of cortisone increases, and by specific feedback mechanisms the adrenal production of cortisone is stopped. If cortisone is taken over a long period of time, the adrenal gland will actually shrink in size from lack of stimulation.



Maintenance of cortisone level in blood.

Effect of oral ingestion of a hormone.





Metabolic pathways of cholesterol.

A higher than normal level of cortisone in the blood can occur if one takes cortisone by mouth over long periods of time, or it may result from an overactive adrenal gland. Either situation may result in a condition known as Cushing syndrome. Resulting symptoms that develop are usually obesity, hypertension, weakness, edema, excessive hair in the female, and osteoporosis (thinning of the bones). Hormone levels in the blood are controlled by sensitive complex mechanisms, and cannot be interfered with for long periods without producing serious problems.

There appears to be an equally delicate balance involved in the amount of vitamin D produced by the sunlight. Previtamin D will not change into vitamin D if it is not needed, and some vitamin D can revert back to previtamin D. Alternate products, lumisterol and tachysterol, also provide an option to the production of vitamin D if levels are high.

As one grows aware of vitamin D's intricate function as a hormone, he needs to seriously review the practice of widespread vitamin D supplementation of commercial food.

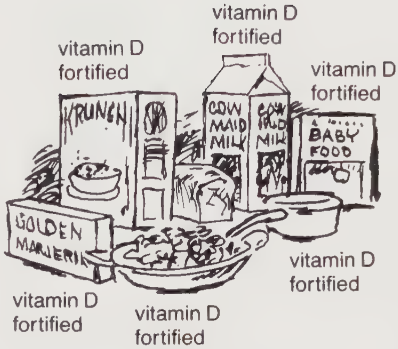
Should food be supplemented with a hormone?

For some years, obtaining vitamin D from dietary supplements, rather than from exposure to sunlight, has appeared to be the more practical method. The availability of ultraviolet light does vary with season, locality, time of day, and, of course, individual habits (indoor vs outdoor life style). So the supplementation of food with vitamin D has nearly replaced the task of educating the public about the benefits of sunlight.

Supplementation of animal feed has been one of the "advances" which has made possible the raising of poultry, swine, and cattle indoors the year around, resulting in wide availability of low cost eggs, meat, and milk. In a similar way, for the sake of practicality, when dealing with large human populations, health educators have chosen a dietary form of vitamin D, instead of urging that vitamin D be obtained by exposure to sunlight.

Determining the required amount of vitamin D to supplement has been difficult, as there is no way to measure just how much of the substance is already manufactured in the body by the sunlight. As closely as can be told, it appears that 400 IU of vitamin D provides children with optimal growth. So 400 IU was adopted by the Food and Nutrition Board (1968) as the recommended daily allowance from birth to 22 years (including breast fed infants).

From a small beginning, has sprung a rush to supplement vast quantities of food. In addition to the familiar vitamin D fortified milk (400 IU/qt), 10,000 lbs a year of vitamin D is added to



Prolific supplementation of Vitamin D.

animal feeds and thus indirectly consumed in the form of meat or eggs. Vitamin D is also added to baby foods, imitation dairy products, beverages, sweet sauces, prepared breakfast cereals, margarine, macaroni, noodles, farina, and flour (3). Most store bread has 250-750 IU/lb added.

With all this supplementation, the average per capita intake is 2435 IU/day, or six times the recommended 400 IU/day. The examination of human muscle tissue has revealed that human tissue may now contain more vitamin D than was found in the tissue of swine fed 14 times the National Research requirements (4).

Effects of consuming this hormone

From the University of Tromso in Norway comes a report that a long-term intake of vitamin D, only slightly above the 400 IU recommended, may stimulate myocardial infarction, or heart attack. Not only heart attacks but also degenerative joint diseases and arthritis are mentioned in the report, as diseases that are apparently promoted by an increased vitamin D intake (5).

Dr. Mildred S. Seelig, a physician in charge of nutrition and metabolism at New York University's Goldwater Memorial Hospital, and associate professor of pharmacology at New York Medical College, has spent nearly a decade developing the theory that heart attacks are triggered by the loss of magnesium from the heart tissue. She points out that excessive vitamin D causes a magnesium deficiency in the heart. Dietary vitamin D has been known for some time to cause heart attacks in experimental animals, attacks that are completely indistinguishable from those caused by a magnesium deficiency. Rats that are fed five times as much magnesium as they would normally obtain from their diet are protected from the heart attacks caused by the high intake of vitamin D (5).

When research scientists compared diets and cholesterol levels of 100 farmers, they found that those who were taking additional vitamin D had significantly higher blood cholesterol levels than those who never took the vitamin. The investigator who reported this study advised "adults not to take vitamin D-containing drugs without a clear reason" (6).

Vitamin D has been identified as an angiotoxic substance (a substance that irritates the lining of blood vessels). Recently, a group of scientists investigated the effects of vitamin D-supplemented feed on the arteries of experimental animals. When damaged arteries from the experimental animals were compared with atherosclerotic human arteries (obtained from bypass surgery), damages seen in human and animal arteries seemed identical, even though a number of the animals were on a low-fat, low cholesterol diet. The exact role which vitamin D plays in damaging the artery wall is not known and is still under study, but the change that does take place is definitely a step in the development of atherosclerosis (7).

A 62-year-old female patient was surprised when I told her that x-rays showed large areas of calcification in some of her major arteries. She informed me that she had always taken the best care of her body and used very little food that contained cholesterol. She had always purposely chosen polyunsaturated fats thinking they were preferred and had taken lots of vitamins. I asked her about vitamin D, and she assured me that she always took extra vitamin D in the form of a natural vitamin A and D capsule as well as in a multiple vitamin tablet. Taking into consideration our supplemented food supply, I estimated that for years she had been getting dietary vitamin D in amounts between 4,000 to 5,000 IU/day. It is interesting to note that rats, when given vitamin D in the amount of 250 IU/day, develop hardening of the arteries and elevated levels of cholesterol and calcium. They also age fairly rapidly (6).

There are particular problems associated with vitamin D and pregnancy, for pregnant women already subjected to high doses of vitamin D from widely supplemented foods are routinely advised by their obstetricians to supplement their diets with vitamin D pills. Since vitamin capsules contain 400 IU, if one per day is prescribed, this adds to the already dangerous average per capita intake of 2435 IU/day.

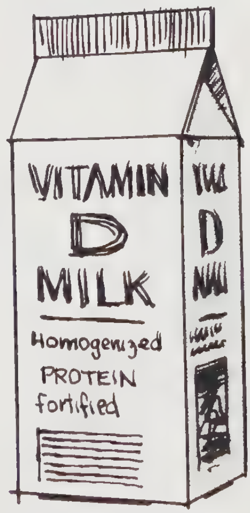
Dietary intake of vitamin D by pregnant women has been implicated in kidney calcification and severe mental retardation in their offspring (8). Children born to mothers taking extra vitamin D in their diet may be born with a certain type of congenital heart disease called supravalvular aortic stenosis (9). These same children may show abnormal bone formations and have faces so abnormally shaped that physicians call them "elfin faces" (10). Abnormalities of the bones of the face have been observed in 70%

of the offspring of rabbits given large amounts of vitamin D during pregnancy (9).

Adding a potentially toxic hormone like vitamin D to milk creates more problems than if it were taken alone, for in our society many people consume large quantities of milk. Milk also has the peculiar property of enhancing the potency of vitamin D. This was shown over 40 years ago in experimental treatment of children who were deficient in vitamin D. It was seen that the effects of adding only 90 units of vitamin D to each child's milk were greater than the effects seen when adding, to each child's diet, 900 units of vitamin D in cod liver oil (11).

Stop supplementation

Many authorities have recommended that vitamin D be removed from our food. Dr. Linden, who gave the report from the University of Tromso, makes this statement: "Attempts should be made to restrict the intake of vitamin D from all sources, save that produced by sunlighting the skin". Also recommending that vitamin D not be supplementally added to food is the British Medical Association (1950), the Canadian Bulletin on Nutrition (1953), and the American Academy of Pediatrics (1963, 1965). The Committee on Nutrition of the American Academy of Pediatrics has recommended that non-supplemented milk be available.

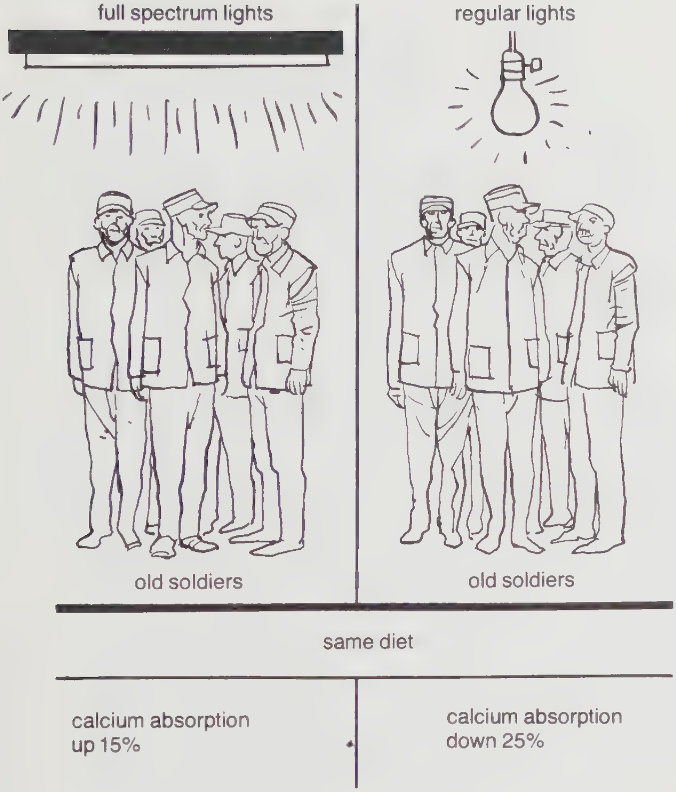


Vitamin D fortified homogenized milk not recommended.

The amount of vitamin D that is currently being added to milk may give one child the amount required for the prevention of rickets while being toxic for another (12). Because of this individual variation in children, it seems only sensible to recommend that vitamin D be obtained from sunlight or ultraviolet light exposure, as the body has built-in safety mechanisms to prevent a toxic build-up. This would eliminate the medication of the total population with a possibly toxic substance intended originally for the protection of a small minority suffering from rickets.

Vitamin D from sunlight found to be superior

In one study done in England it appeared that vitamin D obtained from the skin's exposure to the sunlight was far superior to that obtained from oral ingestion. When over 100 patients were studied as to their intakes of vitamin D, and also as to the individual exposure to sunlight, there seemed to be a direct relationship between the amount of calcium and phosphorous in the blood stream and the amount of exposure to sunlight. The more sunlight a patient received, the higher and more normal would be his levels of calcium and phosphorous, and correspondingly, his bones would be more nearly normal. The amount of vitamin D in the diet of these patients did not seem to be related to the levels of calcium and phosphorous in the blood stream. The researchers felt that even slight sunlight exposures may be sufficient to help in the prevention of a most serious bone disease, and "many old people may be in a stage of 'biochemi-



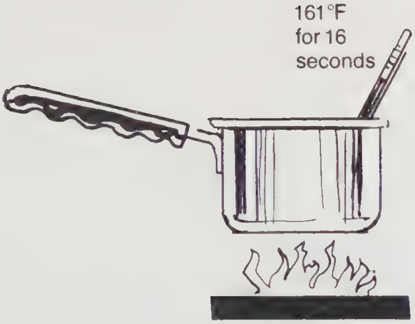
cal osteomalacia' because of sunlight lack" (13).

A study of veterans who lived in the Chelsea, Massachusetts, Soldiers' Home was done to determine whether extra sunlight would help them to absorb more calcium from their food. The men lived indoors and the study was done during the winter months so that they would not be getting any sunlight. They were given dairy products in their diets and probably got around 200 IU/day of vitamin D. One-half of the men were placed in an environment where they were given more ultraviolet light by using a full spectrum fluorescent lighting system. The men were then tested to see how much calcium they were absorbing. In the group that was not getting the extra ultraviolet light, the amount of calcium absorption decreased by 25%, while the group that was getting the extra ultraviolet light increased their calcium absorption by 15% (14). This study shows that sunlight is more important than dietary vitamin D and is necessary for proper calcium absorption.

To obtain a protective dose of vitamin D from the sun, one has only to expose a small amount of skin to the sun for a few minutes during the middle of the day. One researcher mentioned that exposing the face of a baby to the sunlight for a few minutes during the middle of the day, even during the winter, would produce enough vitamin D to protect the child from a vitamin D deficiency. A toxic reaction has never been shown to occur from the vitamin D produced by the sun (15). Excess amounts of vitamin D achieved on one day's exposure are stored in the liver to be drawn on if exposure is not consistent.

Nonfortified milk

Obtaining the necessary vitamin D from sunlight is usually a very safe, simple, easy procedure, that requires just a little individual effort toward the maintenance of good health. For those whose environment enables them to do this and who would prefer to obtain their vitamin D from sunshine in preference to the possibly toxic additions to supplemented foods, an alternate supply of milk not fortified with vitamin D should be provided. As of this writing this

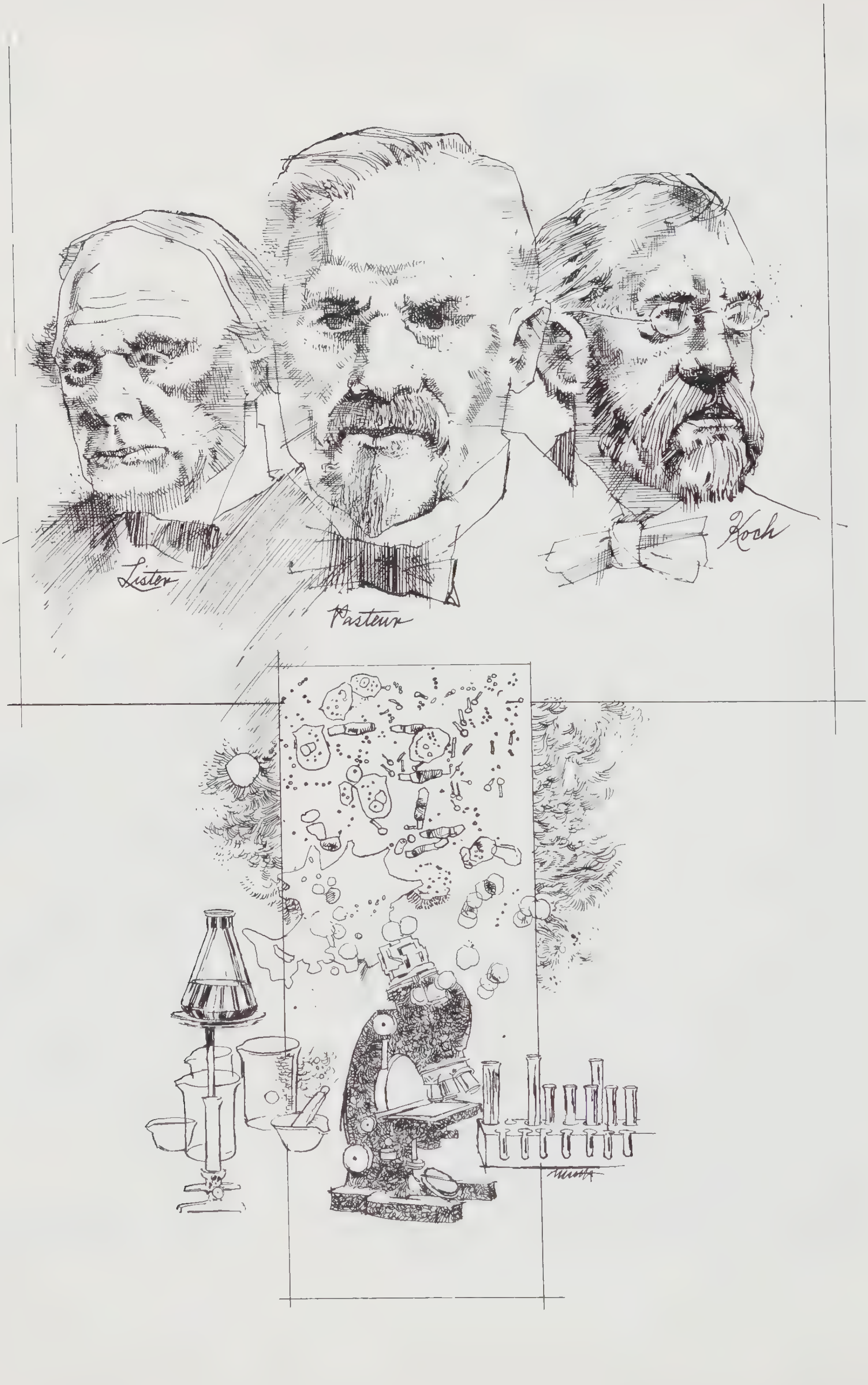


Pasteurization.

choice is not available in the commercially pasteurized homogenized product. In some areas of the country, raw milk is available and provides the only source of nonfortified milk. Raw milk can be easily pasteurized at home by heating it in a pan on the stove to 161°F (212°F is boiling) and maintaining this heat for just 16 seconds. This kills the *harmful* bacteria. If it is pasteurized at home, one may be assured of a safe product. The milk once heated to 161°F for 16 seconds should then be cooled as quickly as possible to prevent the growth of microorganisms which are not affected by heating. Such organisms are not themselves harmful, but could casue fermentation and/or other types of spoilage if the milk is not cooled quickly and then kept cool.

It would seem that the public should at least be offered the choice of receiving their vitamin D safely from the sun, as nature intended, or from supplemented foodstuffs with the possibility of suffering serious toxic effects. Supplementation of food with a hormone, the intake of which cannot be regulated, is in reality an example of a mass experiment without a foreknowledge by the scientific community as to the final results. This seems strikingly unnecessary when we can safely obtain all the vitamin D that we need by just spending a few minutes in the sunshine.

Children enjoying sunlight.


Lister
Pasteur
Koch

Chapter 8

Sunlight and Infectious Diseases

"Seldom comes that evil guest
Where the conscience lies at rest,
And brown health and quiet wit
Smiling on the threshold sit."

— John Greenleaf Whittier

Man had been baffled for centuries as to the cause of infectious disease. In the darkness of ignorance, disease and death were, in most cultures, regarded as the work of the devils. For example, the word "influenza" is derived from a word that meant having celestial influence. It was not until the mid-1800's that, through the work of Pasteur, Lister, and Koch, "germs" were revealed to be a cause of contagious and infectious disease. Out of this knowledge gained from Pasteur and his peers has grown an increasing understanding of man and his relationship to the germ. It is now believed that disease can only occur when one fails to maintain the delicate balance of power between one's body and the organisms that produce disease. This is undoubtedly so, for we find people who are carrying within themselves the germs capable of causing an infection, or a "strep" infection, tuberculosis, or influenza, and yet these

The balance of health and disease.

people are apparently free of disease. Their bodies are strong enough to keep these organisms from growing and developing. This balance, or lack of it, can be seen when members of the same family either resist or succumb to some "bug."

Scientists describe three variables (changing factors) that determine this balance: 1) the number of infectious organisms entering the body; 2) the virulence, or strength, of the organisms; and 3) the resistance of the individual to the invaders. Some germs are experts at invading and can enter, multiply and spread rapidly. Others make and distribute a toxic (harmful) substance.

The advances in the battle against infectious disease have been overwhelming in the last century. Few people now die of acute infections regardless of age or sex. Infectious diseases used to account for the majority of all deaths. Great epidemics or plagues are rare at present. The drop in infant mortality has been spectacular. The credit for this is commonly given to the "wonder drugs," but in reality their contribution has been secondary. Drugs have provided us with a wonderful boost in the fight against infectious disease, and no one would wish to live entirely without their help in an emergency; however, the major health gains of the last century have resulted largely from social measures that have equalized the balance between man and germ instead of violently intervening between them. Let us note some of these measures.

1 Sanitary methods of waste and garbage disposal are used to prevent germs from multiplying and contacting large numbers of people.

The industrial revolution drew thousands of rural families into the cities for employment. The living conditions that resulted were deplorable. Overcrowding was so bad that up to 200 people might share one privy. Cesspools often overflowed into the streets or cellars. Some merely used chamber pots and emptied them out the nearest window. Human waste piled up in large mounds in the streets surrounding some homes with two or three feet of refuse. These conditions encouraged disease, and epidemics were rampant.

2 The improvement in the production and handling of food has eliminated much growth and transfer of germs; also, drinking water is now tested and treated to detect and destroy any disease-producing organisms present. Cholera, a water-transmitted disease, terrorized London when it grew to epidemic proportions in 1849 and 1853. It was eventually discovered that the disease had been spread through the use of water which had been contaminated by a cesspool at a home where a cholera patient lived.

3 Uncrowded living conditions hinder the rapid spread of disease.

In the areas where people live for the most part in single family or small, multiple family complexes, disease epidemics are usually rare. There is usually some space between such building for sunshine and fresh air, as well as less danger of rats breeding around large rubbish heaps. Wherever there is overcrowding with the resulting piles of trash, general unclean conditions, and disease-carrying rats, there will certainly be more human disease.

4 An adequate diet has a great deal to do with providing the materials and energy necessary for the body to resist disease.

Health care workers find the tendency toward disease rises whenever there is general malnutrition. It should be noted that this may be true, not only when persons cannot afford enough nourishing food, but also when persons eat too much, especially of rich, high calory, refined foods. There may actually be more danger of malnutrition among those with more wealth, especially if those with less grocery money are careful to spend that money on whole natural foods. Many agencies have been set up to educate people about the importance of good nutrition to the body's ability to resist disease.

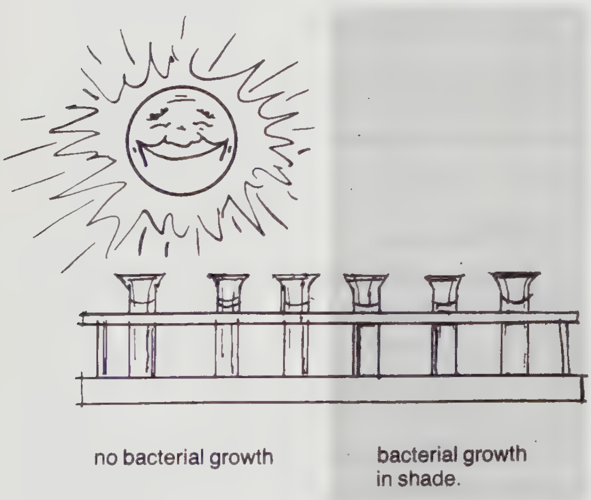
Modern emphasis on better sanitation, and on better nutrition has helped to control the spread of disease by limiting the spread of potentially pathogenic organisms. This has also limited the virulence of some organisms which tend to increase in virulence as they are passed from person to person.

Modern medicine, though armed with wonder drugs, would be hard pressed to maintain the health of the citizens of this land if these sanitary measures were abandoned. It is generally realized that the wonder drugs, such as antibiotics, have limitations. One of these limitations is that microorganisms tend to become resistant to the drugs. How can sunshine help in the war against infectious disease?

Understanding of the sun's effect upon infection

Along with increasing scientific knowledge about the germ and its relation to disease, came the scientific understanding of the sun's effect on disease.

It was in 1877 that Downes and Blunt accidentally found that light could kill bacteria. Observing uncolored tubes of brown sugar water, which they had placed on a window sill, they found that the tubes in the shade had become cloudy, indicating bacterial growth. Those tubes exposed



Sunlight destroys bacteria.

to the light had remained clear, indicating no bacterial growth. "The most marked differences in the two sets of tubes were obtained when the sun shone brightly. Light," they decided, "is inimical to the development of bacteria" (1).

In 1892, Marshal Ward showed that the portion of the electromagnetic spectrum having the most intense antibacterial action is the ultraviolet (2). Table I indicates the dates of discovery of ultraviolet sensitivity of certain bacteria.

Table I

Bacterium's common name	Bacterium's scientific name	Date	Scientist
The anthrax bacillus	*Bacillus anthracis*	1886	Arloing
The plague coccobacillus	*Pasteurella pestis*	1887	Polerino
Strep	*Streptococcus*	1887	Duclaux
The tubercle bacillus	*Mycobacterium tuberculosis*	1890	Koch
The cholera bacillus	*Vibrio comma*	1892	Moment
Staph	*Staphylococcus*	1892	Chemelewsky
The colon bacillus	*Escherichia coli*	1894	Dieudonne
The dysentery bacillus	*Shigella dysenteriae*	1909	Henri

The modern era of sun therapy began with the knowledge that pathogenic bacteria could be killed by exposure to sunlight. Niels Finsen dramatically opened the era by successfully using sunlight therapy in the treatment of tuberculosis of the skin, thereby winning the Nobel Prize in 1903. Stimulated by Finsen, Bernard and Rollier began treating other forms of tuberculosis by 1904. By the 1920's and 1930's, sunbathing for bone tuberculosis and other forms of tuberculosis was a very common treatment. Table II shows results found in one study of different types of treatment of intestinal tuberculosis during that era.

Table II

Treatment	Survival	Death	% Effective
Ultraviolet treatment	59 surviving	19 dead	75% effective
Surgical operation	4 surviving	14 dead	22% effective
Medical	13 surviving	31 dead	30% effective

While there was an increasing recognition of the efficiency of sunlight therapy for certain types of tuberculosis, the same therapy was also found to be dramatically effective in the treatment of streptococcal infections. In 1929, Ude introduced sunbathing in America for the treatment of erysipelas (a streptococcal infection of the skin). This had been a disease with a mortality rate of 10%, and the use of ultraviolet light for the treatment of this disease dramatically reduced the mortality. In 1929, the improved condition of the King of England, after a course of ultraviolet light treatment was widely publicized.

From the turn of the century into the 1930's, there continued to be progressive development in the use of ultraviolet light and sunbathing as the most effective treatment for a number of infectious diseases. In 1938, penicillin was discovered and the era of antibiotics and other antimicrobial therapy began. To a large extent, the advent of antibiotics sounded a death knell for the growing interest in sun therapy. Fortunately, a few investigators have kept a trickle of information flowing on the beneficial effect which the sun may have on our health.

About the time that antibiotics were being introduced, a number of researchers (3, 4, 5, 6, 7, 8, 9, 10) independently published reports of the dramatic results seen when a number of patients, having such various infections and diseases as blood poisoning, childbirth infections, and peritonitis, viral pneumonia, mumps, and bronchial asthma, were treated with ultraviolet light therapy to their blood. Miley reported that in eight cases of viral pneumonia, "the toxic symptoms of pneumonia were gone in 24-76 hours following a single treatment. The cough disappeared in three to seven days. X-rays showed the complete clearing of the pneumonia 24-96 hours following a single treatment. Mumps, a viral disease, responded to this treatment. The temperature would drop to normal in 24-48 hours and all toxic symptoms would disappear. All swelling of the parotid gland would disappear in four to five days" (11). In 1944, Holaender demonstrated the effectiveness of ultraviolet light in destroying the flu virus outside the human body (12). In 1976, Heding found that ultraviolet light could also inactivate and destroy cancer-producing viruses (13).

I have had excellent success in treating fungal infections of the skin with sunlight. One of my patients had a severe fungal infection which had begun in the skin of the groin area and had spread onto his abdomen and down his legs. After several weeks of sunlight treatments, the infected area had remarkably improved and at the end of a month it was completely free of infection.

Fungal infections of the feet, including infections of the toes and the area around toenails, also seem to be cured or to go into remission after sunlight therapy.

So many different bacteria and viruses exist that it is presently impossible to vaccinate against them all. It is not just the many genera of bacteria and virus, but the many different strains within just one genus that make the development of specific antibiotics so difficult. A hundred different strains can be identified just from the two genera, *Pneumococcus* and *Streptococcus*. Even if it were possible to develop antibiotics to destroy all of the presently active, hundreds of strains of microbes, some microorganisms have an astonishing way of developing an entirely new strain that is unaffected by any existing antibiotic.

The ability of some microbial organisms to develop new resistant strains is creating alarm in the scientific community. Dr. Stanley Falkow, professor of microbiology and genetics, University of Washington School of Medicine, states that, "All the presently available data strongly suggest that perhaps as soon as the next decade we are going to see serious antibiotic resistance among all groups of medically important pathogens" (14).

It is within the realm of possibility, that we may witness development of a new microbial strain that could cause a world-wide pandemic, against which all the wonder drugs of modern science would be futile. So while appreciating the help that we have found in drug therapy, we should keep in mind its serious limitations. Emergency measures should not be the basis and foundation of our health care. Research that concentrates on finding ways to prevent emergencies by helping to maintain the balance between man and the ever present microbe, should be of greater interest.

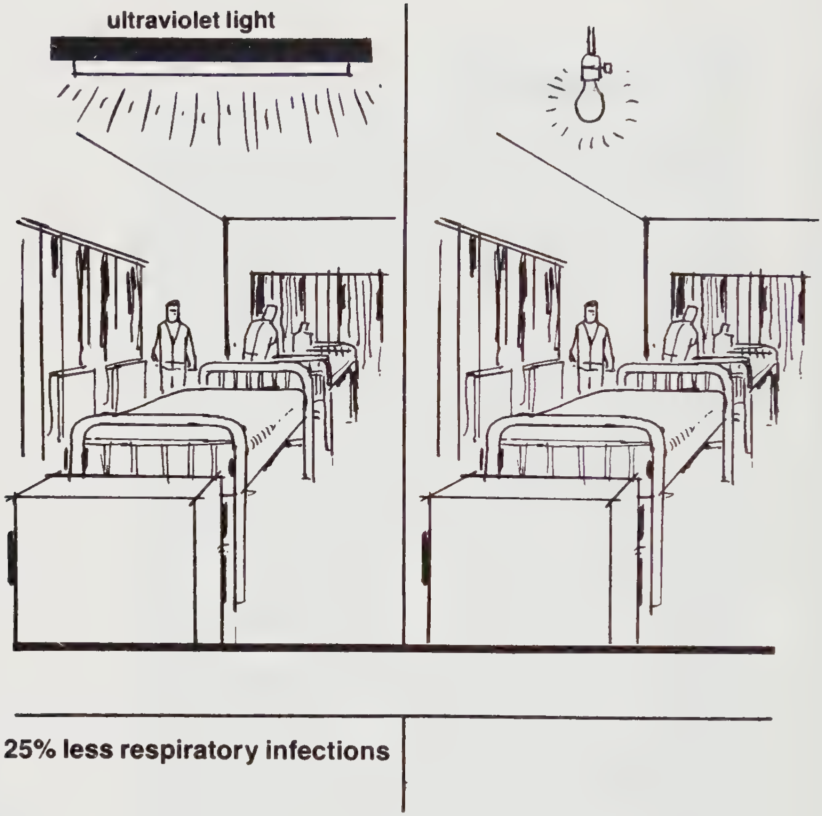
To the social and sanitary methods discussed earlier in this chapter, let us add a further discussion of the everpresent benefits of sunshine. The sun has for centuries played an important, though often unperceived, role in disease control. Intuitively, it seems, some people down through the ages have sensed the need for sunshine and fresh air. Not only are the rays of the sun a potent weapon against the germs themselves, but sunlight plays an impressive role in strengthening the resistance of the individual.

Mechanism of infectious disease

The term "infectious diseases" encompasses everything from colds to flu to the life-threatening condition of spinal meningitis. An infection develops in a person when a disease-producing germ enters the body, multiples, and spreads there. A germ can enter the body in a number of ways; for instance, through the mouth or nose when one is eating or drinking, or perhaps just quietly breathing. Germs may also enter through the other body orifices or through an area where the skin has been broken.

Air-borne diseases

Germs are present in the air at all times. When a person sneezes or coughs, tiny droplets of water, usually containing hundreds of microorganisms, are hurled into the air, and the microbes may travel surprisingly long distances and be inhaled into the body of another person. Dust in the air also carries germs. In 1935, Deryl Hart was disturbed about the frequency of postoperative infections. As part of an experiment to determine the possible cause of such infections, he exposed Petri dishes to the air of an operating room for one hour during the time that surgery was in progress there. After incubating the Petri dishes, he found 78 colonies of staphlococcus on one plate. He then decided to experiment with the bacteriocidal effect of ultraviolet light. Having suspended a bank of ultraviolet lights from the ceiling of the operating room, he found that all the bacteria within 8 feet of the lights could be killed in 10 minutes, even though the intensity of the lights was reduced to a point where blonde skin at a distance of 5 feet would not react with reddening until after 80 minutes of exposure (15). Other researchers, after a ten-year trial of Hart's method, agreed as to the value and importance of his discovery (16). In one experiment, the barracks of a Naval training center were irradiated with ultraviolet light. The light was found to be capable of destroying enough air-borne organisms to cause a 25% reduction in the incidence of respiratory infections among the recruits (17).



Light experiment in naval barracks.

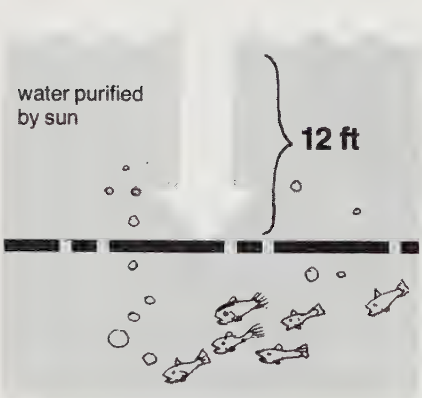
The Russians have recently been experimenting with a full spectrum ultraviolet lighting system in factories where colds and sore throats had been plaguing the workers. The investigators used low intensity ultraviolet light exposures and continued them all day. (The workers did not receive enough ultraviolet light to cause reddening of their skin.) It was found that low intensity exposures lowered the bacterial contamination of the air by 40-70%. Factory workers, who worked where there was no added ultraviolet light, were absent twice as many days from work, as were those who worked under the low intensity light (18).

Since ultraviolet light has the ability to destroy bacteria in the air, thereby purifying it, and since pure air is necessary for good health, the availability of ultraviolet light seems vitally important. We know that natural sunlight reduces the danger of open-air transmission of disease. When sunlight is not readily available, it would seem wise to utilize some sort of low-level artificial ultraviolet light as part of indoor lighting systems.

Water-borne diseases

For centuries, the purification of water by natural means was sufficient to meet the needs of society, but as urbanization and total population have increased, the task of providing safe drinking water has become more difficult. It is true that chlorination can be used to kill the pathogenic organisms in polluted water; however, recent evidence indicates that chlorination may be a factor in the production of some carcinogenic substances (19). Because of this, scientists are studying alternate means for the purification of water. Irradiation with ultraviolet light is one of the possible alternates currently being studied.

There are many microorganisms commonly found in water. They are most prevalent where there is an abundance of organic matter upon which to feed. Bacteria rarely occur in the open



Sunlight purifies sea water to a depth of 12 feet.

sea, but along the coastlines where waste water and organic matter are dumped, the water usually has a high bacterial count.

Not all bacteria found in water are harmful. Bacterial diseases that may be transmitted by polluted water include: cholera — the most swift-to-strike of all the plagues; typhoid — regarded by some as the most dangerous of the water-transmitted diseases; and, bacillary dysentery. Hepatitis is a viral disease which may also be transmitted by polluted water.

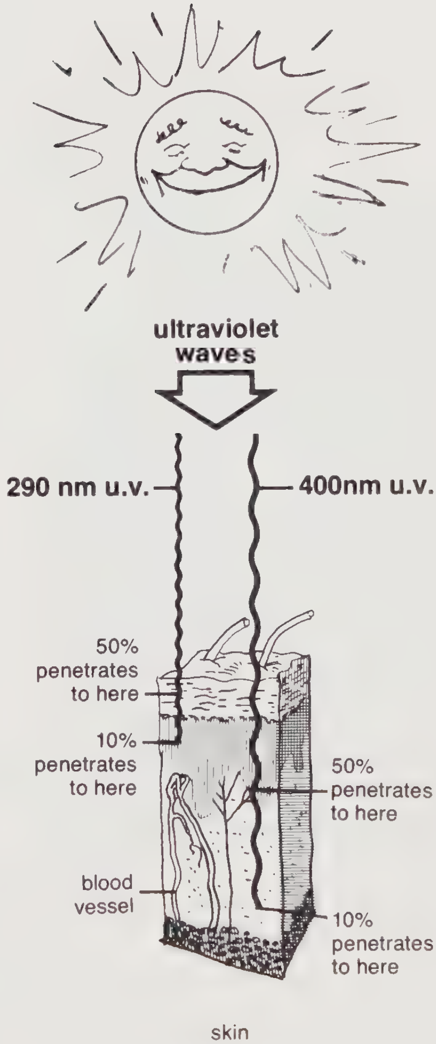
The threat of these dangerous diseases has encouraged the enforcement of county health department measures to ensure safe water supplies. The tests used to determine water safety usually check for the presence of the colon bacillus, *Escherichia coli* (commonly called *E. coli*). This bacterium was chosen as an indicator of fecal pollution in water, because it is commonly found in the intestinal tract of man and animals, and because it is an organism which is very easy to isolate and identify. If *E. coli* is present, it indicates the probable presence of other enteric organisms which could be pathogenic, although most strains of *E. coli* are not usually pathogenic.

Recent studies examining the value of ultraviolet light in the disinfection of water showed that if the irradiation was sufficiently strong and the flow of water slow enough, water could be purified satisfactorily. Scientists, reporting the results of one study, concluded that the sun's ultraviolet rays are an important factor in the natural purification of water because of their effectiveness in killing *E. coli*. By testing water samples from a marine sewage disposal, investigators demonstrated that sunlight could kill *E. coli* to depths of 12 feet in sea water (20).

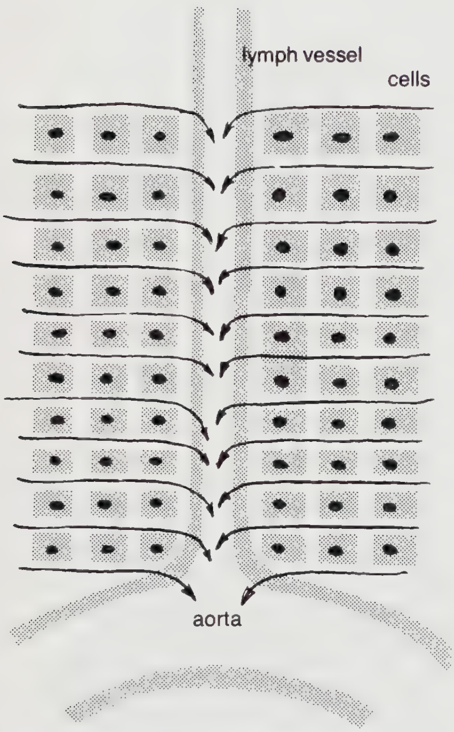
In another study, waste stabilization ponds were exposed to sunlight. Again, *E. coli* was found to be killed by sunlight, and the researchers concluded that solar ultraviolet light is indeed an important though seldom appreciated factor in the natural purification of water (21).

The skin's resistance to disease

Unbroken skin makes an effective physical barrier against most pathogenic organisms. Even the sweat which the skin produces has an acidity which is unfavorable to germs and may kill them. Exposure to sunlight aids in the skin's resistance to disease by killing those germs that are on the surface of the skin. Ultraviolet wave lengths that reach the earth vary from 300 nm to 370 nm. The shorter wave lengths of ultraviolet light are the ones that are more bacteriocidal; however, they penetrate only the superficial layers of the skin and so kill bacteria only in those layers. Though only a small percentage of the ultraviolet light rays reach to the deeper layers of the skin, those deeper layers are felt to be more sensitive to the rays which they receive. This may be responsible for the larger systemic benefits of ultraviolet light which are seen but are not fully understood (22).



The longer the ultraviolet wavelength, the deeper it penetrates the skin. At 290nm,50% of the ultraviolet penetrates to the epidermis, whereas at 400nm 50% reaches the dermis

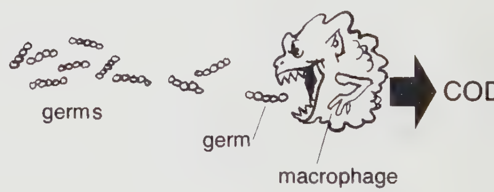


Lymph returns to the bloodstreams.

Not only does the sun have a direct bacteriocidal effect on the skin, but it also changes the oils in the skin into bacteriocidal agents themselves. Even the vapors rising from natural skin oils (after exposure to ultraviolet light) are capable of killing bacteria (23). Because of this and, perhaps, also because of a strengthening effect upon the whole immune system, ultraviolet light has proven to be a beneficial agent in the treatment of acne.

The body's defense system

The entrance of disease germs into a healthy body triggers an immediate response by the body's defense system. The greatest line of defense against invading germs is found in the circulatory and lymphatic systems. The lymphatic system bathes the cells of the body with clear fluid that contains antibodies and white blood cells and acts as a carrier between the cells of the body and the blood vessels.

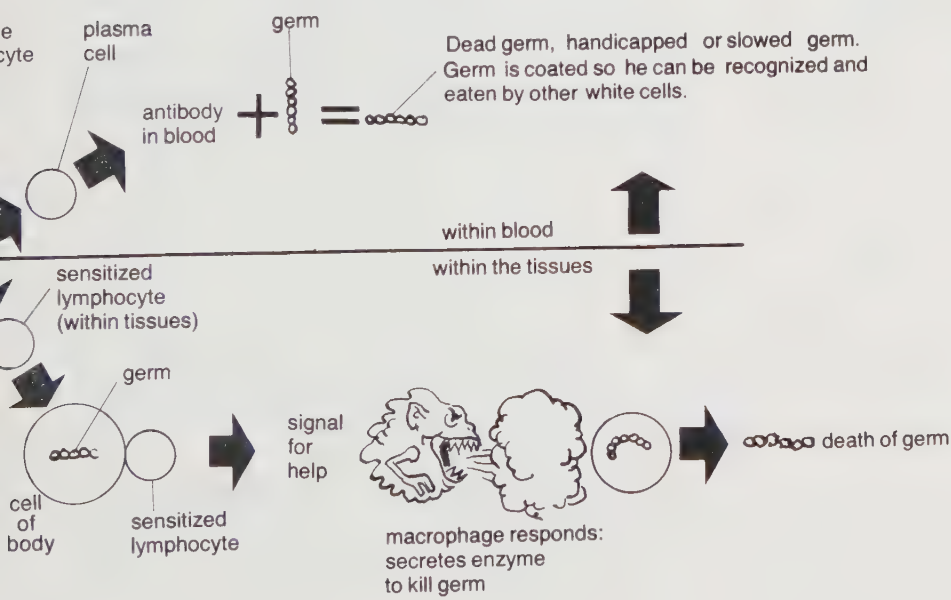


Immune response within the blood and within the tissu

The immune response

The study of how the body works to destroy invading disease germs is a fascinating demonstration of the team work of a group of specialized cells.

First a cell called a macrophage (meaning "large eater") meets an invading germ. It eats the germ, analyzes it, and determines its code or make-up. The macrophage passes this information on to other specialized white blood cells called receptive lymphocytes. The receptive lymphocytes respond to the code information in two ways: they either change themselves into other white blood cells called plasma cells, that have the ability to make and secrete special proteins called antibodies, or they become sen-



sitized lymphocytes that fight the entering germs.

Thus, the immune antibody response of the body is accomplished in two ways: by the response that works within the blood and by the response that works within the cell.

The antibody matches the antigen like two pieces of a puzzle.

Within the blood

Antibodies are the protein substances that are secreted into the blood by the plasma cells in response to meeting a germ or other foreign proteins (antigens). Antibodies act to inactivate or neutralize antigens by combining with them somewhat like two pieces of a jigsaw puzzle.

One of the many ways antibodies work is in conjunction with cells that ingest bacteria. These antibodies coat the outside of bacteria as a signal or label which makes it easier for the white blood cells to recognize and devour the intruders. Gamma globulins are the major kind of antibody found in the blood.

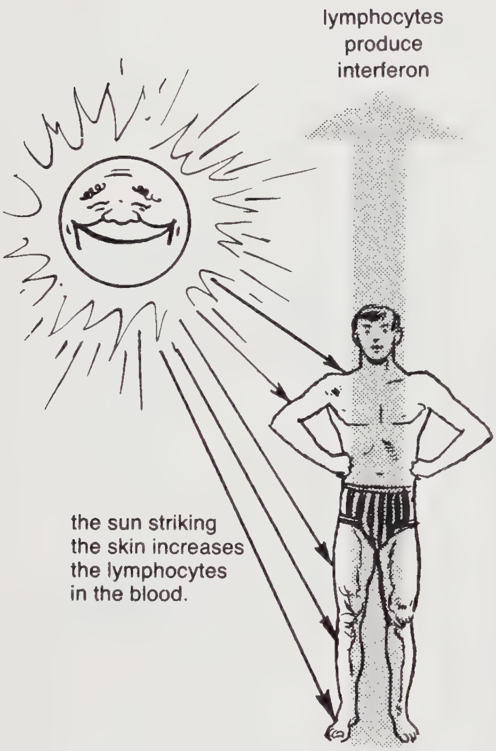
Within the cell

It has only been within the past few years that the protective response within the cells has been understood and appreciated. It is now believed to be of prime importance in the protection against germs inside the cells.

When meeting a germ, the sensitized lymphocytes secrete a variety of chemicals that either send a signal out through the body for reinforcements to come, or that help to destroy the germ. One of the cells that responds to the call for help is called a macrophage. When it answers the call, it becomes "activated" and is increasingly able to eat germs. It also releases an enzyme that eventually kills the germ and, at the same time, causes the inflammation and redness of a localized infection.

Sunlight to the rescue

Studies have shown that exposure to ultraviolet light or natural sunlight (but not enough to redden the skin) increases the number of white blood cells in the human blood. Amazingly, the white blood cell that increases the most is the lymphocyte. It is the lymphocyte that plays the leading role in defending the body against an invasion of germs. Because the lymphocytes increase in number after a sunlight treatment, their products of defense, antibodies (mostly gamma globulins), also increase in the blood (24, 25, 26). In laboratory animals this effect may last as long as three weeks (26).



Sunlight increases the production of lymphocytes.

This increase of lymphocytes and gamma globulins greatly enhances an individual's ability to fight an infection. In fact, it has been shown that experimental animals which have increased lymphocyte counts have a high degree of immunity to cancer as well as to tuberculosis (27).

The lymphocyte is also capable of producing a substance called interferon. This substance has the ability to stop the reproduction of viruses. This is an important fact to remember when one is considering possible reasons for some animals' partial immunity to cancer, since many cancers are believed to be caused by viruses.

Interferon is effective against several different kinds of cancer including carcinoma, sarcoma, and leukemia. This fact spurred the American Cancer Society to spend 2 million dollars to purchase interferon from Finland for experimental use (28).

Dr. Hans Strander of Finland discovered that he could give interferon to terminal bone cancer patients and double the number of long-term disease-free survivors (29). He has gotten similar results in treating other cancers like Hodgkin disease, multiple myeloma and juvenile papillomas. Not only do these patients get better, but they also seem to be immune to infectious viral diseases that so often plague cancer patients (28).

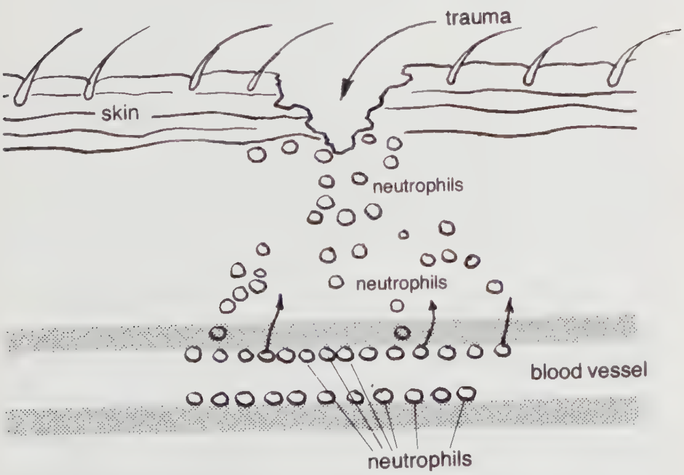
Treatment of many viral infectious diseases such as hepatitis, herpes simplex, herpes zoster, chicken pox, and the common cold may also be improved by interferon (29).

Our own bodies' lymphocytes manufacture this wonderful interferon that can help so dramatically in cancer and viral infections. Sunlight is a great stimulus for increased lymphocyte production and thereby increases the production of interferon.

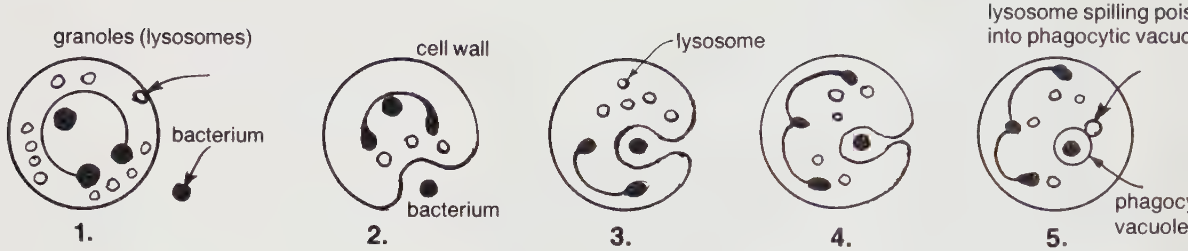
The phagocytic system

Working in conjunction with the immune system is the phagocytic system. Phagocytosis is a term used to describe the ability of a cell to eat foreign substances. Neutrophils are a type of white blood cell and are the most common of the phagocytes. When faced with foreign material — be it bacteria, a fungus, or a glass bead — the neutrophil will eat and attempt to destroy it.

Neutrophils are always present and circulating within the blood. They are found in large numbers at the site of any infection or injury. Whenever tissue is damaged, a stimulus is initiated that affects the neutrophils. They line up along the blood vessel wall and begin squeezing their way through the cells of the wall.



Neutrophils respond to an injury.



Notice in the illustrated steps of phagocytosis how the neutrophil approaches the bacterium and surrounds it, eventually bringing it within itself in a special pocket. Once the bacterium is totally surrounded, the neutrophil spills poison into the pocket containing the bacteria and destroys it there.

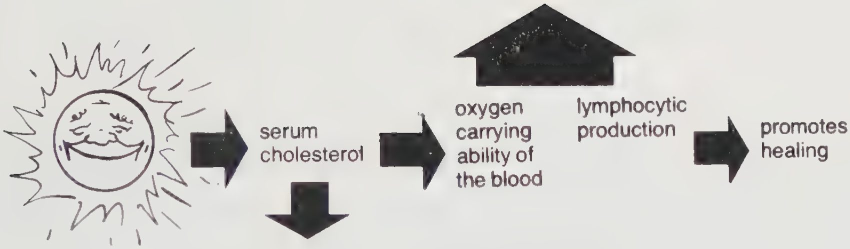
Sunlight stimulates phagocytosis.

Once through, they make their way to the site of the injury and proceed to eat up any foreign matter present. After the initial injury, neutrophils can be found there in less than an hour. It takes only a few hours for large numbers to appear.

Sunlight to the rescue

After an individual is exposed to ultraviolet light, the neutrophils in his blood are stimulated to eat germs more rapidly. In some research, it was shown that they doubled their ability to engulf bacteria (24, 18, 30).

If the sun is able to eliminate bacteria from our air, water, and skin, and is able to strengthen the immune system of a host, it would naturally follow that persons regularly exposed to ultraviolet light would develop fewer illnesses.



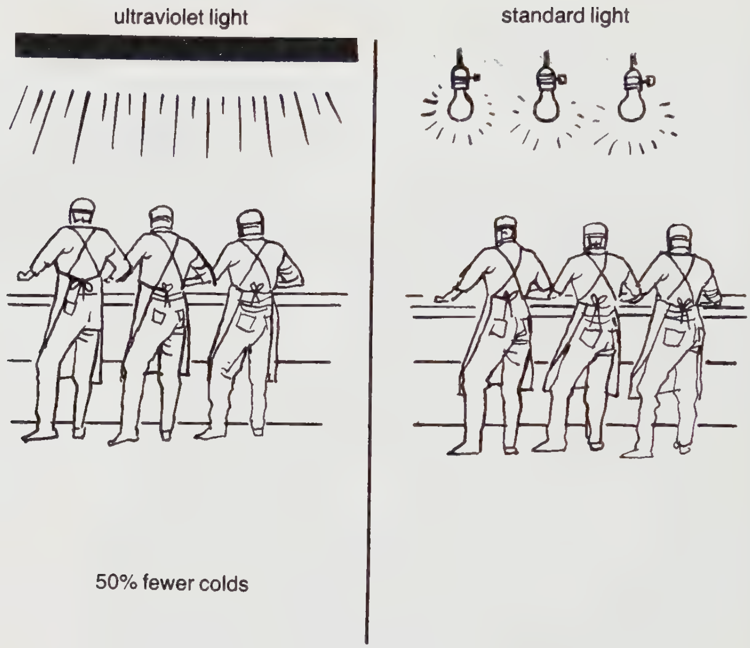
Sunlight promotes healing.

This is exactly the clinical result observed.

For 12 years, 4,000 male college students of Cornell University were observed, and it was found that there was a direct relationship between the temperature and days of sunshine and the frequency of colds. Smaller groups of patients who considered themselves susceptible to colds were studied. It was found that a 10-minute irradiation with ultraviolet light one to three times a week throughout the winter months resulted in a reduction in the frequency of colds from 27.9% to 40.3% (31).

The results of another study (which was of the effects seen when children were exposed to ultraviolet light in the classroom) indicated that children would have less respiratory infections if ultraviolet lights were to be substituted for the standard classroom lights.

The Russians are doing most of the recent research dealing with sunlight therapy. The results of their research have been so convincing that in some northern areas the law requires that miners be given sunlight therapy. One Russian study (mentioned earlier in this chapter) involved workers in a factory where special lamps



Light experiment on Russian factory workers.

were installed that would provide small doses of ultraviolet light all during the work day. The number of colds among workers who received the light therapy was about 50% lower than among workers not receiving therapy (18).

Russian scientists have also developed a test to check the ability of children's bodies to build immunity and resist infections. The scientists have found that exposure to ultraviolet light, especially in winter months, greatly increased the ability of the Russian children's bodies to resist disease (33).

In a study involving over 800 children, it was discovered that the incidence of dental cavities was much higher during the winter and spring months than during the summer months (34). Another study using 94,337 white boys 12 to 14 years of age, showed that the incidence of cavities was directly related to the amount of sunlight available in the area in which the boys lived; the more sunlight, the less cavities. The boys that lived in areas with over 3,000 hours of sunlight per year had 290 cavities per 100 boys while the group with less than 2,200 hours had 486 cavities (35). Since dental cavities are partly the result of bacterial invasion, and since exposure to sunlight builds up the immune system, it is not hard to see that exposure to sunlight could also encourage the reduction of the number of dental cavities which may occur.

The polar regions have the unique characteristic of long winters in which sunlight is never seen. To study the polar regions is to study an area almost totally deprived of sunlight. The fact that early polar explorers, upon returning home, contracted unexplained upper respiratory infections in epidemic proportions, has puzzled many scientists. A doctor, now studying the health of men stationed at a polar research base, theorizes that the strength of a person's immune system is weakened during the polar isolation. The doctor's research indicates that during the 8-month-long antarctic winter season, a person's circulating antibodies and white blood cells markedly decrease (36).

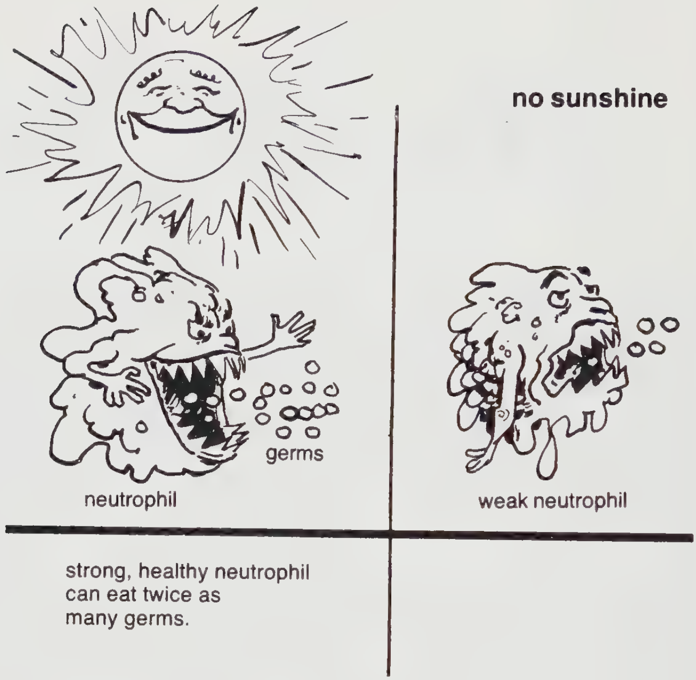


Figure 10 The steps of phagocytosis.

How does sunlight work?

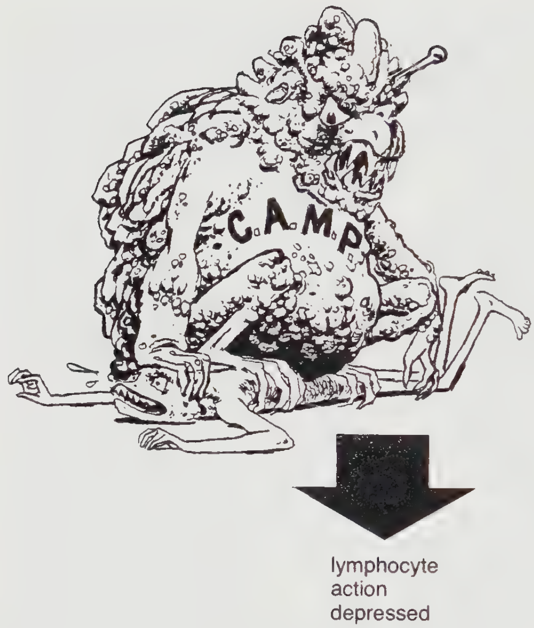
The exact mechanism by which the sun promotes the ability of the body to fight infection is unknown, but one possible explanation may be that ultraviolet light rays cause the serum cholesterol level to drop, and a lower serum cholesterol can increase the oxygen-carrying capacity of the blood. When the cholesterol level of the blood is elevated, cholesterol becomes incorporated into the wall of the red blood cell, making the wall thick and resistant to the transport of oxygen (37). Decreasing cholesterol in the blood increases the capacity of the red blood cell, the main carrier of oxygen, to pick up oxygen from the lungs and transfer it to the cells of the body.

Increasing the oxygen in the blood may promote direct healing. Oxygen has been shown to destroy a wide variety of bacteria in the laboratory (38). There is evidence showing that an increase in the oxygen supply to the tissues of the body promotes healing of a variety of infectious diseases such as deep bone infections (39, 40) and bacterial gas gangrene (41). Oxygen may promote healing indirectly, by strengthening the immune system. It is known that increasing the body's oxygen supply also increases production of lymphocytes which have the ability to fight foreign substances and bacteria (42).

Extra oxygen is required by the white blood cells that engulf and eat germs, because after germs have been engulfed by white blood cells, special poisons are made from oxygen to destroy the germs (43, 44). Since exposure to sunlight may increase the body's oxygen, one may readily see how sunlight may also increase the ability of white cells to destroy invading organisms.

What is "CAMP"?

A very interesting substance found in almost all cells, including lymphocytes, is known as cyclic adenosine monophosphate. In medical circles this long name is shortened to cyclic AMP. However, for the convenience of our readers, we have chosen to abbreviate it even more, referring to this harmful substance from now on simply as "CAMP". If high levels of cyclic AMP build up in the lymphocytes, they become unable to function properly and will not be able to destroy cancer cells (45). CAMP may also depress other factors in the body's immune system.



C A M P inhibits lymphocytic action.

There are many factors which may elevate the level of CAMP in the lymphocytes. An understanding of some of these factors is especially important to one who is interested in sunlight therapy.

Stress

Whenever a person is under stress or is emotionally upset, adrenalin is poured into the system from the adrenal gland. Adrenalin goes to the cells and stimulates the production of CAMP (46). The increased CAMP inhibits the ability of the immune system to destroy cancer cells. It is a well-known fact that cancer may follow an emotional upset or a period of severe stress.

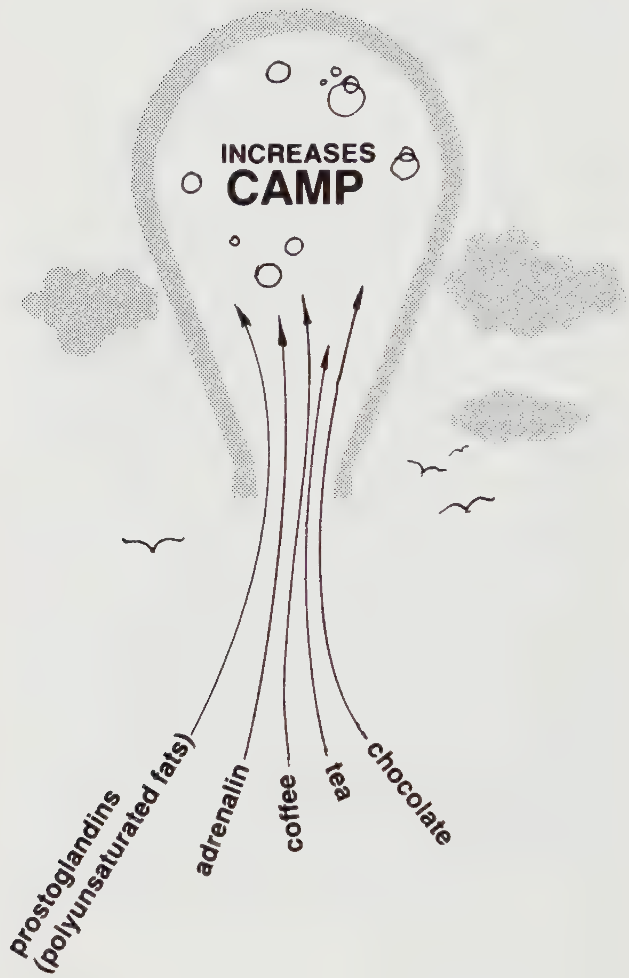
The cup

Coffee, tea, and chocolate contain stimulating substances known as caffeine, theophylline, and theobromine. These substances increase the amount of CAMP in body cells because they block the destruction of CAMP which would normally take place. Increased CAMP depresses the ability of the lymphocytes to function, and is a stimulant to the nervous system. It is by increasing CAMP production in the cell, that coffee and tea are able to produce their stimulating effects. A decrease in gamma globulin has actually been found among coffee drinkers (47). There have been reports that coffee drinking is related to some types of cancer (48). The nicotine in cigarettes may also be a factor in lowered immunity, as smokers have been found to have decreased levels of gamma globulin (47).

It is difficult to find a place for the use of coffee, tea, or chocolate in the sunbather's program.

Prostaglandins

In the chapter on cancer, prostaglandins were discussed as to their role in inhibiting the immune system. Prostaglandins (specifically prostaglandin E_1 and E_2) work by stimulating the cells to produce CAMP, thereby decreasing the lymphocytes' ability to destroy cancer cells (45).

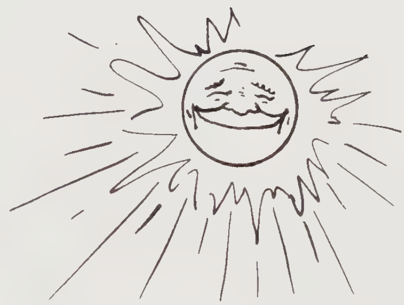


Substances that increase CAMP

As you recall from the chapter on cancer, if one eats freely of polyunsaturated fat, his body may be stimulated to produce excessive prostaglandins and these may inhibit his immune system.

Sunlight lowers CAMP

CAMP seems to be very sensitive to light and easily destroyed by it. For instance, concentrations of CAMP found within the eye are decreased by light. This is very important, because the amount of CAMP in the eye affects one's vision (49). Light is found to decrease not only the CAMP which affects the visual process but also that which is found within the individual cells (50).



The visible light from the sun can penetrate very deeply into the body, even into the brain (51). As before mentioned, the sun decreases levels of CAMP in the body and thereby increases the ability of the lymphocytes and immune system to function properly. This may be why sunlight is helpful in the treatment of tuberculosis and other diseases, including cancer (as mentioned in the chapter on cancer).

The reduction of body levels of CAMP produces a relaxing effect on the nervous system. As caffeine stimulates the nervous system by increasing the level of CAMP in the tissues, so sunlight relaxes the nervous system by decreasing levels of CAMP. The sedating effect of sunlight is evidenced by the many sunbathers who fall asleep while sunbathing only to awake and

Sunlight reduces CAMP

Sunlight's effect on CAMP

find themselves sunburned. Sunlamps suspended over a bed are dangerous without a timing and shut-off device, for many people have fallen asleep under sunlamps and burned themselves severely. The warm sedating sun induces sleep even in most nervous persons. Look at a cat sleeping in the sun and you will see the undeniable relaxing effect of sunshine.

In summary

Sunshine aids in maintaining man's constant war against disease.

The sun aids by destroying the germs in man's environment before they enter the body. Sunlight effectively kills germs in the air, purifies water, destroys bacteria on exposed surfaces including the skin, and produces antibacterial agents on the skin from the oils present there.

The sun aids by increasing the resistance of the individual. Sunlight increases the production and stimulates the activity of the lymphocytes, neutrophils, and other cells of the immune system. These cells in turn produce more antibodies (gamma globulin) and interferon to circulate throughout the body. The net effect is that the individual's defenses against disease are greatly

Coffee's effect on CAMP

strengthened. A strong immune system not only will help to protect one against the common cold, flu, and other infectious diseases, but can also inhibit cancer formation and progression. (The sun's relation to cancer is discussed in the chapter on cancer.)

All of this works together to promote health, including a reduction in everything from respiratory infections to dental caries, among those who expose themselves to sunlight. An added benefit is that while the sun is effecting all these positive changes, it also produces a marvelously relaxing effect.

Obtaining the necessary amount of light to produce the positive benefits of decreasing CAMP is a problem, as the light provided in most homes and offices is only about one-tenth that of outdoors in the shade (52). Housing should be designed to provide many large windows and skylights, thereby increasing the amount of light available. The cost of artificially lighting a room with the proper intensity is greater than most people are willing to spend. Under the present circumstances one should spend as much time as possible out of doors to obtain all the natural light he can. In so doing he will be strengthening his body's own resources to resist a host of diseases and their trail of miseries.

Chapter 9

Sunlight Electrifies the Air

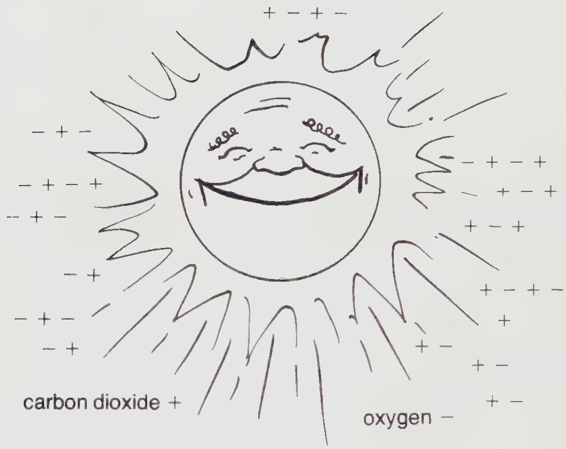
"Give me the splendid, silent sun, with all his beams full-dazzling!"

— Walt Whitman

As sunlight passes through the atmosphere, it electrically charges some of the air molecules, usually in a ratio of 4:5 negative to positive ions. Some of the negative ions are oxygen ions while carbon dioxide ions contribue to the positive ion total. On cloudy days, fewer ions are formed (1). Other factors in our natural environment such as the radioactivity in the soil and air, thunderstorms, and the active movement of water through the air as in a waterfall or in a heavy rainshower, contribute to the production of ions.

Although various heating and air conditioning systems differ in their effect on the air, they generally remove most of the negative charges and may even add positive charges (2).

As the number of positive ions increases, with a corresponding decrease in negative ions, one may feel such adverse effects as headache, nasal



Sunlight puts a charge on the air.

obstruction, hoarseness, fatigue, dry throat, and dizziness (3). Negatively charged air, on the other hand, produces a feeling of exhilaration and well-being (4, 5). A proper ratio between the number of positively and negatively charged ions is important. If only negatively or positively charged air is breathed over an extended period, detrimental effects may be observed (6).

The fact that negatively charged ions commonly disappear becomes very important when we understand its effects on our bodies. As an example, a study published in the Journal of Cancer Research reported that negatively charged air has an inhibitory effect on the growth of cancer. A group of rats with cancer were allowed to breathe charged air while an equal number breathed common indoor air. After one month the cancer in the rats breathing the indoor air was twice the size of the cancer in the rats breathing the charged air.

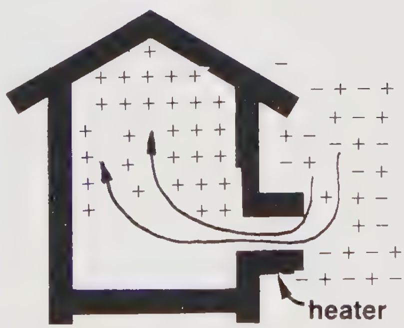
Calcium lactate (a common form of calcium supplement) when added to the diet has very little effect on the growth of cancer, but when it is combined with the breathing of negatively charged air, cancer stops growing completely (7).

Negatively charged air has been shown to decrease the respiration rate and lower blood pressure, while positively charged air has just the opposite effect (4). One group of researchers reported that patients who had high blood pressure and breathed negatively charged air had an average drop of the systolic blood pressure of 39 mm Hg (8).

Positively charged air depresses the adrenal glands and their ability to secrete hormones that protect the body against stress (9, 10). Thus, living and working indoors can leave us vulnerable to stress unless the outdoor, negatively charged air is allowed to come through an open window or is properly treated by a heating or air conditioning unit.

Negatively charged air also has a beneficial effect on patients who suffer from hay fever and bronchial asthma. In one study 83% of the hay fever patients tested found some relief while breathing negatively charged air; up to half of these experienced complete relief (6).

Normally in the airway tube to the lungs there is a continuous, thin film of mucus covering the inside wall. This mucus, moved by thousands of tiny, waving feet called cilia, flows up into the



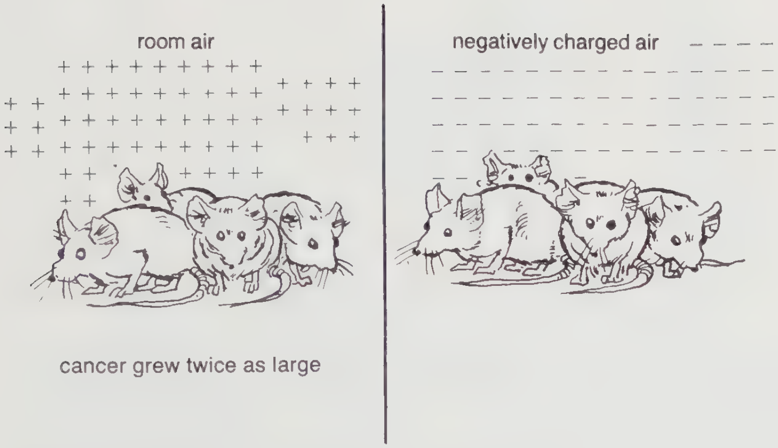
Commercial heaters alter the charge on the air.

throat and is swallowed. This action removes from the lungs any dirt or germs that have come in with the air. Negatively charged air increases the mucus flow and speeds up the rate at which the cilia move, while positively charged air does just the opposite (11). It is important to keep this film of mucus moving rapidly because germs not moved out promptly will multiply and invade, causing bronchitis or pneumonia. Thus it can be seen that the quality of the air we breathe is important if we are to successfully fight respiratory tract infections.

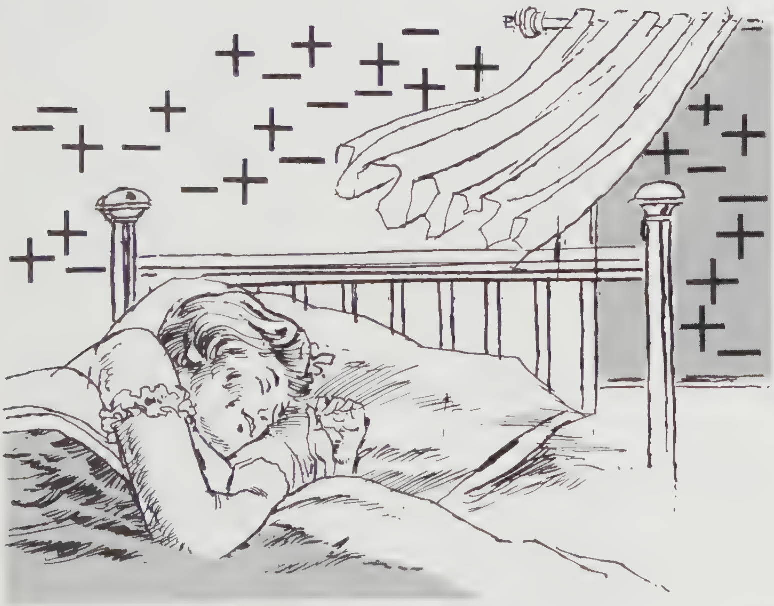
From the above information, we can draw some conclusions and make recommendations: Spending as much time as possible out-of-doors in the bright sunlight and negatively charged air is important. Since the outdoor air remains negatively charged during the night, the bedroom windows should be open. This may require heavy bedding during the winter months and possibly a water cooler during the summer in certain areas. Water coolers would probably produce a good supply of negatively charged air since both the movement and vaporization of water have been shown to do this (12).

In cool weather during the day it is best to keep the inside temperature set lower and to wear warmer clothing. In that way some fresh, outdoor air can come in without raising the heating bill. The air in occupied rooms should be changed continuously to maintain its negative charge, which is lost when the air is breathed (13).

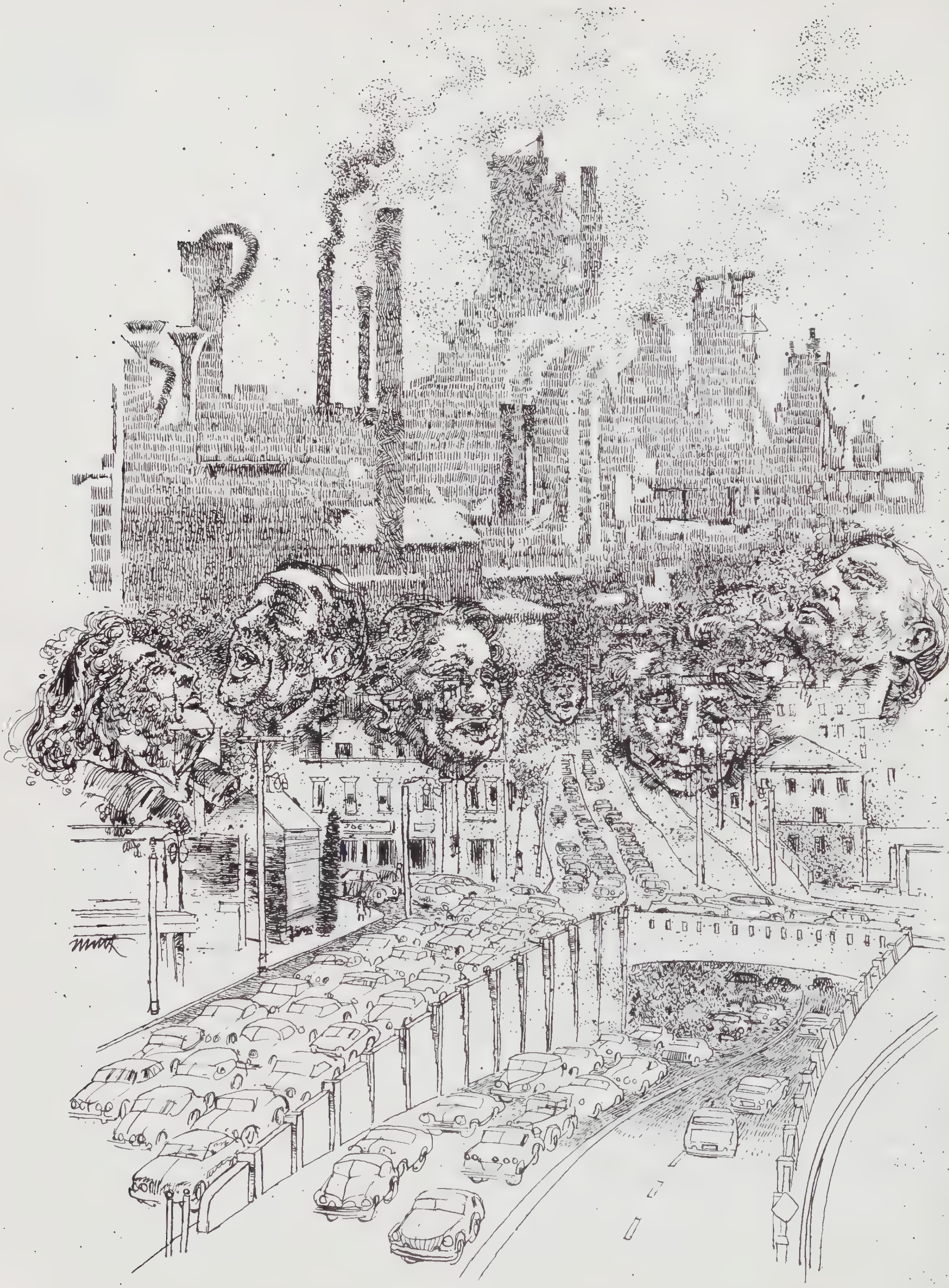
Ideally, heating and air conditioning systems should be able to modify the temperature of the air, moving it into the occupied rooms without losing its optimal electrical charge.



Air ions and the growth of cancer in experimental animals.



Open windows allow charged air into the home.


JOE'S

Chapter

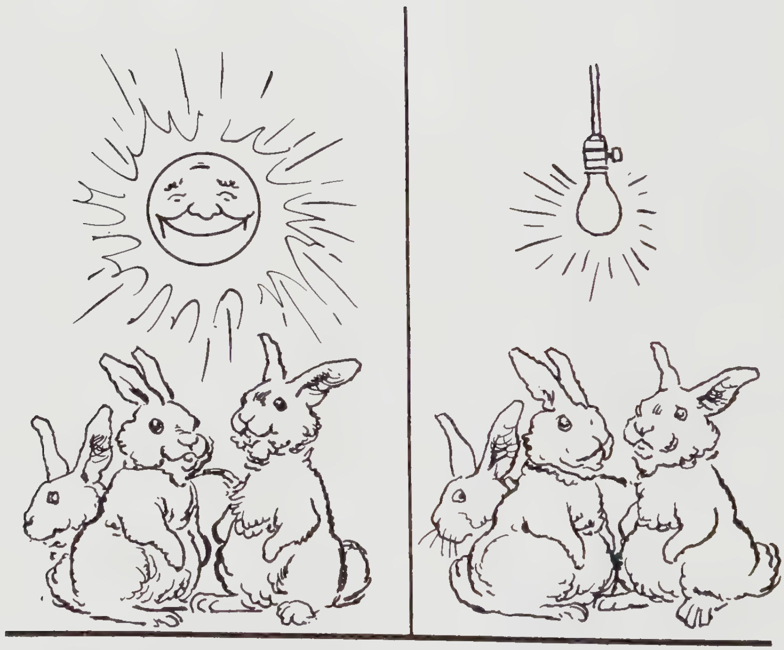
10 Sunlight and Pollution

"A little rule, a little sway,
A sunbeam in a winter's day
Is all the proud and mighty have
Between the cradle and the grave."

— John Dyer

In this modern era we are constantly reminded that our air, water, and food are contaminated with pesticides, heavy metals and various other chemicals. Our bodies need to eliminate these noxious agents as rapidly as possible, as their presence will cause damage.

Sunlight has the specific ability to speed up the metabolism, decontamination and elimination of toxic agents. The amount of sunlight one receives appears to be very important in this regard. Too much sunlight, which causes burning, may be as ineffective as no sunlight at all. The optimal amount necessary to eliminate noxious chemicals is that which occurs just before burning (1). Experiments with animals have shown that the very best results were obtained when the animals were started on treatments several weeks prior to the administration of the noxious agents.



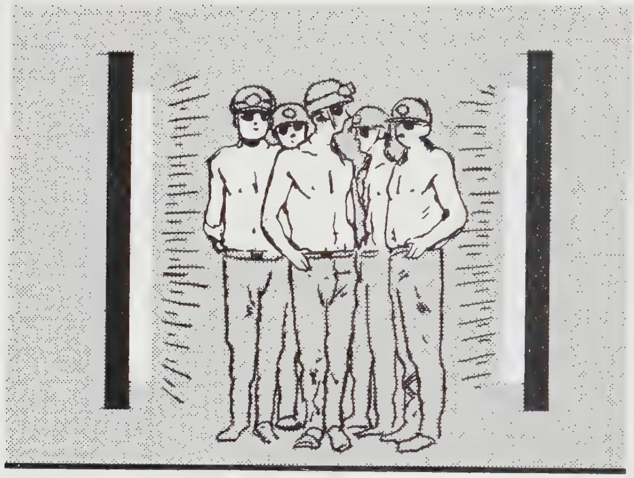
Sunlight speeds elimination of toxic chemicals 10 — 1000 times faster than artificial light.

A number of noxious chemical agents have been tested including lead, mercury, cobalt, manganese, cadmium, fluoride, benzene, carbon tetrachloride, pesticides (hexachlorobenzene and methylmercaptophos) and dusts (quartz and coal). The amount given is usually enough to cause a chronic intoxication (1, 2).

The animals being given sunlight treatments eliminated some of the toxic chemicals ten to twenty times as fast as did the animals not receiving the treatments.

Lead was removed twice as fast from the animals receiving sunlight therapy as from the others. The ultraviolet light seemed to increase the enzymes that metabolize toxic chemicals and help to remove them (1)

In mining operations workers are often exposed to large amounts of coal or other rock dusts in the air. These dusts can cause great damage to the lungs. When experimental animals are allowed to breathe air laden with coal dust, their lungs soon become loaded with this black dust. There is a general clearing of the coal dust when sunlight treatments are given to these animals. As one Russian investigator puts it, "The results obtained permitted the conclusion to be made that ultraviolet radiation results in an acceleration of the removal of dust from the lungs" (2). Miners in some areas in Russia are now given sunlight treatments every day to help remove the coal dust.



Russian miners receive ultraviolet treatments by law.

Quartz and other rock dusts are harmful when inhaled; sunlight has been shown to accelerate the removal of these dusts from the lungs (2).

By aiding in the removal of many toxic chemicals from the body, sunlight helps to get rid of cancer-causing agents. This may be one of the ways sunlight is able to reduce the incidence of cancer (3).

The introduction of a toxic chemical into the system produces a physical stress on the body. Animals that are continually exposed to sunlight treatments are found to have more adrenalin in their adrenal glands and heart muscle. This fact suggests that the animal is better able to withstand stressful situations such as the introduction of noxious chemicals (1). The skin may also produce adrenalin when exposed to sunlight (4) and may further add to the body's ability to overcome stress.

Sunlight not only aids in moving the toxic heavy metals out of the body, but it also seems to have a dramatic effect on the trace minerals needed by the body. The sunlight's effects on copper, molybdenum, manganese, and nickel — all necessary to the body — have been studied.

As an example, let's look at copper. Following multiple exposures to sunlight, the copper level in the liver drops to almost half while it nearly triples in the blood. Copper also increases by 100% in the heart, skeletal muscles, bones, and various other tissues.

About 60% of the copper in the muscle tissues is found in the mitochondria where the body energy is produced. The sun's ability to move copper from the liver out into the body where it is an aid to energy production is certainly a positive aspect (1).

Sunlight has a surprisingly intricate relation to the metals in our body. It accelerates the body's ability to dispose of heavy toxic metals and to move the necessary trace minerals in the body to their most advantageous position for use.

Chapter 11

Sunlight and Jaundice

"Shadow and sun — so too our lives are made —
Here learn how great the sun, how small the shade!"
— Richard Le Gallienne

Recently, light therapy has been used for the treatment of jaundice in newborn infants. Jaundice is caused by a yellow pigment called bilirubin, which builds up in the skin and tissues and turns the skin yellow. Light therapy has given excellent results, without the risk which attends exchange transfusions, which previously had been the usual treatment for jaundice in the newborn.

Light therapy was discovered almost by accident at Rochford General Hospital in England. Sister Ward, the nurse in charge of the premature infant unit, was a real advocate of fresh air and sunlight. On warm summer days she would wheel the premature infants out into the courtyard. She thought that this would be much more beneficial to them that the stuffy, warm air of the incubator. She felt, too, that the doctors would not be happy with her if they found out what she was doing, so she would hurriedly bring the infants in when the doctors made their rounds.

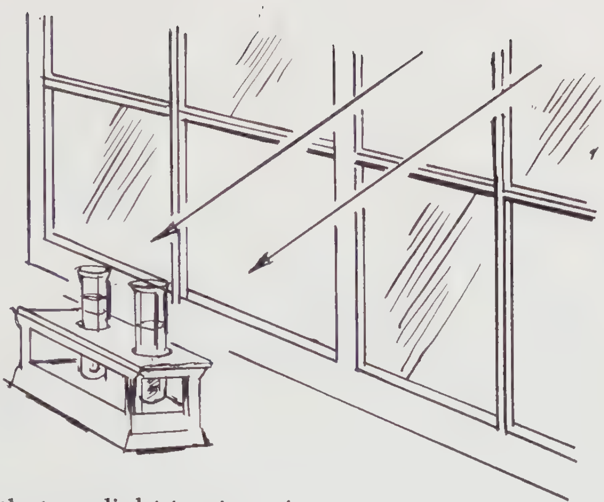
Sunlight destroyed the yellow skin color except where diaper shielded the skin.

During ward rounds one beautiful summer day in 1956, Sister Ward showed the doctors a premature, unclothed babe. The infant was a pale yellow color except for a very bright yellow triangle across the abdomen. "Sister," said one of the doctors, "what did you paint this baby with, iodine or flavine, and why?" Sister Ward replied that it must have been the sun. Unconvinced, the doctor told her that suntan takes days to develop. Sister Ward finally explained that the darker yellow area was where the diaper had covered the child while it had been out in the sun and that "the rest of the body seems to have faded." Since the infant did well and went home shortly after this, the doctors did not forbid the nurse's continuing of the fresh air and sunlight treatments.

A few weeks later, blood from another jaundiced infant was sent to the laboratory for analysis. After an unexpected delay of several hours, a very unusual report came back which indicated to the ordering physician that the laboratory work had not been done properly, as the reported bilirubin level was much lower than expected. The doctor ordered a fresh specimen taken and sent directly to the laboratory, asking for an explanation of both the preceding delay and of the incorrect analysis of the first sample. The biochemist repeated his analysis of the first specimen that was still lying on the window sill in full sunlight. The bilirubin level in the first specimen seemed to be lower than before, although the new specimen showed a high level of bilirubin.

These two events stimulated the doctors to action. They found that sunlight actually has an effect upon the chemical, bilirubin, that causes

Sunlight destroys bilirubin.



the jaundice, and that sunlight treatments were very effective as therapy for the jaundiced infants. This very recent discovery made it possible to avoid the replacement transfusion. Although artificial lights were somewhat less efficient than sunlight, they were discovered to also be effective against infant jaundice, with the added advantage that they could be used the year round.

Intense blue light has been used recently to treat jaundice in newborn babies, possibly because it is brighter. It seems to be more effective than common artificial light in bringing down the bilirubin level, especially in dark-skinned infants; but as one considers the dramatic effect which different types of light have on health, it seems a far safer measure to use an intense, full-spectrum, white light that would more nearly match the sun's rays. In all mankind's history, newborn infants have never been subjected to intense blue light. What the possible short- or long-range ill-effect may be is not known. The more that light's effects on health are studied the more apparent it becomes that the unique spectrum available in natural sunlight produces the safest beneficial results.

Chapter

12

Sunlight and Pyschological Impact

"The windows of my soul I throw
Wide open to the sun."

— John Greenleaf Whittier

A sunny day is mood elevating.

In 1828, Dr. Hautrive wrote regarding sunlight: "In certain mental diseases such as melancholy, the physician will not neglect the most powerful cure nature offers." (1).

It is obvious to everyone that there is something about a sunny day that is mood-elevating. It elicits responses such as "wonderful", "beautiful", and "great". Those who take advantage of the weather by sunbathing find that the sun definitely has a tranquilizing effect, more that the effect one obtains from just lying down and relaxing or resting.

As discussed in the chapter on infections, coffee drinking affects the nervous system by increasing a substance in the tissues known as cyclic adenosine monophosphate (cyclic AMP or CAMP). This substance also increases when an individual becomes emotionally upset. It acts upon the nervous system by putting it in a state

of red alert. Sunlight is very destructive to this substance (2, 3). When levels of CAMP are reduced in the tissues, the nervous system relaxes. This then may be one of the mechanisms by which the sun produces its wonderfully relaxing effect.

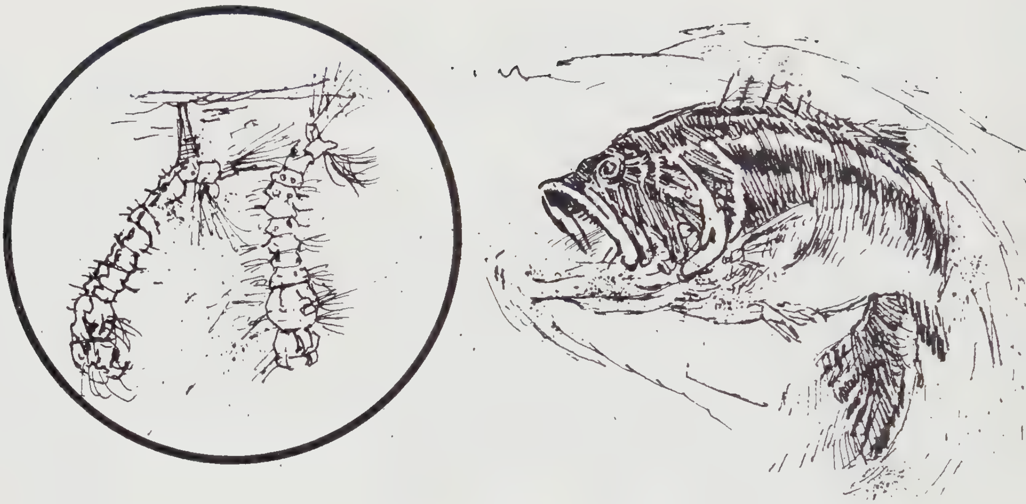
John Ott, president of Health and Light Research, Inc., has studied the effects of different types of light on the nervous and mental states of individuals. He believes that environmental lighting may be responsible for hyperactivity in children. In 1967, he discovered that 12 hyperactive children in Sarasota's special adjustive educational center came from homes where the television sets leaked x-rays. The television sets were repaired and the children were no longer hyperactive.

John Ott testified before a Congressional committee, and his testimony helped lead to the 1968 Radiation Control Act that limits the amounts of x-rays that television sets may emit (4). He then set up an experiment to test whether environmental lighting had any effect upon hyperactivty.

The test ran over a 120-day period and was conducted in four, windowless, first-grade classrooms. Time-lapse photographs were taken of the children during their classes. The children did not know that they were being photographed or that an experiment was being run.

The teachers felt that the hyperactive children's behavior and learning abilities definitely improved under full-spectrum lighting. The time-lapse photographs taken during this period suggested the same conclusion (4). This is startling for it suggests that conventional fluorescent lights may aggravate behavioral and learning problems.

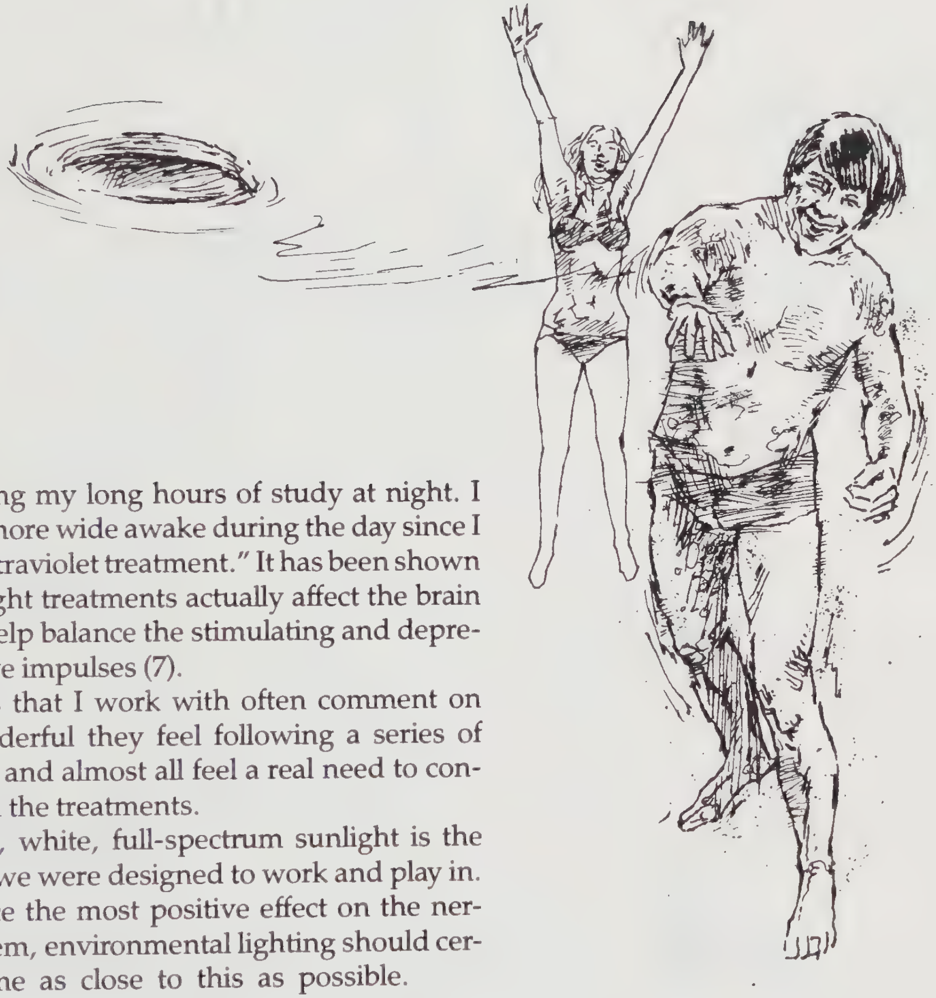
An interesting incident occurred in St. Petersburg, Florida, when the management of radio station WILZ decided to brighten up the studio and control rooms by replacing the regular white fluorescent lights with pink ones. Within two or three months, the personnel began to have problems. The announcers did poorly on the air; the staff began to oppose the management; employees became irritable and generally very difficult to handle. Several decided to resign without giving any reason other than just general dissatisfaction. Finally, one employee remarked, "If those pink bulbs aren't removed, I'll go out of my mind". Somehow the comment sparked an immediate reaction and all the pink lights were replaced with white bulbs that day. Within a week, tempers seemed to be much improved, cooperation and friendliness returned, and all resignations were withdrawn (4).



A college psychology professor did a psychological study to determine the relationship between tinted eyeglasses and the behavior of 300 college students. Three of the students who wore hot pink glasses were generally rated by the faculty as being the most psychologically upset students on the campus (4).

This brings to mind a recently published study showing that fish are also affected by different colors of light. When fish of a certain species are exposed to red lights, they become much more aggressive in their behavior in regard to eating more mosquito larvae (5).

In a study done at the University of Illinois (6) the effects of sunlight treatments on physical fitness were observed. It was noticed that the students who got the sunlight treatments showed greater interest in their classwork, attended classes more regularly, and voted unanimously to continue the treatments following the experiment. A typical comment from students was: "I think the light has kept me from feeling



tired during my long hours of study at night. I have felt more wide awake during the day since I had the ultraviolet treatment." It has been shown that sunlight treatments actually affect the brain and can help balance the stimulating and depressing nerve impulses (7).

Patients that I work with often comment on how wonderful they feel following a series of sunbaths, and almost all feel a real need to continue with the treatments.

Natural, white, full-spectrum sunlight is the kind that we were designed to work and play in. To produce the most positive effect on the nervous system, environmental lighting should certainly come as close to this as possible.

Chapter

13

Sunlight and Sexuality

"Forget me for a month, a year
But, oh, beloved, think of me
When unexpected beauty burns
Like sudden sunlight on the sea."

— Sara Teasdale

Our 24-hour days are divided into periods of light and darkness. This division appears to play an important role in our hormone production. If this division of light and dark is changed, it will also affect the hormone balance.

As an example, if young rats are kept in an environment of continuous light they will become sexually mature much sooner than those kept in a normal environment with periods of light and darkness (1). Rats are active during the night while humans are active during the day. This seems to make a big difference in the response to light. Humans when kept in darkness, such as blind children, will become sexually mature sooner than children who are not blind (2).

Americans have been gradually moving from the farm and the outdoor life into the city and an indoor, factory or office life. Indoor environmental lighting provides only one-tenth as much light as out-of-doors in the shade (3).

During this same period of time when Americans have been moving indoors, the age when children become sexually mature has been decreasing. It is no longer unusual to see girls menstruating and becoming pregnant at eleven, twelve or thirteen. In industrialized European countries the average age that girls start to menstruate has been decreasing by four months every ten years between the years 1850 to 1950. The average age of voice change for boys in the chorus of J. S. Bach in Leipzig prior to the year 1750 was 18 years and at present it is approximately 13.5 years (4).

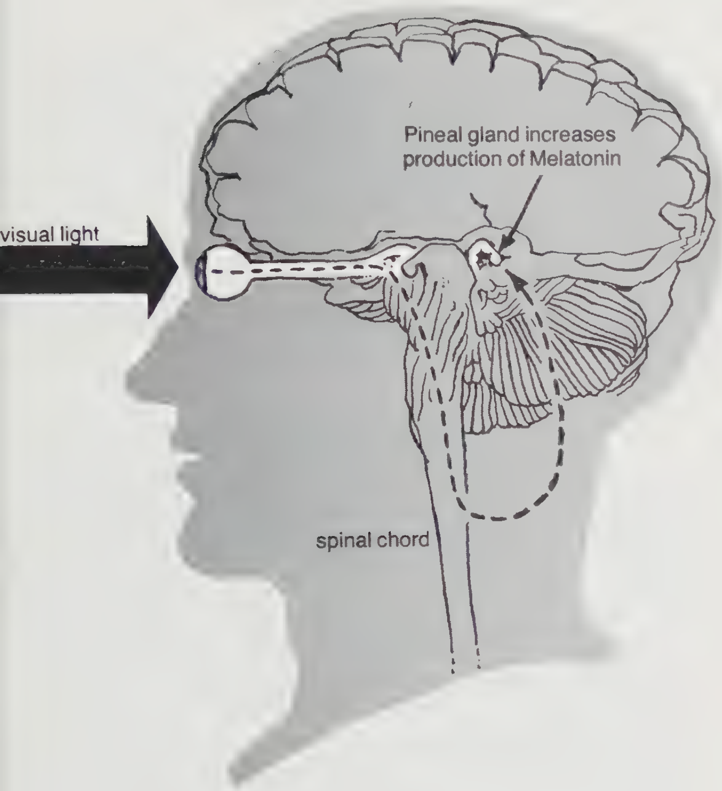
Sunlight affects the hormonal balance of the body in two ways; by stimulating glandular production when light passes through the eye into the brain, and by producing hormones directly in the skin.

Exposure of the eyes to sunlight affects one's hormones

When light enters the eye, it stimulates nerves in the back of the eye to send impulses to the spinal cord. From there the impulse is sent back into the brain to a tiny organ called the pineal body.

The pineal body or gland, produces a hormone called melatonin. This hormone not only affects the brain but also other glands such as the pituitary, adrenals, ovaries, and testes.

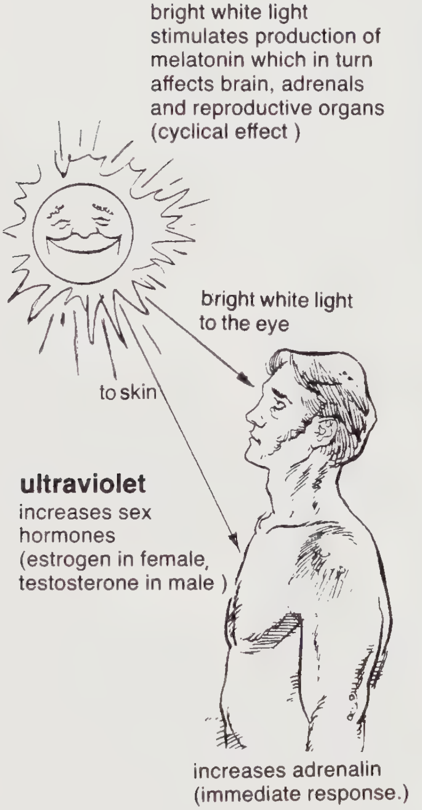
When melatonin is given, it induces sleep and will actually change the wave pattern on the



Visual light stimulates the pineal gland to secrete melatonin.

electroencephalogram. It also seems to have control of various glandular functions: for example, it can stop the ovaries from ovulating (5), and can delay sexual maturity(6).

Notice the two-way arrows between the adrenal glands and melatonin (page 218). When experimental animals are kept under highly stressful conditions, melatonin is secreted regardless of the lighting. It appears that the pineal gland's secretion of melatonin is influenced by



Hormonal Response to Sunlight.

the presence of epinephrine in the blood stream, which is produced by the adrenal glands when an animal is under stress. Melatonin, therefore, may function as a stress hormone as the other adrenal hormones do (7).

Exposure of the skin to sunlight affects one's hormones

When sunlight strikes the skin, it produces sex hormones in the skin itself. Research reports show that sunlight produces an estrogen-like substance in the skin which moves into the blood. This substance will start the menstrual cycle in castrated female rats and mice (8). Sunlight elevates human-female hormones, and will elevate human-male hormones even more rapidly (9).

The author has observed that, depending upon the problem involved, young women who are not having monthly periods may establish regularity following several months of sunbathing and an out-of-door lifestyle.

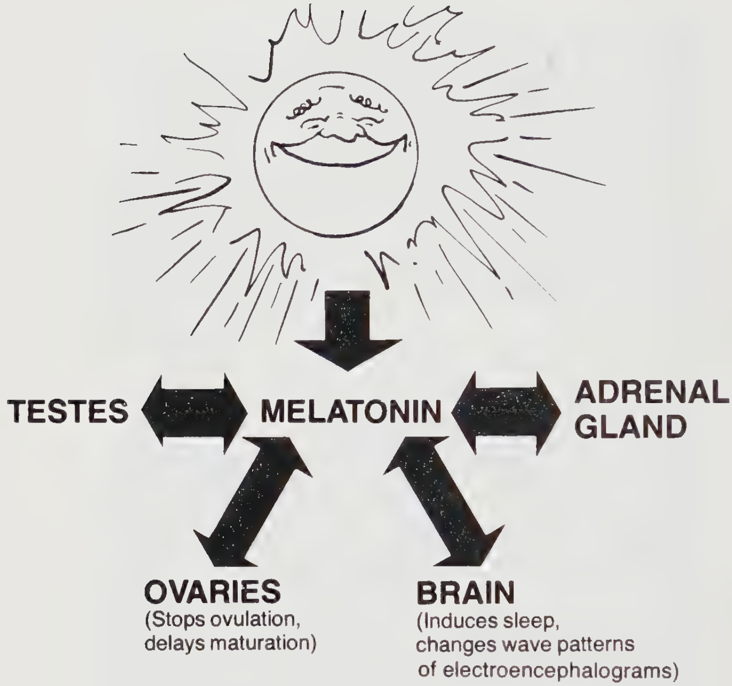
A former patient, who was a 23-year-old nurse, complained that she had not had a menstrual period for two years. When I questioned her as to her physical activity during that time, she told me that during the two-year period and prior to that time as well, she had been indoors almost all the time. As a student nurse, she had been very busy with studies and work and so had not had time to spend out-of-doors.

I advised her to begin a sunbathing program, very slowly at first with only a few minutes out-of-doors, then to gradually increase her time in the sun to several hours as her body became accustomed to the program.

Within two months of beginning the sunlight therapy, she had a small menstrual period; the next month her menstrual period was normal, and she has menstruated regularly since that time.

Another patient, a 50-year-old woman, came to me because of severe menopausal symptoms. Emotional instability and hot flashes were causing her great distress. I started her on a progressive sunbathing program, and after three months she reported that her hot flashes were almost gone, and she was really enjoying life now with her new-found emotional stability.

As previously mentioned, male sex hormones are also elevated by sunlight. When the chest or back is exposed to sunlight, the male hormones may increase by 120 per cent. When the genital area is exposed, the hormones increase by 200 percent. When equal areas of back and genital skin (such as 4 square inches of each) are exposed to sunlight, there is almost no rise of male hormone from the the back exposure as compared to a good rise of hormone with the same exposure of the genital area (9). This finding is consistent with the principle that different areas of the skin, when exposed to sunlight, are more effective than others in having certain effects upon the body. As another example of this principle, skin on the back is far more effective in producing vitamin D than is skin of the abdomen (10). More information about the skin's specialized areas may be discovered in the future.



Melatonin affects glands of the body.

In young men and women, sexual inadequacy or dysfunction is usually a psychological problem. In aging men and women, a deficiency of the sex hormones can produce sexual dysfunction. When hormones are replaced, it can make a dramatic difference. Perhaps sunlight can be used effectively to replace the deficient hormones. There may also be many other diseases and abnormal conditions, which produce hormone deficiency, that could be helped by sunlight treatments.

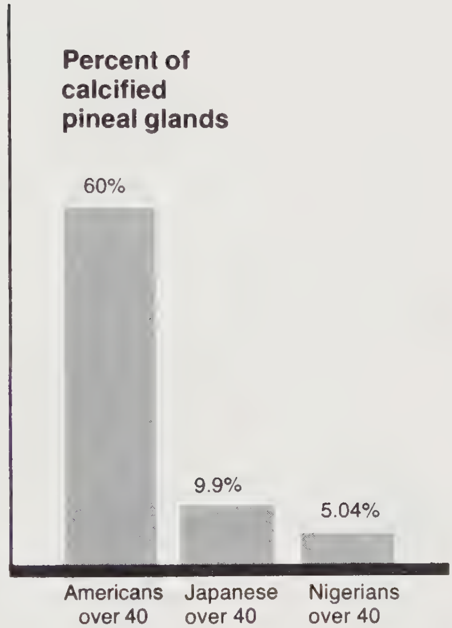
There is some evidence in the scientific literature that adrenalin is produced in the skin during exposure to sunlight (11). Adrenalin can stimulate the pineal body to produce more melatonin. This will in turn affect the hormone-producing glands in the body (12).

On the one hand, it appears that sunlight, by way of melatonin, depresses the function of the gonads; on the other hand, sunlight appears to stimulate the gonadal function by way of increasing the sex hormones in the skin. How the conflicting aspects of solar hormonal stimulation correlate is yet to be understood. Perhaps the antagonistic effects upon the gonads provides a protective check and/or balance.

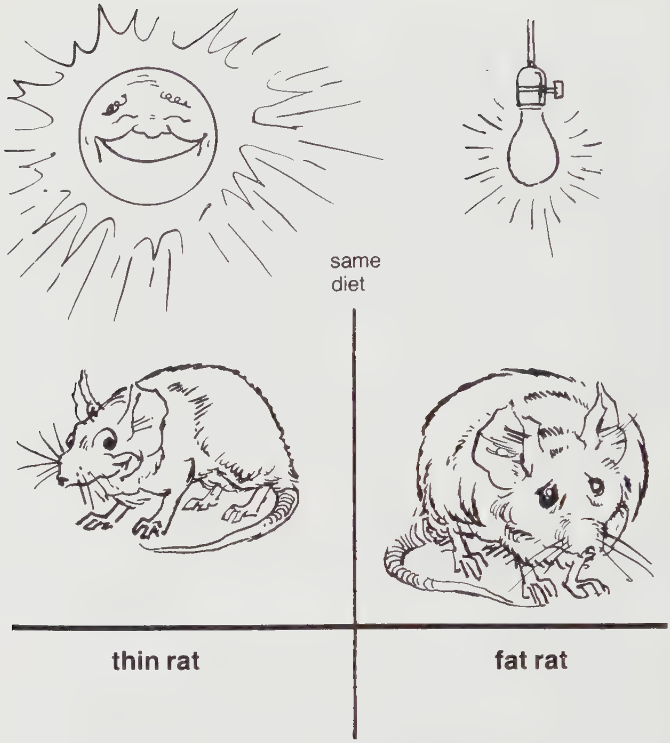
Melatonin and cancer

Continuing research confirms again and again the importance of melatonin. When the melatonin-producing pineal gland is destroyed in animals, they become much more susceptible to cancer; malignant melanomas will grow larger and metastasize to more areas of the body in these animals than in those that have functioning pineal glands (13).

In humans, the evidence that light is involved with cancer is coming into focus. When the pineal gland in humans becomes calcified, it cuts down its production of melatonin (14). This, in turn, stimulates the production of estrogen, which causes an increased amount of breast cancer (15). Up to 60 per cent of Americans have calcified pineal glands when they are over 50 years of age (16). In Japan, only 9.9 percent (17), and in Nigeria 5.04 per cent (18) of persons beyond 40 have calcified pineal glands. Since the



Calcified pineal glands of different cultures.



Sunlight's effect upon the weight of experimental animals.

incidence of breast cancer is low in Japan and South Africa and high in North America and Europe, it would appear that calcified pineals are associated with an increased incidence of breast cancer.

The reasons why the pineal gland becomes calcified remain obscure. The low-light intensity that the human eye receives while indoors combined with the lack of stimulation of the pineal, may be factors contributing to calcification of the pineal. This hypothesis deserves further study.

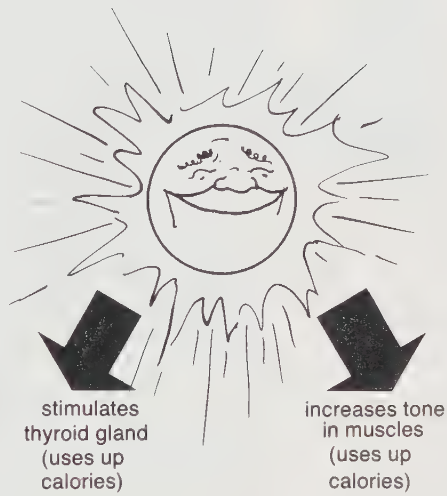
Overweight

Experimental animals that receive sunlight treatments lose weight as compared to animals given the same diet but not the sunlight treatments (19). How the sunlight treatments were able to cause a weight loss is unknown. The investigator who did the experiment, however, decided after various tests that the weight loss was due to the sun's stimulation of the thyroid gland.

Recent evidence now makes it clear that sunlight does stimulate the thyroid gland to increase hormone production (20).

Stimulation of the thyroid gland increases the body's basal metabolism rate, burning up more energy or calories.

When sunlight strikes the skin, it also increases the tone of the muscles under the exposed skin (21). This, in turn, burns more calories and would increase weight loss.



Sunlight's influence on weight.

Summary

Although the evidence is fragmentary, it does appear that light plays a powerful role in the balance and rhythm of the hormones in the body. Our environmental lighting should be such that it matches the full spectrum of the sun. Also, the intensity of light indoors should be increased, as much as is practical, by using more windows and skylights. Curtains should be pushed back to allow all the light possible to enter the room. Dark nights and bright days will help keep the hormones in the body functioning properly.

Chapter

14

Sunlight and Werewolves

"Everyone is a moon, and has a dark side which he never shows to anybody."

— Mark Twain

For centuries people have believed that humans could be transformed into wolves. This transformation was thought to be the result of personal intent, by the witchcraft of others, or by the instigation of the evil spirits. Out of this legend have grown many spine-tingling horror stories. Stories of werewolves have been recorded in the literature of five continents and reached their height during the Middle Ages. In studying the medieval descriptions of werewolves there seems to be a surprisingly common picture among them. They were usually excessively hairy creatures with greenish or yellowish skin, with many severe sores and scars on the face and hands. The mouth, lips, teeth, and urine were red and the eyes unsteady. They were (to say the least) mentally deranged. They were usually found wandering at night. It was felt that the sores and scars were from associating with wolves or perhaps as a consequence of their attacks on humans. The red mouth, teeth, and urine were believed to be from sucking blood (1, 2). Werewolves were reported to occur more than once in the same family (1).

Physicians today know that the symptoms of a congenital disease called erythropoietic porphyria have a remarkable relation to the descriptive medieval accounts of werewolves. Erythropoietic porphyria is a disease caused by the build-up in the tissues of large amounts of porphyrin molecules which are light-sensitive. When light strikes this molecule, it is activated and becomes very destructive. It will cause severe sores on exposed surfaces of the body. Porphyrin is colored red and will discolor the mouth, teeth, and urine when it builds up in the body. Individuals with this disease are often anemic, hence pallid (yellowish-green) in color. They cannot be exposed to light as its effects will be very destructive; hence, they have to stay indoors during the day and venture out only during the night.

Werewolf

Werewolves, in all probability, may be the first, albeit extreme, recorded cases of photosensitivity. Sensitivity to sunlight still remains a problem today. A number of diseases and drugs can cause skin to become abnormally sensitive to sunlight.

Carotene, the percursor to vitamin A, appears to be beneficial in treating some types of photosensitivity. The itching, burning, redness, and swelling of the exposed skin is dramatically cured when carotene is included in the diet (3).

Certain diseases like systemic lupus erythematosis may cause abnormal sensitivity to light. The exact cause of this disease is unknown; however, there is some evidence that a virus may be involved. If so, sunlight could be very helpful in building up the white blood cells that fight viral infections. Those with systemic lupus erythematosis should take extra care that they do not become sunburned. Their initial exposure time, when beginning sunlight therapy, should be brief, and they should build up gradually to a longer time out-of-doors.

Carotene can help decrease the burning effect of sunlight (4), as well as protect against the sunlight-sensitizing effect of certain drugs (3).

Many drugs sensitize the skin so that it burns easily. A partial list of these more common drugs appears below in Table 1.

Table I

Drug	Clinical uses	Clinical observation
Sulfa	Antibacterial agent	Exaggerated sunburn
Para-amino-benzoic acid	Sunscreen	Exaggerated sunburn
Sulfonylureas *Orinasc* *Diabinase*	Hypoglycemic agents used to treat diabetics	Exaggerated sunburn
Chlorothyiazides *Diuril* *Hydrodiuril*	Diuretics for high blood pressure	Skin erruptions and rashes
Tranquilizers *Stelazine* *Thorazine* *Compazine* *Sparine* *Librium*	Tranquilizers for nervous condition	Rashes and exaggerated sunburn
Antibiotics *Tetracycline* *Declomycin* *Aureomycin* *Griseofulvin*	Broad-spectrum	Exaggerated sunburn
Antiarrhytmic Quinidine	Used to suppress abnormal heart rhythms	Potentiates sunburn
Halogenated antiseptic compounds	Used in soaps, cosmetics and other consumer products	Exaggerated sunburn
Antihistamine *Phenergan*	Used for colds and allergies	Exaggerated sunburn

The above table is by no means complete but will give the reader a general list of various medications that may cause problems when one is exposed to the sun. As an example, antiseptics added to soaps and other cosmetic compounds, may cause problems. Careful studies have shown that under conditions of normal use, even dark-skinned individuals who are sensitive to these products can suffer severe sunburn after having been in the sunlight for only a few mintutes (5). Many of these persons probably feel they are allergic to sunlight and avoid it completely, when actually the antiseptic in their soap or cosmetic is causing the problem.

If you believe yourself to be extremely sensitive to sunlight, check with your physician as to the cause of your photosensitivity; look over the list of drugs in this chapter, examine your cosmetics and soaps, and make sure to include an ample amount of carotene in your diet. Above all avoid burning by carefully beginning with a brief exposure time and gradually increasing the time as your body's tolerance to the sun is increased.

White
Saasha
DRUG
DRUGS

Chapter 15

Sunlight, Arthritis, and Miscellaneous Diseases

"Love comforteth like sunshine after rain."
— William Shakespeare

The use of sunlight for treating arthritis dates back many centuries. Reports of its healing effect are recorded in the scientific literature of many different periods of history.

In 1815, Dr. Cauvin wrote concerning a severe case of arthritis that he cared for personally.

> I believe that the sun is a powerful cure for rheumatism. Here is an observation of mine to prove it: In January, 1808, one of my college comrades, age 23, was attacked with acute articular rheumatism, first in both knees, then in the joints of the leg and foot. There was redness and swelling around each....In spite of all treatments, the condition became chronic and he became bedridden....This went on until mid-April....I decided to take him to the country. We rented an apartment with a southern exposure in St. Germain....I tried to have him receive the benefit of light as soon as possible. I carried him from his bed to a reclining chair in the sun. The first day, the shock of this new life fatigued him a little and in the evening he had a little fever. The next day I allowed him to rest. The second exposure was less fatiguing and successive exposures increased my

hopes. As the sun became stronger, so did my patient. Each day I prolonged the time for insolation. At first his lower extremities, sites of the disease, were exposed to the sun, but covered by linen cloth day and night. Little by little I removed the clothing and exposed the bare skin....I obtained a marvelous result. Little by little the joint swelling went down....On rainy or cloudy days I placed previously warmed flannels around the joints. In the evenings I exposed the joints to glowing coals, but I was more successful with the heat of the sun. Soon the patient could move his limbs in all directions. He took his first steps in the house. On June 15, we took a short walk in the forest. Eventually my friend felt recovered completely and he never has had another attack of rheumatism. (1)

You will notice that it took several months of sunbathing before beneficial results were obtained. Sunlight is a lot like exercise in that it may take a number of weeks before beneficial results are observed.

In 1845, Dr. Bonnet, in his book on the treatment of arthritis, also recommended sunlight as the choice treatment for arthritic, swollen knees (2).

In some foreign countries, especially in Russia, sunlight treatments are given routinely to miners because of their beneficial effects. In one study there was a definite reduction of arthritis in those miners who received the sunlight treatments (3).

Cortisone is used to treat arthritis. It generally seems to decrease the symptoms of joint pain, although long studies have shown that it will not stop the deformity that occurs with severe arthritis. Cortisone was given to one group of children with severe arthritis while a similar group was given sunlight treatments. The arthritic symptoms of those taking cortisone decreased more rapidly, but the people in that group were also more susceptible to infections and suffered some side effects from the cortisone. Although the arthritic symptoms of the group getting the sunlight treatments decreased more slowly, relief did come. Resistance to infection increased and, of course, no one suffered from any of the side effects that accompany cortisone treatment (4).

One of the worst types of arthritis is rheumatoid arthritis, for it can cause serious deformity of the arms and legs. The blood of persons having this disease usually has an abnormal antibody called rheumatoid factor, and this factor can be produced in experimental animals by repeatedly injecting them with bacteria. Humans may also develop this rheumatoid factor at times when they have a chronic infection, but it usually disappears after the infection has cleared up. Because of this and other available information, most researchers feel that rheumatoid arthritis may be caused by an infectious agent such as a virus or a bacterium (all of the evidence is not in yet since the offending "bug" has not been identified).

Arthritis

Sunlight can help arthritis in several ways. The warm rays loosen stiff, sore joints and can have a general relaxing effect. Probably the greatest effect which sunlight has on the disease is the building up of the immune system and of the body's resistance to invading germs. Since some types of arthritis may be caused by germs, a review of the chapter on infectious diseases will give a clearer picture of the ways in which arthritic patients might be helped by sunlight.

Wounds

Since the 18th century, sunlight has been known to be beneficial for the healing of wounds (5). Additional favorable reports of the wound-healing effect of sunlight have become available more recently (6).

Wounds receiving sunlight treatments seem to heal faster, better, and have a much greater blood supply (7).

The fact that sunlight keeps a wound germ-free, suggests one way in which sunlight encourages healing (8). It seems, however, that since there is more rapid healing and a better blood supply in germ-free wounds treated with sunlight than in wounds not so treated with sunlight and yet equally germ-free, that sunlight must promote healing in more ways than just keeping the wound free of germs. The sunlight may promote production of a hormone that stimulates cells to rapidly divide and multiply, thereby promoting the process of healing (9,10).

Sores and ulcers

There are many factors which may lead to impairment of the circulation of the blood, either in a specific area of the body, or in the whole circulatory system. Some of these factors are obesity, paralysis, old age, prolonged fever, diabetes, anemia, etc. Whenever one has impairment of the circulation, he is in danger of developing body sores, which may lead to ulceration and even gangrene. It is encouraging to note that slow-to-heal sores and ulcers of this type have been found to be helped by ultraviolet light (11).

Adult jaundice

Jaundice in adults can be caused by a number of different factors. Infectious (viral) hepatitis is one disease in which the accompanying jaundice may usually be decreased by sunlight treatments. In my experience, patients with this disease seem to do much better with sunlight treatments than patients who do not take the treatments. It seems probable that exposure to sunlight not only lowers the level of the bilirubin, which causes the jaundice, but also strengthens the immune system so that the invading viruses may be destroyed more quickly.

Gout

Ultraviolet light is believed to aid in excretion of uric acid. This gives support to the use of ultraviolet light in the treatment of gout (14).

Psoriasis

Psoriasis is a common disease of the skin which is often treated with sunlight therapy. People who live in hot, sunny areas of the world are less subject to this disease than are those who live in cooler areas (15). Also, the bothersome symptoms and effects of a patient's chronic psoriasis seem to be reduced during the summer months. Regular sunbathing can usually keep psoriasis under control. The dietary recommendations in this book are especially important for psoriasis patients.

Acne

Acne is another common skin disease that is frequently treated by sunlight. When sweat glands become plugged and infected, sunlight can help to sterilize the area. Dead cells in the outer layer of skin tend to plug up the sweat glands, a situation in which sunlight, by causing a more rapid renewal and removal of the outer layer of skin, is very beneficial, for it allows the sweat glands to drain, decreasing the congestion and inflammation in the surrounding areas.

Here, we must emphasize again, that persons having a skin disease, such as acne, must attempt to follow carefully the special dietary plan which this book recommends for sunbathers.

Baldness

There are reports in the scientific literature of the use of sunlight to stimulate hair growth, especially in a condition called alopecia areata, in which patches of hair fall out and require months to regrow (16). Thorough, controlled studies need to be done in order that we may know if some types of baldness can, in fact, be cured, or if the rate of progressive baldness may be slowed by sunlight.

A rare skin cancer

A rare, malignant skin cancer, known as mycosis fungoides, has been treated very successfully with sunlight therapy. Barbara Gilchrest of Massachusetts General Hospital's Photobiology Department reports that 10 of 11 patients with this condition achieved 95% clearing during a three-year study. Two who continued treatments are still disease-free; three of the eight who stopped the treatments died of the disease (17).

Peptic ulcers

Russian scientists have been experimenting with ultraviolet light for the treatment of ulcers. They found the light to be beneficial not only in the healing process, but also in the prevention of the reoccurrence of ulcers (18, 19). It appears that ultraviolet light has an effect on the deep internal organs. The pancreas, stomach, liver, kidneys, and adrenal glands are apparently benefitted by light treatments. The effect is seemingly due to the stimulation of the sympathetic nervous system (20). Sunlight can alter the flow of hydrochloric acid, which may be the reason stomach and duodenal ulcers respond so favorably to light therapy. The adrenal glands contain more adrenalin following sunlight treatments, and this may account for one's increased ability to withstand stress after such treatments (20).

Chapter 16

How to Sunbathe

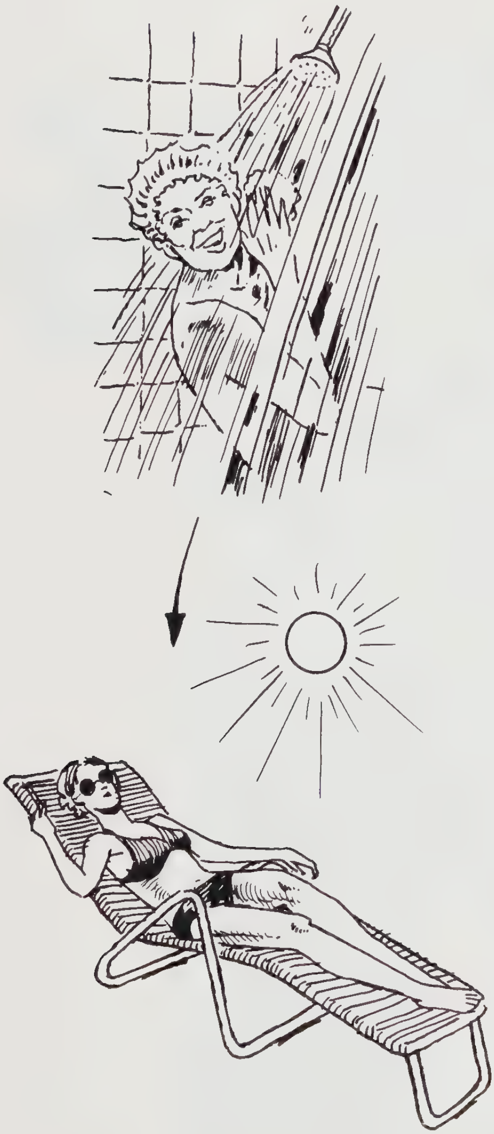
"Is it so small a thing
To have enjoyed the sun?"

— Matthew Arnold

How long

When one conducts a question-and-answer period after lecturing on sunlight therapy, almost invariably, someone will ask, "How long should I sunbathe?" At first, this question seems simple enough, but answering it properly usually means giving a fairly lengthy explanation. First of all, one should consult his physician before beginning a sunbathing program. He can best evaluate your particular needs and possible problems.

One's sensitivity to sunlight is the first deciding factor. Some can spend hours during the summer out-of-doors and not become sunburned, while others can spend only a few minutes. As mentioned in an earlier chapter, many drugs, cosmetics and soaps can so sensitize the skin that burning becomes a real problem. Generally, blond and red-haired people need to



Washing and then sunbathing.

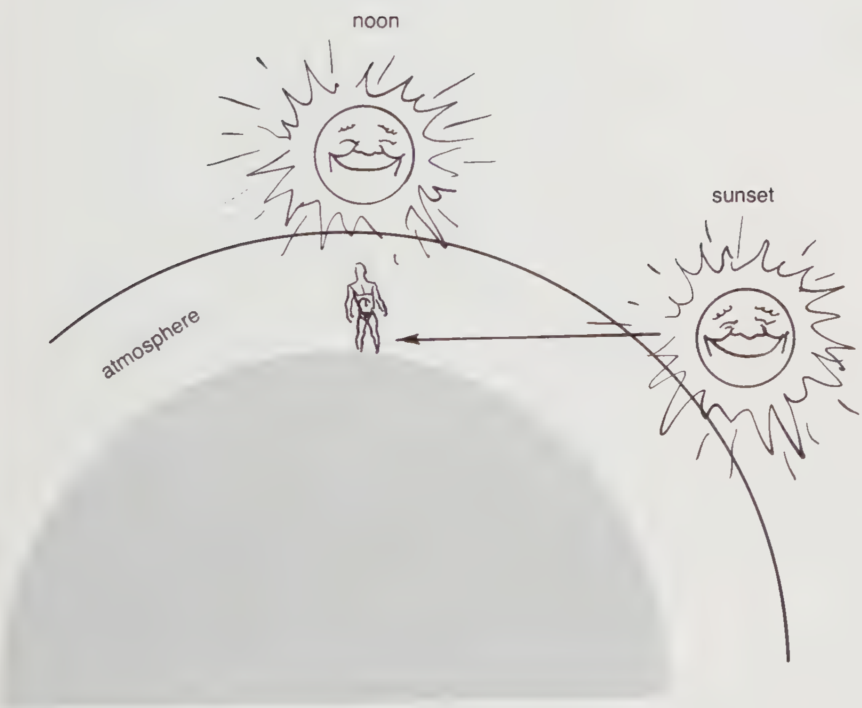
begin with brief exposures to sunlight, and they will require less total sunlight than do brunettes, because the light can pass more readily through lighter skin. Dark-skinned people can spend more time in the sun initially, and then they will need to increase their exposure time, because sunlight does not readily penetrate dark skin.

The time of day that one is able to sunbathe is important, because as the sun rises higher in the sky, more ultraviolet light rays become available. This is because the atmosphere is in a uniform layer around the earth, and the higher the sun rises in relationship to a given point, the more directly its rays can shine upon that point.

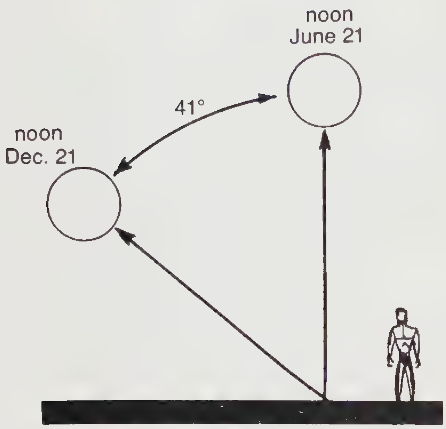
Especially during the winter months (when the sun is low) sunbathing, either early or late in the day, will not be very effective. Jogging in the early morning or in the evening will give some exercise and fresh air, but he will miss the sun's healing rays.

During the summer, it is preferable to sunbathe earlier in the day while the air is cooler, because sunbathing can become uncomfortable as well as dangerous during the heat of the day. Overheating is definitely a thing to avoid. If one feels himself becoming too warm, he should move into the shade or take a lukewarm shower. One can always go back to spend more time in the sun after his body has cooled. One should not be afraid of sweating, as the sweating process cools the body and eliminates toxins, and the sweat contains substances that can absorb some of the sun's burning rays (1).

The beneficial effects of the sun vary not only according to the time of the day, but also according to the location on the earth. To illustrate how



Ultraviolet light is filtered out when passing through large amounts of atmosphere.



Summer noon position of sun and winter noon position of sun.

Table I

Variables affecting length of sunbath

type of skin
location on earth: elevation, latitude
season of the year
time of day
surrounding environment

the time of day affects the amount of sunlight, let's look at an area across North America, 40° north latitude, which would take in such cities as Salt Lake City, Denver, Indianapolis, and Philadelphia. Let's use untanned, white skin as our base and consider how much sunlight it would take just to start the skin turning red. Burning could start to take place if exposure lasted 30 minutes or less, from March to October, provided the sunbathing took place between 8 am and 4 pm. From November through February it would take much longer than 30 minutes and the sunbathing would have to be done between 10 am and 2 pm.

Contrast this with an area 60° north latitude that would take in Seward, Alaska; the southern tip of Greenland, Oslo, Stockholm, Helsinki; and Leningrad. Here, exposure for 30 minutes or less would give a burning reaction from April to September, provided the sunbathing were done between 8 am and 4 pm. From November through February it may be impossible to get enough sunlight to cause the skin to turn pink (2). Most of the beneficial effects of sunlight can be obtained without turning the skin red, so even in northern areas, winter sunbathing can be helpful.

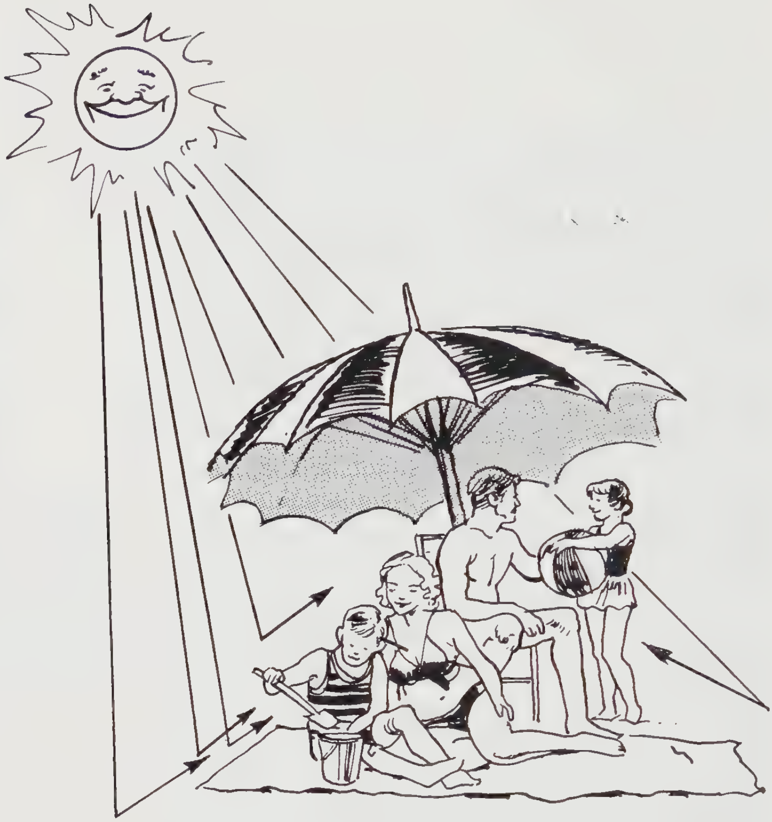
It is apparent now that the time of day, season of the year, and latitude are all important when considering how much time to sunbathe. Elevation also plays an important part, for sunburning can take place faster at mile-high Denver, Colorado, than it can at sea level, for the sun's rays have a mile less of atmosphere through which to pass. In addition, atmospheric turbidity and the amount of ozone in the upper atmosphere are factors that may change the amount of ultraviolet light available. These are factors which, of course, the sunbather cannot control.

One last important item, which concerns the length of time to sunbathe, is the environment where the sunbathing takes place. If one is sunbathing at the beach, he will probably burn in less time than on the back lawn. The amount of ultraviolet light reflected from the environment can make a big difference. Snow will reflect about 85% of the ultraviolet, dry sand 17%, and grass 2.5%. Water is a poor reflector of ultraviolet light, contrary to popular opinion.

There are a number of factors which tend to accelerate sunburning when one is at the beach. As mentioned above, the sand reflects ultraviolet light, so that there are more ultraviolet rays bouncing at the sunbather, from all directions, than he realizes. Then, too, cool ocean breezes tend to give one the feeling that the sun's rays are not as intense as they really are. Reflection of the sun's rays by a clear, blue sky overhead, may double the effect of the ultraviolet rays which come from the sun itself. Add to this the effect of the wide, open beach with few or no buildings or trees to cut down the rays from overhead or from the beach's reflection, and one begins to see how easily one may burn before he realizes it. A beach

Table II

Reflecting surfaces	
snow reflects	85% of ultra violet
dry sand reflects	17% of ultra violet
grass reflects	3-5% of ultra violet
water reflects	3-5% of ultra violet



Reflection of ultraviolet light on beach even in the shade.

umbrella may screen one from the direct overhead rays of the sun, but not from those reflected off the sand and other surfaces.

One other thing to remember is that wet skin will burn more rapidly than dry skin (3).

Possibly by now you are completely confused as to how much time to sunbathe. It really comes down to a program that varies with individuals. The best way to start is by experimenting, perhaps 2 minutes on each area — front, back, right, and left side — in full summer sun, and then one should gradually increase the exposure on each area by, perhaps one minute or longer every day. If you turn slightly pink several hours after the exposure, hold the time steady for several days and then again start increasing the exposure time. It is best, when starting, to keep the time lower than necessary rather than longer and experiencing a burn. Don't overkill! Never burn!

Very fair-skinned people and albinos who do not tan can become resistant to sunburn by repeated exposures and the thickening of the outer layer of the skin.

Try to sunbathe during the same period of time every day, and in the same area, so you can soon know exactly how long to stay.

A question that comes up frequently is, "Can I sunbathe with my clothes on?" The answer is, "Yes," but remember that sunlight, to be effective, has to strike the skin, and tightly woven material will filter out the ultraviolet as well as the visible light. Therefore white, loose-knit clothing is best in this case because small amounts of light can penetrate. The circumstances and the situation certainly will dictate how much skin can be exposed while sunbathing. In a semiprivate area, a bathing suit can be worn; in a more public area, shorts and a brief, white top may be more appropriate. In a secluded area, sunbathing in the nude may be in order. Certainly, one showers or bathes nude. What's to hinder sunbathing the same way, if the circumstances allow?

"What kind of cream, lotion or screen do I put on my skin while sunbathing?" This question must always be answered with an emphatic, "No kind!" Clean skin is the best (skin washed with

Avoid suntan lotions and sunscreens.

plain water to remove soap films and cosmetics that may sensitize it).

"But I burn so easily that I can't stay out in the sun very long." Then, get out of the sun sooner, as there is no excuse for lying out in bright sunlight for hours, using lotions and screens, if you are not seasoned to it by graduated, day by day exposure. "The sun dries my skin." Not if you use sunlight moderately and in graduated doses. If you overdo it, certainly your skin will dry out and flake and peel, but used moderately, sunlight will give the skin a soft, velvety-smooth feel along with a healthy glow.

As previously mentioned in the chapter on cancer, fat or oil applied to the skin will stimulate the formation of cancer cells (4). Most of the suntan creams, butters, and lotions have fat as their base and they should not be used.

Sunscreening agents, like those based on para-aminobenzoic acid (PABA), will filter out sunburning rays but will still allow some tanning rays to pass. However, many of the therapeutic and healing effects of sunlight are blocked out by these sunscreening agents (5).

PABA, which is finding its way into so many sunscreen preparations, is running into trouble. Researchers have now discovered that the chemical causes increased genetic damage when exposed to sunlight. Damage to the genes and chromosomes composed of DNA is serious because the cells are not able to properly reproduce themselves if their genetic material is damaged. In a recent research paper, Dr. Hodges states, "In this paper we present results which indicate that PABA can increase the formation of ultraviolet-induced damage to DNA at wavelengths which are present in normal sunlight" (6). The long-term effects to the skin cells of this genetic damage are at present unknown.

Sunbathe year around

In most temperate climates it is possible to sunbathe the year around if you get out of the wind. On bright, sunny winter days it is a fabulous experience to lie in the warm sun. The secret to this is getting completely out of the wind with no air movement over your body. You can lie in the sun on days so cold that your breath can be seen as billows of white steam, and yet you can be perfectly warm. The sun's rays will feel hot on your skin if you are out of the wind. You will

Location	Season	Hours of day	Average duration
40° latitude	March-Oct.	8 a.m.-4 p.m.	30 min.
	Nov.-Feb.	10 a.m.-2 p.m.	1 hour
60° latitude	April-Sept.	8 a.m.-4 p.m.	30 min.
	Oct.-March		limitless

Approximate time required to produce redness in untanned white skin.

need a warm blanket to lie on. If a cloud comes between you and the sun, make a dash for the house, as you will chill quickly without the sun.

A good sunbathing area can be built away from the house, on the roof, or against a wall facing the sun. Make the walls of material that will be a good windbreak; for instance, plywood or close-fitting boards. The wall facing the sun should be at an angle slanted toward the sun so the low winter rays can shine into the sunbathing area. A door can be made on either end, or both, giving entrance and allowing air passage on hot days. Louvered doors and portions of walls that can be opened partially to allow air passage are ideal.

Often the complaint is voiced that there is no time to sunbathe during the week because of the work schedule, for by quitting time the sun is rapidly dropping out of sight. If possible, a two-hour lunch break would be ideal. One could start his work earlier in the morning and end it later in the day. During this break there would be time for a period of exercise followed by a sunbath and lunch. Progressive companies, interested in the health of their employees, could initiate two-hour lunch breaks and provide areas on top

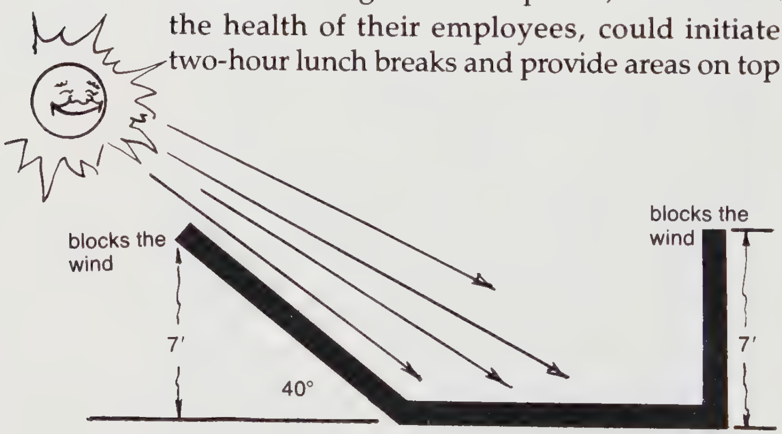


Diagram of outdoor sunbathing area

of buildings, or elsewhere, for sunbathing.

There are people who cannot get a long lunch break and, even if they could, would have no place to go to sunbathe because of their environment. Their living quarters may be an apartment with no place provided for getting out in the sun. This is a very difficult problem with no simple solution. Some of these same people probably have trouble finding a good place in which to jog because of their big-city environment. Moving into a less congested area where there are open areas for exercise and sunlight, as well as a back yard where a sunbathing area is available, certainly is to be recommended. If this is not possible, providing an artificial form of full-spectrum light is the next best solution.

Sunlamps

You probably have noticed that thus far in the book we have avoided discussing sunlamps. Why? First of all, they are not nearly as effective as natural sunlight. It is true that many of the experiments which show ultraviolet light to be beneficial have been done with sunlamps; however, it is quite certain that natural sunlight would have given even better results.

Ultraviolet light is not visible to the human eye and when used alone may actually break the chromosomes in our cells. On the other hand, visible, bright light will keep intact or even repair broken chromosomes, especially blue light which is found in the natural, full-spectrum sunlight (7).

If we were to design a sunlamp that would fill all the criteria for natural sunlight, it would have

	Short term response (Response after several days exposure)	Long term response (Response after weeks to months exposure)
↓ Blood pressure	•	
↑ Cardiac output	•	
↓ Resting heart rate	•	
↓ Respiratory rate	•	
↓ Blood cholesterol	•	
↑ Electrocardiogram improved		•
↑ Oxygen carrying of blood	•	
↑ Resistance to infections		•
↓ Blood sugar	•	
↑ Energy & endurance		•
↑ Muscular strength		•
↑ Stress tolerance		•
↑ Vitamin D produced	•	

to be an intensely bright white light with both ultraviolet and infrared that matched the spectrum put out by the sun. As far as we know at this writing, a sunlamp filling all these requirements does not exist. Some of the sunlamps commercially available have wave lengths that are different from the natural sunlight and may actually do damage. Not all lamps are of the same quality, and some are definitely better than others. Do not buy a sunlamp that produces ultraviolet rays with frequencies below 290 nm.

Several companies now manufacture fluorescent tubes that produce ultraviolet rays with frequencies above 290 nm. The fixtures holding the tubes should be mounted on the wall in a vertical position so one can stand about two feet away, rotating the body to expose all four sides. Be sure to wear protective glasses at all times. Infrared lamps can be mounted alongside the fluorescent fixture to provide heat to keep you warm.

Start with one or two minutes on each side and then gradually increase the time. If you become slightly pink following the light bath, hold the time and don't increase it until your skin has adjusted.

Do not mount a sunlamp above your bed unless it has a timer that will shut off automatically when the light bath time is over, even though you should go to sleep. Burning is dangerous, so don't take any chances.

Sunlamps are only for those who cannot get the natural sunlight — those who live close to the north or south poles, or in inclement weather areas, or in the glass jungle of the big city. The artificial sun rays may be better than nothing, but they do not approach the value of the actual sunlight. Make every effort to obtain as much of the real thing as possible.

Some glass manufacturers who are aware of the latest scientific information regarding the importance of ultraviolet light to health will produce window panes which allow the full spectrum of sunlight to pass through them. Replacing your existing glass with these panes is possible for an additional cost. Using ultraviolet window panes in new homes, especially those designed for solar heating, is ideal. This trend opens up an exciting new future for solar homes. With such windows one could enjoy sunbathing indoors even during winter blizzards, since overcast skies filter out only about 20% of the ultraviolet light.

Progressive optical companies are producing eye glasses and contact lenses which pass the full spectrum of sunlight. These lenses can have a grey tint but should not be colored.

It is encouraging to see that industry is keeping abreast with the latest scientific research in this area so that in the future we may look forward to better health as a direct result of these revolutionary developments.

Artificial sunbathing.

"Exposure to the sun is highly necessary in persons whose health needs restoring and who have need of putting on weight. In winter, spring, and autumn the patient should permit the rays of the sun to strike full upon him, but in summer because of the excessive heat, this method should not be employed in treating weak patients."

— Herodotus

Chapter 17

Solar Therapy of the Past

"If I have regarded the sun in its radiance
or the moon moving in splendor,
so that my heart was secretly enticed
and my hand offered them a kiss of homage,
then these also would be sins to be judged,
for I would have been unfaithful to God on high."
— Job 31:26 - 28, (NIV)

It is impossible to study the ancient history of solar therapy without delving into the companion aspect of sun worship. It was the very obvious necessity of the sun for life and health that led to its deification. And where the sun was worshipped, there also the beneficial aspects in regards to human health were studied, encouraged, and practiced. To understand, therefore, our present stance toward the sun, whether in the form of scientific literature or in the form of the present intuitive response, it is helpful to gain the historical perspective.

Ancient man marvelled at the natural world. Virtually unaware of natural law he sought to explain the mysteries of nature with a childish intellectual perception. The forces of nature that were beyond his control he attributed to deities with characteristics similar but superior to his own. The sun being the most brilliant object in the sky and the source of warmth and light became the object of greatest interest. And hence the sun was regarded as a potent, dominant god. As ancient man progressed from the pastoral stage to the agricultural stage, his observation of the sun became more accurate. He found that when daylight and darkness were almost equal, the germination of seeds and the growth of vegetation quickened and that all soil preparation should precede this time. Experience taught him that the reaping of crops should be done before the hours of darkness exceeded those of daylight. Thus in time a fuller knowledge of the behavior of the sun was developed. Ancient man became so intimately involved with the sun that in virtually every culture, the sun, in some aspect, was worshipped. Festive days in the sun's honor were derived from observation of the sun's crucial behavior in the sky, and these festivities are still honored by modern man, albeit for different reasons.

One such observation was in regard to the changing locations of sunrise and sunset. It was found that the changing direction and distance of sunrise in the east corresponded exactly with the same directional change of sunset in the west. It was also found that the hours of daylight were greater when the arc of the sun's path was longest and the noon sun highest in the sky, and that the fewest hours of daylight were when the arc was the shortest and the noon sun lowest. At first this observation caused some anxiety. Did the diminishing hours of daylight mean the sun was dying or losing its power? Would its path reverse and bring summer again with its attendant luxurious vegetation? There was a period of time each year when the sun appeared to stand still, neither increasing nor decreasing its arc.* When the sun began its upward climb and daylight hours lengthened, relief and joy abounded. Hence, the ancient festival held from December 17-24, the Brumalia,** was a time of great rejoicing, marking the end of the period of shortening days and the beginning of the lengthening of daylight hours. December 25 was dedicated to the festival of the Nativity of the Sun (Natalis Invicti Sol) because the increase in the duration of daylight and the height of the sun at noon signified a rebirth of power. This festival was instituted by the Roman Emperor Aurelian (AD 212-274) about AD 273. Since about AD 400, the Christian church has observed December 25 as the nativity of Christ. The church found that pagans accepted Christianity more readily when the dates of the chief solar festivals were retained rather than forbidden. Lacking the actual date for the birth of Christ, they settled on December 25 as politically expedient. Although sun worship is not now associated with Christmas, the gift giving and frivolity that marked the heathen festivals have remained. The abundance of lights in the homes and on the streets and on the Christmas trees are symbolic of the fires built by the sun worshippers to guide the sun god back to their land.

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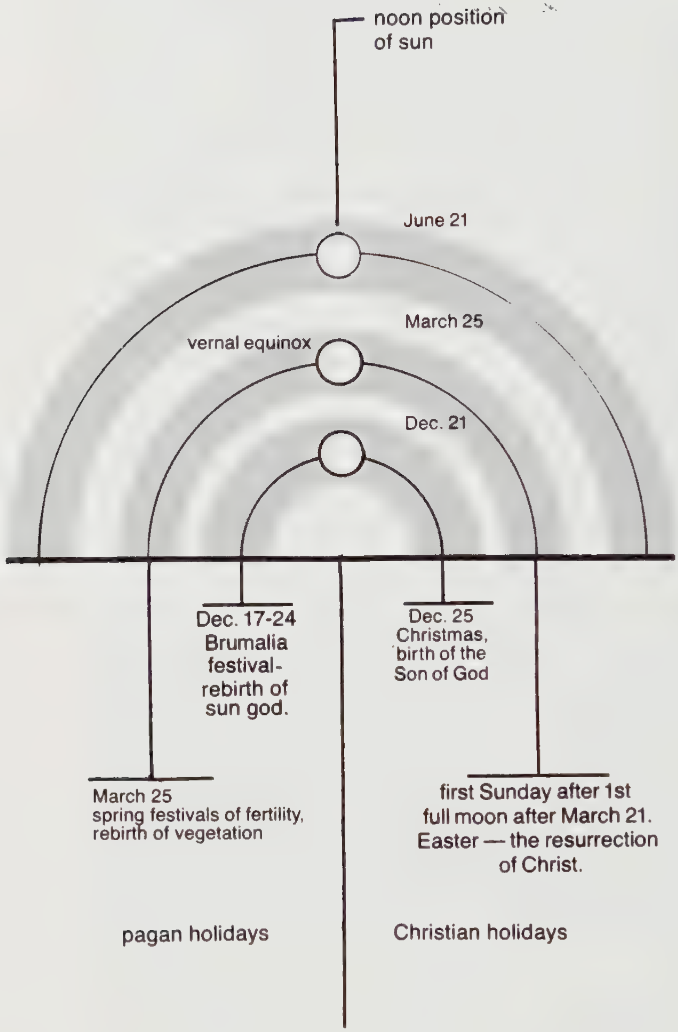
*It is this period that is now called the solstice (fr. L. sol, sun; sistere, to stand). In the northern hemisphere the winter solstice.

**fr. L. *bruma,* shortest day of the year; *brumalis,* pertaining to the winter solstice.



Solar involvement in the Christian calendar.

Vernal equinox

The next most crucial incident in the path of the sun is the day on which the hours of daylight become equal to the hours of darkness.* March 25, in the Julian calendar, is the date of this most special occasion. For ancient man, it was a day of rejoicing, for it indicated that the god of vegetation (Attis) would reawaken to bless the earth with abundance; and so in this god's honor the great spring festivals of fertility were instituted.

The date of our Easter observance (Eastre, Anglo-Saxon goddess of spring) was determined by the council of Nicaea in the year AD 325, at which time it was decided that the anniversary of the resurrection of Christ should, as closely as possible, approximate the vernal equinox. Hence it was decreed that Easter should fall on the first Sunday after the first full moon (for ease of night travel on pilgrimages) after March 21, the approximate date of the vernal equinox. Eggs, rabbits and baby chicks used on Easter celebrations are all symbols of the fertility honored at the ancient fertility festivals.

Summer solstice

This important point in the sun's path in the sky is realized when the sun attains its highest noon position and the period of daylight is longest. It again seems to stand still (solstice) for a few days before lowering its path across the sky.

*This is referred to as the vernal equinox (fr. L. *ver,* spring; *aequus,* equal; *nox,* night.

Today, the time of the summer solstice is little noticed by the world in general, but there does remain in Sweden, a three day festival, called Midsummer's Day, to welcome the season.

Autumnal equinox

After the summer solstice the duration of daylight steadily decreases until it equals the interval from sunset to sunrise on September 22-23. The autumnal equinox is scarcely noticed today.

In addition to the solar pattern of the Christian year, there was the naming of "The Sun's day" as the holy day of the Christian week. This took place not only to ease the pagan sun worshippers into Christianity, but also to provide a way by which Christians could disassociate themselves from the Jews. It was during the fourth century that the adoptions of most of the solar festivals into the Christian year began. The emperor Constantine and his whole household had been ardent sun worshippers. Preceding his conversion to Christianity, he is supposed to have seen a vision of a blazing cross at noonday, this itself being a strong solar symbol. After his conversion, Christianity became the state religion. One Christian historian comments that "the Empire was partly Christianized and the church partly paganized." There must have been confusion following the attempted amalgamation of the first state religion of sun worship and the subsequent state religion of Christianity, with pagan solar festivals and Christian holy days running simultaneously. Augustine had to warn the brethren not to solemnize the day on account of the sun like the heathen, but, rather, on account of Him who made the sun. Leo the Great rebuked those who thought that Christmas was observed for the solstice and not the nativity of Christ. The eastern Christian church taunted those of the western church as being no better than pagan sun worshippers.

There evidently followed an aversion to the sun, for in studying the ancient medical concepts of solar therapy, one notes an abundance of comment during the Graeco-Roman period, but until the 18th century (excluding a few isolated comments), an almost total absence of it following the rise of Christianity.

Table I lists some of the countries in which sun worship became the basis of religion, and shows similar characteristics of worship in these countries.

Table I

Country	Solar deities
Babylon	Marduk and his father, Ea, the supreme healer, were the chief gods of healing. (Nebuchadnezzar II and his successors spent great sums of gold restoring the ancient temple of Shamash, a sun go at Sippar, the original home of Shamash.)
Phoenecia	Baal, god of the burning sun, was referred to as a sun and health god. Gibil, son of Baal, was the noon sun god wh protected people from the plague.
Sumeria	In the lower part of Mesopotamia, Sumer was a region probably settled before 3000 BC. The Sumerians left a record their government, law, business practices, and religion on clay tablets. Apparently the Sumerians believed in a primary trinity of creator gods who ruled over the secondary trinity in which th sun god took his place. Shamash was the semitic sun god. Some believed that the main god, Marduk, was originall solar deity, in particular a god of the spring sun. Hammurabi himself proclaimed: "I am the sun of Babylon which caus light to rise over the land of Sumer and Akkad." The usual title of any Mesopotamian king was, "the sun of his land.
Assyria	Assur unequivocally was a sun god. His symbol was a winged disk, and he was often pictured as an eagle. So power was the dominance of Assur over their other gods that their theology might be called a many-sided monotheism.
Egypt	The sun god was worshipped as supreme but in a variety of forms: Re: Creator of universe, the supreme deity Atum: Solar divinity of the temple at Heliopolis Khepri: Beetle. The beetle pushing the ball of the sun up the sky became one of the most potent of all solar symbols. Aten: Sun's physical disk or orb. Harakhte: The falcon, the ancient sky god Horus of the sunrise. Pharoah: The ruler of Egypt was himself regarded as a god. Every morning the pharoah, having been purified by priests, climbed the stair to the great window to salute his other self, the sun. Other symbols of the sun in Egyptian worship were the pyramid and the obelisk.

ece	Phoebus (fr. Gr. *Phiobus*, light) Apollo was the Greek divinity of radiance and light. About the fifth century BC he became identified with Helios, the sun god. Both were attributed with the brilliance and power to produce and destroy life, to bless with health or destroy with illness. Apollo was particularly regarded as able to protect from evil and disease. At Crete, Zeus was also regarded as a sun god.
me	Mithras was the Sol Invictus (the unconquerable sun). Augustus, after the conquest of Egypt, brought two obelisks of Heliopolis to Rome and consecrated them to the god Solone.
a Empire	Sapa Inca or Unique Inca (king) was identified with the royal solar cult. One of his titles was Intip Corti, meaning "son of the sun." His children were called "children of the sun." Inti — the actual sun god, was not a supreme creator god, but was supremely worshipped as the present source of light and life.
yan Empire	The name of the chief priest was Ah Kin Mai (he of the sun).
ec Empire	Sun worship was obviously dominant. Great pyramids upon which human sacrifices were made were erected in honor of the sun. Pulsating human hearts were held up to the sun to give it strength to return the next day.
rmany	Woten Odin was a sun god to whom parents exposed their sick children on the roofs of their homes.
ia	Ancient Hindus worshipped the morning sun deified as Vivasat.
pan	The early Japanese respected Amaterasu as a sun god.

A chronology of ancient medical concepts

Specific record of the practices involved in solar therapy and the theories behind those practices began with the Greeks.

Greece

The Greeks practiced *arenation,* or exposure of the body to the sun on the sand, and they exercised in the nude. The places in which they did this were called *arenariae* and were often near the seaside, and the practice itself was called *heliosis*.

Antyllus was one of the Greek physicians who prescribed heliotherapy (helio meaning sun) for his patients. He left us a description of their sunbaths. "Persons expose themselves to the sun. Some cover their skin with oil, others do not; some lie down or are seated; others stand or work. Those who lie down, rest on sand or a cushion or a piece of fur, do not oil their skin because the heat of the sun produces much perspiration. It prevents increase of body weight, strengthens muscles, makes fat disappear and reduces hydropic swellings."

Herodotus was called the father of heliotherapy because he recommended the sun for many illnesses. One of his statements is that: "Exposure to the sun is highly necessary in persons whose health needs restoring and who have need of putting on weight. In winter, spring, and autumn the patient should permit the rays of the sun to strike full upon him, but in summer because of the excessive heat, this method should not be employed in treating weak patients."

Rome

After the conquest of Greece, the Romans went on to record the benefits of sunlight therapy.

Aurelian advised sun bathing in epilepsy, paralysis, asthma, esophageal diseases, jaundice, malnutrition, dropsy, bladder and colon diseases, obesity and pediculosis. The frescoes of Pompeii show people stretched out on flat roof tops exposed to the sun. Roman homes had *solaria* for that purpose; the word was part of the language. Romans called on Apollo (Greek god of sun) to stop an epidemic. The wife of Emperor Gallienus (218 AD) was sent to Nicaea (Nice) for a sun cure.

A brief history of modern man's relationship to sunlight therapy

Apparently because Christians feared to be called sun worshippers, there is little record of sun therapy during the period from the fall of pagan Rome until the early 18th Century. From the 1700's through the first third of the 19th Century, the emphasis on sun therapy increased. The following are extracts from some of the written records of that period, given by date.

1700's

Theodore Tronchin, a French court physician, urged royal patients to take long walks in the fresh air, and Rousseau's 'back to nature' slogan sent commoners, too, to seek fresh air and sunshine.

1796

The University of Gottingen in Germany offered a prize for the best essay on the effect of light on the human body. The prize was won by Ebermaien, who came very close to describing the relationship between the sun and rickets.

1815

Cauvin wrote, "The influence of light on the morale of man is very powerful. The physician will prescribe sun for the sad and the weak. When taken with moderate exercise, it will revive lost courage. The rich people of England and Germany go to the south of France and Italy to cure the disease of temper called spleen; or at least to get away from the monotony of an almost continuing climate. Among the diseases which too much sun can bring is ophthalmia.

"Careful observations have shown that sunlight is a curative agent for scrofula, rickets, scurvy, rheumatism, paralysis, swellings, dropsy and muscle weakness. The absence of sunlight together with poor food is probably responsible for prison fever."

1820

Lachaise, a French physician wrote, "There is scarcely a physician in any of the large cities who has not observed that people who work and live in dark, damp places lack energy and have rheumatism and related conditions. This is especially true of children. Sunlight gives marked relief in scurvy and rickets."

1827

Johnson makes this observation "If we wish to etiolate men and women, we have only to congregate them in cities where they are pretty securely kept out of the sun and where they become white, tender and as watery as the finest celery."

1849

H. Lebert won the prize of the French Academy of Medicine in 1849 for a treatise on the treatment of scrofula and tuberculosis in which he speaks of sunlight as a positive factor.

1852

In an essay on geriatrics, Turck gave exact instructions for the application of sunlight.

Ollier and Poncet treated their patients with surgical tuberculosis by exposing them to sunlight. Finding their weather unreliable, they opened sun treatment stations along the Riviera. In 1899, Millioz, a student of Poncet, reported four cases of arthritis improved by exposure to sunlight. He wrote, "For tuberculous arthritis without marked tendency to deformation and advanced osseous lesions, use prolonged sun baths. The beneficial action of sun exposure extends beyond the local tuberculosis. Heliotherapy, in our opinion, constitutes an excellent form of treatment in a number of chronic diseases."

1877

Downes and Blunt proved that sunlight kills bacteria. They found that it was the violet end of the spectrum that produced the most dramatic effects on the bacteria.

1885

Wise wrote, "The aspects of health which are created by the sun's rays speak for themselves, showing that light is a therapeutic agent of much value."

1890

Palm studied the statistical reports on the disease rickets in Great Britain. He found direct relationships between the population density and the northern vs southern location. He studied the incidence of rickets in different countries and concluded that the one factor present where rickets was unknown was the abundance of sunlight. He advanced the development of sanitariums in the country where the city people could stay to improve their health. He wrote, "I would urge the education of the public to the approach through the appreciation of sunshine as a means of health."

1892

Marshall Ward demonstrated that it was the ultraviolet part of the spectrum that produced the most intense antibacterial action.

Table II indicates the dates of discovery of ultraviolet sensitivity of certain bacteria.

Table II

Bacterium's Common name	Bacterium's Scientific name	Date	Scientist
The anthrax bacillus	*Bacillus anthracis*	1886	Arloing
The plague Coccobacillus	*Pasteurella pestis*	1887	Polerino
Strep	*Streptoccoccus*	1887	Duclaux
The tubercle bacillus	*Mycobacterium tuberculosis*	1890	Koch
The cholera bacillus	*Vibrio comma*	1892	Moment
Staph	*Staphlococcus*	1892	Chemelewsky
The colon bacillus	*Escherichia coli*	1894	Dieudonne
The dysentery bacillus	*Shigella dysenteriae*	1909	Henri

1903

Niels Finsen was the man who first successfully treated tuberculosis of the skin. The treatment was ultraviolet light, and for his discovery, he won the Nobel Prize in 1903.

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1909

Rollier, after observing the dramatic beneficial results of treating skin tuberculosis with sun therapy became convinced that tuberculosis was a generalized condition that required a generalized treatment. He began treating all surgical patients, and was so successful that by 1938, his sanitarium had grown from one building to thirty-six.

1929

Ude introduced ultraviolet therapy for streptococcal skin infections, which had formerly been fatal for 10% of those persons who developed the disease. Ultraviolet therapy was found to dramatically reduce the mortality rate. Also, in 1929, the king of England, whose condition had deteriorated after diathermy, was found to be improved after ultraviolet treatment. This resulted in much favorable publicity for the use of ultraviolet light therapy.

1933

F. H. Krusen, authored a book published by P. B. Hoeber, Inc., in 1933, titled *Light Therapy,* and includes a large list of diseases once thought to be benefitted by light treatment. Table III, which includes the diseases listed in Krusen's book, as well as others, will give the reader an idea of the many conditions which have been treated with ultraviolet light. (156)

ble III

ea of Body	Diseases
mentary tract	appendiceal abscess, chronic colitis, chronic constipation, chronic inflammation of gallbladder, cirrhosis of the liver, hemorrhoids, hyperacidity of the stomach, ischiorectal abscess, post-operative adhesions, pyloric stenosis, pylorospasm, tuberculosis of the peritoneum and intestines, visceroptosis
rculatory system	anemia, arteriosclerosis, chlorosis, hemophilia, hypertension, hypotension, pericarditis, phlebitis, varicose veins
spiratory system	bronchial asthma, bronchitis, pertussis, pleural adhesions, pleurisy, pneumonia, pulmonary tuberculosis
rvous system	anterior poliomyelitis, chorea, disseminated sclerosis, encephalitis, hysteria, insanity, locomotor ataxia, myelitis, neurasthenia, neuritis, paralysis agitans, Raynaud disease, sciatica
usculoskeletal system	fibrositis, fracture, fragilitas osseum, gonorrheal arthritis, gout, lumbago, myalgia, osteoarthritis, osteomalacia, osteomyelitic sinus, rheumatoid arthritis, synovitis, torticollis, tuberculosis of bones and joints
in diseases	acne, adenoma sebaceum, alopecia areata, alopecia prematura, alopecia senilis, boils, burns, carbuncle, chicken pox, cicatrix, cracked nipples, dermatitis, herpetiformis, dermatitis venenata, dermatophytosis, eczema, erysipelas, erythema multiforme, erythema nodosum, falliculitis, herpes simplex, herpes zoster, impetigo, keloid, lichen planus, lupus vulgaris, neurodermatitis, onychia, paronychia, pernio, pityriasis rosea, pruritis, psoriasis, rhinophyma, scabies, scleroderma, seborrheic dermatitis, sycosis vulgaris, tinea
enitourinary system	cystitis, nephritis, prostatitis, tuberculosis, urethritis
ynecologic diseases	amenorrhea, bartholinitis, dysmenorrhea, endocervicitis, menorrhagia, metritis, oophoritis, tuberculosis salpingitis, urethritis, vaginitis
ye, ear, nose, d throat diseases	blepharitis, choroiditis, conjunctivitis (chronic and catarrhal), corneal ulcer, herpes, hordelolum phlyctenular keratitis, trachoma, tuberculosis
seases of the ear	otitis media, tuberculosis, ulcer of ear drum
seases of the nose	catarrh, ethmoiditis, hay fever, lupus, ozena, polyps, rhinitis, septal ulcer, sinusitis
seases of the throat	laryngismus, laryngitis, peritonsillar abscess, pharyngitis, tonsillar ulcer, tonsillitis, tuberculosis of the larynx, Vincent angina
iseases of the mouth	dental caries, gingivitis, pyorrhea, stomatitis, ulcer
iscellaneous conditions	adenomata, calcium metabolic disorders, chilblains, colds, eclampsia, lactation deficiency, malnutrition, mumps, rickets, spasmophilia, tetany, thymus enlargement, tic douloureux, tuberculosis

1935

Deryl Hart, disturbed at the high incidence of infections following surgery, conducted an experiment to determine the amount of bacteria in the operating room. He grew as many as 78 colonies of bacteria on one Petri dish. To destroy the many bacteria in the room, he decided to use antibacterial properties of ultraviolet light. He suspended a bank of cold quartz mercury arcs from the ceiling of the operating room. With these lights, he was able to destroy all bacteria within 8 feet of the burners in 10 minutes, even though the intensity of the lamps would produce redness in blond skin only after 80 minutes.

1939

Domagk's reception of the Nobel Prize in medicine for his success in treating bacterial infections with sulfanilamide, ushered in the era of antibiotic and other antimicrobial therapy and started the pharmacological dominance in medical therapy. Whereas previously, sunlight's effect on infectious disease was the focus of greatest interest and study, the discovery of antibiotics caused solar therapy to become obsolete, and research into its many-faceted effects on human health has only been fragmentary since that time.

However, because of the rapid development of resistant strains of bacteria, the failure to find anti-viral agents, and the marked increase in the degenerative diseases untouched by antibiotics, it is now obvious that chemotherapy is not the basic answer to human disease it was originally thought to be. As a result of this trend, more attention is now being focused on the immune response of the individual. And so, after years of neglect, immunology is again rapidly progressing to the center stage of research and discussion. Because solar therapy plays such an effective role in developing the immune response and in alleviating many of the symptoms associated with degenerative diseases, it, too, promises to move into greater recognition. The thinking of man has now come full circle.

The intent of this book has been to provide serious readers with the latest knowledge of the sun's glorious benefits. If this book can provide a method of natural therapy by which readers may increase their bodies' defenses against microbial invasion, resist the inroads of degenerative disease, improve their health and live fuller, happier lives, its purpose will have been fulfilled.


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ISBN: 0-9604268-2-5