INTRODUCTION

Although slow-motion photography has been known for many years, it has not been popularized until recently, when Americans have come to expect "instant replays" in sporting events on television. These are motion pictures taken at higher-than-normal speed. When they are then projected on the screen at normal speed they appear to slow the motion and make it possible to analyze a golf swing, determine the winner of a horse race, or follow a football player who receives a pass and runs for a touchdown.

There had been little use for the opposite type of photography, which gives the illusion of speeding up motion by means of taking single exposures at relatively long intervals, until John Ott began, while in high school 45 years ago, to experiment with what is now known as "time-lapse" photography. Fortunately for mankind, his hobby led eventually to a full-time career as a photo-biologist. It is also fortunate that he had the fortitude to persevere against great odds; his chosen field was so new that much of the necessary equipment had to be designed by him and custom-built. Further-more, some projects that he undertook required whole years to photograph even though the showing time of the resultant film was only a minute or two. Flowers and plants were among his first subjects. One of these films involved the growth of the banana from the emergence of the first shoot to the mature fruit. This project required ten cameras and two years to complete. Another sequence showing flowers, made to appear to dance by controlling light direction and temperature, took three years to produce — even though it lasted only two minutes on the screen.

Anyone who has observed individual cells under a microscope is aware of the fact that activity usually occurs so slowly that nothing seems to be happening. However, because of Ott's pioneering work in time-lapse photography, science has a new and invaluable tool which has almost limitless application. It is now possible, for example, to observe and record what happens within a single living cell — or to watch mitosis, or cell division, take place and to see changes that occur when a given stimulus such as a drug is introduced into the cell's environment.

It was while conducting a series of experiments in which individual cells were being photographed as certain drugs were introduced into their environment that Ott noted that changing the filters over the camera lens from one color (or wavelength) to another often had a greater effect on the cells than the drugs. This observation led to further studies on whole animals and the discovery that the quality of light is of great importance to both animals and man. It had long been recognized that the quality of light is important to plants, but Ott's work now showed that the process of photosynthesis in plants is only carried on at full efficiency in the presence of the complete spectrum of sunlight.

Man has lived on this earth for at least 100,000 generations and has been almost completely dependent upon the sun for light — until about five generations ago when Edison developed the incandescent lamp. Research has now demonstrated that the full spectrum of daylight is important to stimulate man's endocrine system properly and that he suffers side effects when forced to spend much of his time under artificial light sources that reproduce only a limited portion of the daylight spectrum. It therefore became obvious to Ott ten years ago that the design of artificial light sources should be changed to broaden their spectral analyses. His attempts at that time to persuade two of the major manufacturers of light sources in America to do so failed, but it was my good fortune subsequently to be instrumental in prevailing upon the executives of a third company in the field to undertake such a project and to retain him as consultant. As a result, it has since produced a fluorescent light source that — for the first time in history — virtually duplicates daylight. Some remarkable testimonials have come from many industrial plants that have since installed this new lighting — such as substantial reductions in absenteeism and accident rates and marked increases in production.

It would not be presumptuous in the least to look at him as a twentieth-century Leeuwenhoek. As the 18th century Dutch scientist used the scientific "toy" — the microscope — and opened up new worlds to mankind, so has John Ott taken the motion picture camera, added Leeuwenhoek's "toy" and made a remarkable break through in the study — and understanding — of light.

Recognition of his untiring research work has come to John Ott in the form of citations and awards from horticultural, scientific and medical societies, plus the Grand Honors Award of the National Eye Institute (in 1967) for an important contribution to eye care. In 1971, he was asked to give a seminar to scientists who were designing the specifications for the first United States space station. They wanted his counsel on the problem of growing vegetables for astronauts in space. His papers have been published in many scientific and educational journals, including those of the New York Academy of Sciences, the National Technical Conference of the Illuminating Engineering Society, the Fourth International Photobiology Congress at Oxford, the New York Academy of Dentistry and others.

There is much still to be learned about the effects of light on plants, animals and man, but there is enough knowledge already available to provide important guidelines to manufacturers, architects and scientists who can directly influence the environment in which millions of people work and live. It has been my privilege to enjoy the opportunities of collaborating with John Ott in a small way for the past ten years. I firmly believe that the reader will gain important insights from *Health and Light*.

— James Winston Benfield, D.D.S.
October 1972