ENGINEERING

Invisible Light Shows the Way

Invisible ultraviolet and infrared forms of light are revitalizing the arsenals of medicine and defense. These radiations are under constant study and have proved very versatile.

By RALPH SEGMAN

INVISIBLE LIGHT is showing the way in medicine and defense.

Ultraviolet light is the basis of a heralded revolution in medical diagnosis.

The Armed Forces are developing infrared devices for voice communications, rocket-launch detection and anti-aircraft "bloodhound" missiles.

These two forms of invisible light are very versatile. They have been used for years for all kinds of jobs, exotic and commonplace, from roasting chickens in rotisseries to detecting forged masterpieces. Hardly a few weeks ever pass when some new role is not discovered for them.

They are part of what is called the electromagnetic spectrum, which also includes visible light, radar and radio waves, X-rays, gamma rays and cosmic rays. All of the electromagnetic radiations travel through space at the velocity of light (about 186,000 miles per second), but they have many physical differences. One such difference is wavelength, from less than a trillionth of an inch in the case of cosmic rays to several miles for radio waves. Visible light wavelengths are near the center of the spectrum, ultraviolet is on its short side, and infrared is on its long side.

Of the most recent developments in ultraviolet, none promises to be more beneficial for mankind than the fluorescent antibody diagnostic technique. The U. S. Department of Health, Education, and Welfare has predicted that when the technique is perfected the whole system "for identification of communicable diseases will be revolutionized."

HEW Secretary Arthur S. Flemming believes that the new ultraviolet diagnosis opens up an avenue "toward eventual eradication of rheumatic fever and rheumatic heart disease," that it could bring about almost immediate treatment of perhaps 50 different communicable diseases, and that it could be an indispensable tool for germ warfare defenses.

Technique Simple and Short

The technique, magnificently simple and fast, utilizes little more than antibodies and ultraviolet light. (Antibodies are substances marshalled by the human body to battle off invading germs, each antibody-type destroying only one germ-type.)

Material taken from a patient suspected of having a disease, say rabies, is smeared on a glass slide. Rabies antibodies, stained with a fluorescent dye, are dropped onto the smear. If rabies viruses are present in the smear, the antibodies immediately attach themselves. The slide is washed clear of antibodies not combined with viruses and is placed under ultraviolet light. The diagnosis is positive if the smear shows a green fluorescence.

The fluorescent antibody diagnosis is completed in a few minutes. The old standard rabies test with mice requires two to three weeks. The value of the speedy new technique is obvious, in the case of rabies which is invariably fatal if not treated in time, and for most other communicable diseases which spread rapidly and insidiously.

The technique was discovered ten years ago by Dr. A. H. Coons, Harvard University. Dr. John Riggs, University of Kansas, developed one of the dyes, fluorescein isothiocyanate.

Man's quest into the nature of life may get a rewarding thrust from a new ultraviolet instrument. Known as the Ultrascope, this Radio Corporation of America development gives scientists a visual picture of some of the processes in living cells.

Before it became available, such ultraviolet views into living matter were available only with a complex television apparatus, costing about $15,000 and expensive to maintain. Only three of them are in use in this country. The new Ultrascope, mechanically simple and less costly, is not outside the means of low-budget laboratories.

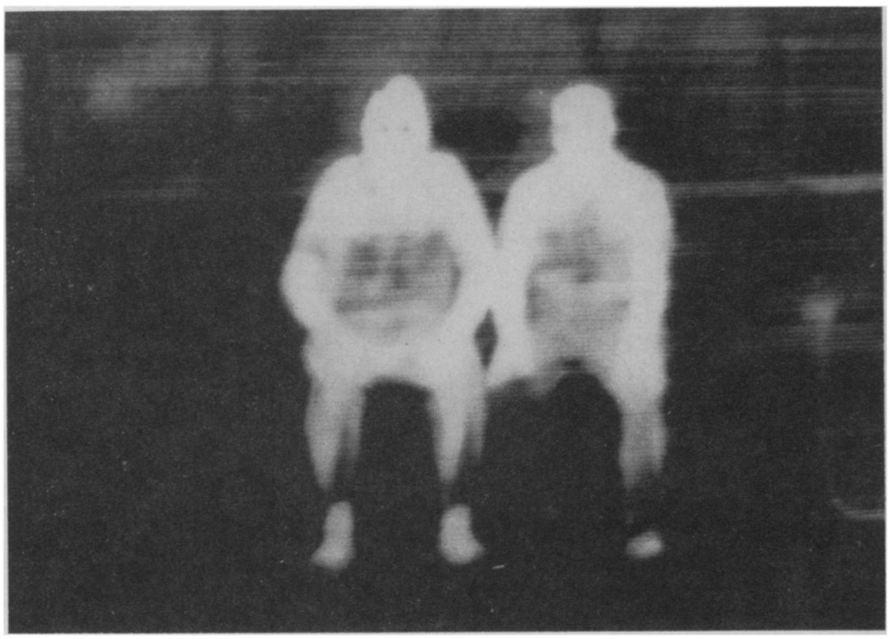
It consists of a microscope, an ultraviolet-generating tube, a small viewing screen and a photographic attachment. The Ultrascope takes advantage of the fact that many chemicals characteristically absorb only certin ultraviolet wavelengths. For example, a researcher studying the hemoglobin in red blood cells bathes the cells in ultraviolet light at 4,100 Angstrom units (a measure of wavelength). In the viewer and on film, the hemoglobin appears darker than the rest of the cell material.

Infrared light can be modulated, like radio waves, to transmit voices. Although details are hidden deep in the drawers of secrecy, the Armed Forces are known to be experimenting with interception-proof, jam-proof infrared communications systems.

Silent Speed

Generally, the system in operation may be described in this way: A microphone picks up spoken words and feeds them through an electronic device into an infrared transmitter. The now silent voice rushes at the speed of light along a narrow invisible beam of infrared aimed directly at a distant receiver. The signal is converted by another electronic device back into an intelligible voice.

The system is superior to radio communication on the battlefield, primarily because the infrared voice cannot be jammed or intercepted unless the enemy locates the invisible beam. This would require a monumental effort or luck.



INFRARED PHOTO—These two ghost-like men were photographed in the dark with only the infrared radiations given off by their own bodies. The man at the right is a good example of why you cannot hide much from an infrared detector. He has an artificial leg which does not show in the picture.

Infrared detectors and anti-aircraft missiles are almost too good to be useful. Every object in the universe above the absolute zero in temperature (minus 459.7 degrees Fahrenheit) radiates infrared, the hotter the object the more intense the radiation.

Missiles homing in on this radiation can be so accurate they knock flares off the wing tips of target drones and hardly damage the wing. On the other hand, they sometimes go a bit berserk and charge toward the sun until their fuel is exhausted. Some detectors can spot a Russian missile at the moment of launching, but also can respond to a Siberian bonfire.

Unless some recent secret research has imbued a little human-like intelligence into these infrared devices, they still cannot tell the difference between a bonfire and a missile, or a hot jet exhaust and the sun.

Although quite a few knowledgeable people believe infrared will replace, or at least supplement, radio and radar, many disadvantages remain to be worked out. Besides those just mentioned, infrared is unable to turn corners or curve over the horizon.

For long-distance communication, at the present level of technology, the transmitted signal must hit line-of-sight relay stations all the way to its destination. Missile detectors, unless stationed high in the atmosphere or in earth satellites, are incapable of sensing launchings until the missiles have risen above the horizon and are well on their way.

These problems are not necessarily different in magnitude from those overcome by research and development people who have made successes of the telephone, antibiotics, atomic energy, airplanes and all the rest. No one can say solutions to the problems are inevitable, but there is a wealth of scientific talent hard at work on them.

Science News Letter, July 18, 1959

GERIATRICS

Even More Middle-Aged Women Seen by 1970

MORE MIDDLE-AGED and older women are living longer than their male counterparts. By 1970 the numbers will be larger.

Eleven years from now, the females in this group will experience relatively greater reductions in mortality than the males of that period. The excess of females over males will increase, the sex ratios in these age groups will lower and the number of widows and duration of widowhood will expand.

So says Dr. James D. Tarver of Oklahoma State University. His report on the projections of mortality in the United States appears in the *Milbank Memorial Fund Quarterly* (April).

There will be fewer deaths, proportionately, among infants and youngsters than among adults by 1970, he says. Fewer infant deaths will mean increased chances of the infants living through older ages. This will, in turn, supply an increasing number of persons who will reach productive ages.

By 1970, more than 70,000 white males out of every 100,000 born, as compared to 66,000 in 1955, can expect to reach the age of 65, Dr. Tarver explained.

If life expectancy increases the number of people over 65, more people will be receiving Social Security benefits. In addition, this will lengthen the period that workers spend in retirement, intensifying the aging problem.

These projections may seem optimistic, Dr. Tarver commented, especially after the temporary 1957 reversal in the death rates that occurred at the time of the Asian flu epidemic and other respiratory infections. Nevertheless, numerous factors and trends indicate that more people will live longer.

Apparently, a gradual and progressive reduction in death rates will continue for infants and young adults. On the other hand, the greatest possible mortality reductions lie among the aged populations, especially males, he concludes.

Science News Letter, July 18, 1959

SCIENTIFIC MANPOWER

NSF Surveys Scientists For Budget Bureau

HOW MANY SCIENTISTS and technicians we have now and how many we will need in the future are just two of the questions the National Science Foundation hopes to answer with a comprehensive survey.

Timely information on the "supply, demand and utilization of scientists and technical personnel" is the goal of a Federal program it is now undertaking, the Foundation has announced. The Bureau of the Budget requested NSF to set up the program.

An advisory panel on scientific manpower recommended that three projects in particular be started as "most urgent:" 1. identification of scientific and technical occupations; 2. periodic survey of scientific and technical personnel; 3. periodic study of the demand outlook for various kinds of scientific and technical personnel in each major activity.

Science News Letter, July 18, 1959

GEOPHYSICS

IGY Follow-Up Program Receives First Grants

THE INTERNATIONAL Geophysical Cooperation—1959 got off the ground with the announcement of its first 41 grants by the National Science Foundation. The grants totalled $1,686,225.

IGC—1959 is an outgrowth of the International Geophysical Year that ended on Dec. 31, 1958, after 18 months.

Dr. Alan T. Waterman, director of the Foundation, in announcing the grants, explained: "Prior to the end of the IGY . . . it had become apparent to many individual scientists in the United States and abroad . . . that continuing scientific cooperation was highly desirable in certain areas of science which by their nature require international or worldwide observations. It was hoped that some of the facilities and cooperative scientific experience of the IGY might be used on a reduced basis to accomplish this."

Science News Letter, July 18, 1959