BIOTECHNOLOGY

Diseases Detected by Heat

Promise of diagnosing breast cancer seen aided by new technique in photography by infrared or heat rays. Thermography has potential in fighting other diseases.

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➤ PHOTOGRAPHS taken by heat instead of light promise to rival X-rays in medical diagnosis. Heat photography is being used for detecting various hidden human diseases. And most promising is its diagnosis of breast cancer.

Called thermography, this method has also shown great potential in assessing seriousness of burns and diagnosing cerebrovascular disease. In addition, it maps the fight that drugs make against cancer and arthritis.

The main principle upon which medical thermography rests is that illness and injury cause increases in body temperature at the affected spot. Therefore, when a picture is taken of a person who has cancer, the malignancy will show up in the thermogram whiter than the rest of the body because the temperature is different.

Thermography Is Effective

Recent evidence has shown that thermography is superior to diagnoses of circulatory problems using radioactive isotopes and other detection methods. In particular, preliminary reports indicate that thermography is an effective device in detecting diseases that affect the principal artery of the neck.

A typical thermograph uses a large, hanging mirror, which is tilted so that a camera, mounted parallel to the ground, can focus on the image of a patient lying beneath the camera. Moving back and forth, the so-called "eye" of the thermograph scans the image, registering temperature differences.

Infrared heat given off by tissues in the body is imprinted on the film in the thermograph's camera. When developed into a thermogram, white shows up as hot areas while black represents cooler regions.

Thermograms are not, however, conventional infrared photographs that need the object to be irradiated with short-wave infrared radiation from an external source. Photographs like these can be taken with a regular camera outfitted with special film and filters.

On the other hand, thermograms require no irradiating props to turn out successfully. As a matter of fact, they can even be made in total darkness.

Thermography is considered to be most promising in its use for diagnosing breast cancer because of the good correlation between surgical findings and thermographic findings. Research indicates the possibility that the new process could be valuable in mass screening for breast cancer, as an aid to early detection.

Detection in the early stage, when the tumor is still confined to the breast, and considered therapeutically curable, is believed to be of utmost importance.

Evidence that thermography can be employed, not only to diagnose breast cancer but also to provide a prognosis has been presented. Dr. K. Lloyd Williams, Middlesex Hospital, London, a pioneer researcher in this field, disclosed that "in 100 consecutive cases of previously untreated breast cancer, 95 showed a rise in temperature of one degree centigrade, or more, of the skin overlying the cancer, compared with the skin of the normal breast. The degree of temperature difference was compared with the prognosis of the cancer patients as evaluated by the appearance of the metastases, or their deaths from the cancer, in a two and one-half year follow-up."

The first use of the natural thermal radiation of the body for clinical diagnosis was described by R. N. Lawson in 1957. Mr. Lawson took his first thermal pictures with a Baird Evaporograph, an apparatus that forms images of warm objects by the effect of thermal radiation upon a very thin film of oil.

Later he obtained better definition with a radiometer developed by Barnes Engineering Company, Stamford, Conn. This is an infrared scanner that uses a thermistor as the temperature-sensitive element.

Heat patterns may find a regular use in assessing burns. In a series of observations, depth of burning was accurately forecast in 50 out of 55 "deepskin" (dermal) burns. Thermograph works here because tissue in which blood vessels have been destroyed does not conduct heat as well as normal flesh. Consequently, there is a subnormal flow of heat from the warm interior of the body to the skin surface, which cools down.

In thermal pictures, therefore, burn injuries show up as dark patches on a lighter background.

Observers see considerable promise in the use of thermography in charting the effectiveness of different drugs. The use of medicines that interfere with the metabolism of the cancer cell is one of the main lines of cancer research. If changes in the metabolic rate of diseased cells could be correlated with their infrared radiation, this would provide a rapid way of assessing the value of particular medicines.

Thermography also has been shown to be very effective in locating perforating veins in patients with varicose ulceration. With such a fast machine available, the best technique seems to be to cool the limb and then take pictures in rapid succession as the limb returns to normal. This shows up the blood vessels quite clearly.

Another important advance seen possible from thermography is in the use of narrow spectrum pictures to demonstrate the presence and location of specific molecular resonances. This might, for example, enable surgeons to tell the difference by direct observation between a harmless mole and a malignant melanoma which often appear similar to the naked eye.

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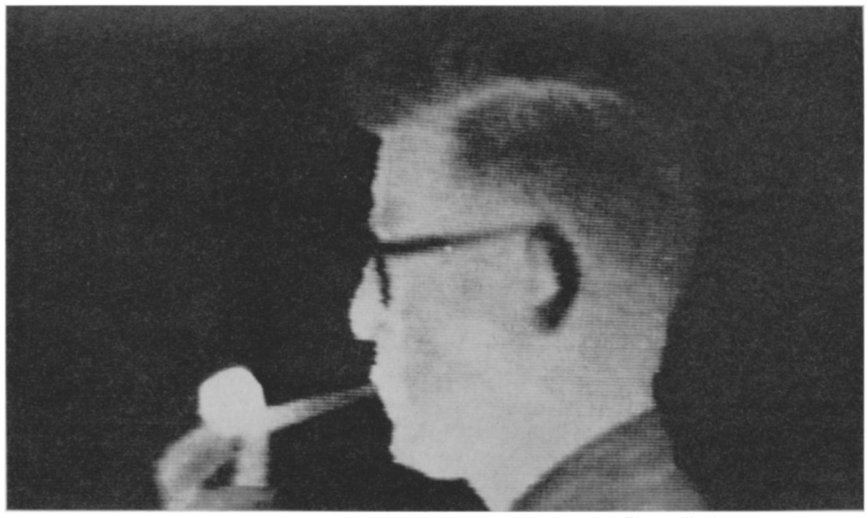

Barnes Engineering Company

WHITE HOT—Principle of thermography is effectively disclosed in photograph of man smoking pipe in completely darkened room. Pipe bowl is hotter than any point. Stem cools rapidly until it is almost at room temperature at the mouth. Glasses and most of hair are at room temperature. Note that regions of maximum blood circulation—mouth, chin, throat—are warmest portions of face.