Pulsed light: Unexpected new effect

Studies of thermal conductivity in metals at IBM's Thomas J. Watson Research Center have led to the discovery of a new and unexpected effect of laser light on thin films. It appears that pulses of laser light striking thin films of metals such as molybdenum or tungsten generate voltage pulses of up to 1/20 of a volt.

The discoverers, Robert J. von Gutfeld and Eugene E. Tynan, attribute the effect to a thermal gradient in the film caused by the arrival of a pulse of laser light on one side. The belief is held in spite of the fact that the direction of the voltage generated is at right angles to the temperature gradient.

In an article in the Aug. 15 APPLIED PHYSICS LETTERS, von Gutfeld suggests that the voltage may arise from some action of the temperature gradient on asymmetries within the film. These could be microscopic distortions caused by stress while the film is being deposited or misplacement of atoms as the film piles up. The action could produce a crosswise voltage that would be independent of the film's orientation with regard to the laser beam axis. If the voltage were due to asymmetry in the laser beam or the detector circuit, rotating the film around the beam axis would change the polarity of the voltage. The only way to change the polarity of this voltage is to irradiate the film from the opposite side.

Further strengthening the belief that a temperature gradient is at work is the disappearance of the voltage when a continuous rather than a pulsed beam of light is shone on the metal. A continuous light beam would wash out the gradient and bring both sides of the film eventually to the same temperature.

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Tynan and von Gutfeld with magnified image of film.

The new effect promises cheap and versatile pulsed light detectors. Voltages have been produced by light pulses ranging from blue to near infrared. The effect is not degraded (it is in fact enhanced) by heating, at least to 250 degrees C. (Performance of silicon-based detectors declines with heating.) Applications will appear in various kinds of communication, control or sensing devices. But applications are not the most exciting thing, says an IBM spokesman; rather it is the discovery of a new and unexpected effect. "That is really the role of our research organization: to keep turning up new effects."

Unraveling the biology of human puberty

Puberty—the emergence into adulthood—is one of the most crucial events in the lives of individuals and in societies in general. Classical cultures have celebrated puberty with great circumstance. Harvard sociologist Daniel P. Moynihan attributes the turmoil of the 1960's partly to the disproportionate number of Americans emerging into adulthood in that decade (SN: 8/11/73).

Puberty is more than a cultural phenomenon, of course. It is essentially a series of biological changes that usually take place from the eleventh to the sixteenth years. For some young people, however, puberty comes too early or late and causes serious psychological difficulties. So pediatric endocrinologists are anxious to unravel the mechanisms of puberty so that they might treat puberty problems more effectively.

Three hormones are the major triggers of puberty. They are growth hormone, luteinizing hormone and follicle-stimulating hormone. All three are put out by the pituitary gland in the brain. But what programs these hormones into action? "That," says Salvatore Raiti, director of the National Pituitary Agency, "is the $64,000 question." "If we had the answer," says another researcher, "we'd be on our way to Sweden to pick up the Nobel Prize."

Investigators have postulated that the trigger might be something in the pituitary gland. Or it might be chemicals in the hypothalamus that release the pituitary hormones. Or the trigger might be hormones from the adrenal gland—androgens and steroids. Evidence for this theory is presented by New York investigators in the Aug. 9 NEW ENGLAND JOURNAL OF MEDICINE.

They studied LH and FSH secretions in some sexually precocious patients and compared their secretions to that of normal pubertal children. They found that FH and FSH secretions in the precocious patients were similar to that in normal pubertal children. With four of the patients, precocious puberty appeared to be due to abnormal stimulation of the central nervous system. But with two others, the precocious puberty appeared to be due to excessive secretion of adrenal androgen—which had started before birth and continued throughout life, preceding pubertal secretion of LH and FSH. So the investigators suggest that the adrenal hormones might be the trigger for normal puberty.

One of the investigators, Jordan W. Finkelstein of Montefiore Hospital, puts their theory in simple terms: "We envisage that there is a counter in your head somewhere, and it counts molecules of, say, androgen. When enough androgen has gone through the counter, it switches puberty on." □

X-rays of the brain in thin cross sections

A new technique, already hailed by some physicians as the most important advance in X-ray diagnosis since its original development, promises to give a detailed new look at the inner brain unavailable now even with the most sophisticated radiography equipment. By analyzing the signal received by two electronic detectors of a thin X-ray beam scanning a patient's skull, a computer is able to depict any desired brain cross section on a television screen, from which a Polaroid snapshot is made for permanent reference. A computer engineer, Godfrey Hounsfield, developed the device, now being marketed by EMI, Ltd. of England.

Previously, detection of brain tumors and other disorders required injecting fluids into the cranium, a costly, painful and dangerous procedure for the patient, and detailed analysis of stroke damage was often unavailable with any technique. By substituting some 28,000 separate readings on two sodium iodide scintillation counters for the conventional film plate, and rotating the thin X-ray beam about the head rather than bombarding the skull with a massive charge of rays, the EMI device produces detailed information about a particular region of the brain with relatively little radiation exposure. Two American hospitals already use the EMI device. □