Meetings

Medical Electronics

The physical transducer was the central topic of the 5th International Conference on Medical Electronics when it met in Liège, Belgium, 22–26 July 1963, with over 600 scientists from 37 countries in attendance.

In general, the papers tended to be more about the "state of the art" than reports of new work, with a few notable exceptions. As might be expected there are no universal transducers that satisfy the physiologist, the clinician, and the space physiologist, but it is obvious that most of the physical phenomena that can be exploited for biological measurements are being explored for what they can offer, and each endeavor is providing new ideas on the development of sophisticated instruments and methods for biological experimentation and medical therapy.

A particularly fine review of techniques for measuring blood flow, with particular reference to ultrasonic techniques, was presented by D. Franklin (California). His review included some data on the shift in ultrasound frequency produced by reflections from moving red cells as a potentially useful method that could be adapted to passive telemetry systems. A catheter tip pressure gauge having high sensitivity, stability, and extreme frequency response was presented by E. T. Angelakos (Boston). The transducer utilizes the most advanced techniques of the semiconductor art to produce a gauge element diaphragm, 2.1 millimeters in diameter, of pure crystalline silicon into which a full four-arm strain gauge of p and n type silicon was introduced by diffusing appropriate impurities into local regions of the diaphragm and capitalizing on the high resistance of the pure silicon and complimentary diode junctions to provide the inter-element insulation. The resultant diaphragm, having the nearly perfect elasticity of pure silicon, provides a resistance strain gauge with four active arms and a gauge factor an order of magnitude or more greater than metallic resistive strain gauges.

Two papers on development of a heart sound microphone, one from Japan presented by S. Takagi (Tokyo), and the other presented by D. J. Coleman (Washington, D.C.), were markedly similar in both reasoning and final product. Both microphones utilized a contact element to couple the chest wall with a crystal element and depended on the inertia of a floating case to limit low-frequency response while maintaining proper position of the contact element. Some cooperative efforts here could lead to standard procedures for recording data to be exchanged through the newly available means of communication occasioned by developments in space relay stations.

Ultrasonic echo measurements were in evidence in several of the exhibits where one could sit down and have the mid-line of his brain measured for deviation from center. A bit of oil and a crystal probe are applied to the side of the head. Deviations are of great value in diagnosis of unilateral radiolucent space filling pathology. Y. Tsutsumi (Tokyo) presented a variation in the ultrasonic echo technique in which finer discrimination for diagnosis of intracranial hemorrhage resulted from a system for detecting the deflection of an ultrasonic beam through the head. C. H. Hertz (Lund) described the measurement of the motion of heart valves with ultrasound echoes.

Application to medical problems of long-wave thermal detectors (wavelength 2 to 6 microns) that reconstruct an image from thermal emission of a warm body permitted the determination of the status of the circulation in burn wounds. Third-degree burns that will eventually require grafting are evidenced by lower emission due to the reduced blood circulation. A scan picture, made without contact with the surface, can be produced in about a minute to provide this valuable prognostic information. The system, known as Pyroscan, presented by C. M. Cade, is in regular use in Middlesex Hospital, London, for this and other applications. The use of indium antimonide detectors and high-efficiency reflective optics provide this relatively great speed of scanning with good resolution.

R. S. Mackay (California) presented his electronic tonometer for intraocular pressure measurements and pointed out the need for tonometers to diagnose glaucoma before irreversible damage to vision occurs. The idea of passive transducers that answer on interrogation provided the basis for several papers and material for speculation in the discussions. These devices take the form of various tuned circuits and oscillator configurations that contain an element sensitive to the parameter of interest that changes the frequency of oscillation or the duration of the blocking period in a blocking oscillator. A radio-frequency pulse of energy from outside the animal is used to "ring" a tuned circuit or provide energy to charge the blocking capacitor. Suitable external means are provided for measuring the response and resolving the measurement of interest. Pulsed systems of high repetition rates are used to record wave forms of several hundreds of cycles per second.

A bleeding detector for the gastrointestinal system utilizes the specificity of red cell catalase to decompose perborate to produce heat which changes the back resistance of a germanium blocking oscillator. The passive transducer idea, implemented with microminiature electronic techniques, eliminates the need for power sources, but battery-powered blocking oscillators with their low duty cycle provide the means for telemetering intracavitary pressures in ski jumpers in action (Oslo).

The electrocapillary effect of alternating droplets of mercury and sulfuric acid in capillary tubes which provided the instrument used for some of the earliest electrophysiological measurements in the form of the mercury capillary electrometer has for many years provided the basis for a sensitive accelerometer of notable instability. C. Yoshimoto (Hokkaido), with some careful attention to the purity of the reagents, condition of the capillary walls, and the addition of dodecylbenzene sulfonate, has exploited the phenomenon to produce some fine, stable microaccelerometers that can measure eyelid tremors with a negli-

gible load on the lid and an unusual differential micromanometer of exceptional sensitivity and stability.

The International Federation for Medical Electronics was formed in 1958 to be a federation of societies having an interest or activity in medical electronics. The concept that it should be made up of societies affiliated for mutual advantages has matured with the participation of the Japan Society for Medical Electronics and Biological Engineering with 850 members. Over 70 percent of the membership have medical degrees, in contrast to medical electronics groups in America, where the members are predominantly engineers and physical scientists. An opportunity to become more familiar with the Japanese activities in this field will be available in September 1965 when the 6th International Conference will be held in Tokyo after the International Physiological Congress, scheduled for 1–7 September. This schedule has been arranged to facilitate attendance at both conferences. Further information about the federation and future meetings can be obtained from the secretary, L. E. Flory, 167 Hamilton Ave., Princeton, N.J.

ROBERT L. BOWMAN
National Heart Institute, Bethesda 14, Maryland

Information Systems: Learning, Adaptation, and Control

Approaches in the engineering and physical sciences to learning, adaptation, and control in information systems were the main topics of discussion at the 1963 Computer and Information Science Symposium held 17 and 18 June at the Technological Institute, Northwestern University. Related papers in mathematical techniques, artificial intelligence and learning, computers and control, and pattern identification were presented.

One of the most persistent problems in the theory of brain mechanisms has been the requirement for a model capable of storing and recapitulating the sequence of experience which may occur in the duration of a human life. Reviewing the present state of his research in cognitive systems, Rosenblatt (Cornell) presented a mathematical model for long-term sequential memory, which appears to be of sufficient capacity to record an entire life history of sensory experience with a high probability of permitting correct judgments and decisions to be made in retrospect. His model is also consistent in size and structural organization with the known constraints of the human nervous system. Following an intuitive geometric approach, Charnes (Northwestern) presented new proofs of the fundamental theorems of the perceptron-learning theory of Rosenblatt and Block. His discussions clarified the motivation and restrictiveness of the previous work. Block (Cornell) and Nilsson and Duda (Stanford Research Institute) studied the problem of determining a small number of features for a given set of patterns by considering a pattern on a discrete retina to be the set of active retinal points. They also developed an algorithm for finding features of restricted sets of patterns and considered the mechanization of this algorithm by adaptive neural networks.

Pattern identification plays an important role in the design of learning systems. Viewing pattern identification as a problem in statistical classification wherein an n-dimensional space is partitioned into category regions with decision boundaries, Cooper (Sylvania) discussed the concept of hyperplanes, hyperspheres, and hyperquadrics as decision boundaries. He introduced techniques for determining the actual optimum boundary from known samples and for efficiently reducing the