cent tapioca and 20 per cent groundnut-cake powder is three times as nutritious as rice, and that 75 per cent rice and 25 per cent tapioca is as nutritious as whole rice. Dr. Subrahmanyan has also improved the manufacture of tapioca sago by the addition of 1 per cent of stearic acid, so that the grains no longer stick in cooking. His work has given results contrary to the common belief that tapioca debases rice. The practical value of such work can be immense. "Our production," said Sir S. V. Ramamurthy, "is 60 million tons and our deficit is 6 million tons. This deficit can be made up either from 20 million acres of cereals or only 2 million acres of synthetic cereals."

The inaugural function on October 21 last, which was attended by many distinguished men of science and political leaders, was presided over by His Highness the Maharaja of Mysore. His Highness welcomed the Hon. C. Rajagopalachari and other distinguished guests, and in thanking Mr. Nehru for having accepted for the Institute his gift of the Cheluvamba mansion, His Highness paid a warm tribute to the Indian Government's zeal for progress in scientific research.

The Hon. Mr. C. Rajagopalachari in his address referred to the importance of problems of food technology and recalled how the Marhatta soldiers on their expeditions used to carry flattened rice and roasted pulses in their bags, showing that dehydration was nothing new. He referred also to the importance of subsidiary foods and directed attention to the need for investigations that would eliminate harmful constituents from otherwise edible material and thereby convert it into wholesome food. Mr. Rajagopalachari thanked His Highness and the Mysore Government for the gift of the mansion, as also did Sir Shanti Bhatnagar and Dr. Subrahmanyan.

Among other addresses on the occasion was one by the Deputy Minister for Food and Agriculture, and another by the Vice-Chancellor of the University of Mysore, who stressed the need for simplified cookery and expressed the hope that the Nutrition Research Institute at Coonoor would also gravitate to Mysore.

Sir C. V. Raman paid a tribute to Sir Shanti Bhatnagar's resourcefulness and organizing ability, and rejoiced that men of science are now being given a chance to do things. Speaking of the desperate food situation in India, he said: "We have a vast population in this country living on the land . . . we must allow science to do something for feeding and nourishing this great population".

SCIENTIFIC ADVISORY BOARD OF THE INDIAN RESEARCH FUND ASSOCIATION

ANNUAL REPORT FOR 1949

THE report for 1949 of the Scientific Advisory Board of the Indian Research Fund Association* includes some accounts of research carried out during the year, as well as giving the membership of the Board and its Advisory Committees, a list of papers published on medical research carried out under the auspices of the Indian Research Fund Association during 1949, and the programme of researches and miscellaneous grants recommended to the Governing Body for the year 1950–51.

Besides various inquiries on cholera carried out at the Central Research Institute, Kasauli, the King Institute, Guindy, Madras, and the School of Tropical Medicine, Calcutta, four inquiries on malaria are reported. The Malaria Institute of India, Delhi, was responsible for laboratory and field studies with insecticidal and mosquito-repellent formulations, including both 'Gammexane' and DDT, and at the School of Tropical Medicine, Calcutta, a comparative study was made of the action of paludrine, chloroquine and camoquin in equivalent doses with the view of devising a simple form of mass treatment for people in rural areas. At the Haffkine Institute, Bombay, about forty sulphone derivatives were synthesized, but negative results were obtained with the ten examined for prophylactic activity in the mosquito.

Nutrition researches included studies on pyridoxine and fatty-acid metabolism, on vitamin D, the influence of nutritional factors in liver disease and the influence of dietary protein on the nitrogen balance (at the Nutrition Research Laboratories, Coonoor); the biosynthesis of ascorbic acid, fatty-acid oxidation by the guinea pig and the rat, and the absorption, excretion and effect of iron in foods (University College of Science and Technology, Calcutta); fat metabolism and experimental rickets (Seth G. S. Medical College, Bombay); nutritive value of soya-bean milk and curd (Indian Institute of Science, Bangalore); metabolism of vitamin A (All-India Institute of Hygiene and Public Health, Calcutta); and the biosynthesis of nicotinic acid by germinating pulses and by guinea pigs (Presidency College, Calcutta).

Leprosy inquiries at the School of Tropical Medicine, Calcutta, related to the intramuscular administration of sulphetrone, its concentration in the blood, excretion in urine and the relation between the blood and urinary concentrations and the use of *p*-aminosalicylic acid. The use of sulphetrone and other sulphones in leprosy was also studied at the Government Lady Willingdon Leprosy Sanatorium, Chingleput.

The curative value of aureomycin and chloromycetin in experimental plague infection in mice has been studied at the Haffkine Institute, Bombay, plague researches have included studies of the use of DDT in plague control work in the Nilgiris district under the director of public health, Madras, which have shown that DDT is an extremely effective pulicide which should offer considerable savings on cyanogas, and a preliminary trial with 'Gammexane' has been made. Filariasis inquiries have included, besides screening tests on various compounds, the preparation of thirty new compounds at the B.J. Medical College, Poona, and the Technology Department of the University of Bombay in the chemical part of a study aimed at changing the physical properties of drugs by the introduction of long alkyl chains which confer surface activity. In addition to N-substituted derivatives of stibanilic acid and a range of *p*-alkoxyaniline antimonyl tartrates, derivatives of *p*-aminosalicylic acid have been included in the study.

The work on indigenous drugs at the School of Tropical Medicine, Calcutta, and at the Drug Research Laboratory, Jammu, continued, and at the University College of Science and Technology, Calcutta, an investigation of the action of snake venoms and their constituents on the biochemical activities of tissue

* Report of the Scientific Advisory Board for the Year 1949. Pp. xli+307. (New Delhi: Indian Research Fund Association, 1950.) 1 rupee.

cells made further progress. The report also includes notes on various researches in the field of industrial health, such as environmental factors, the prevalence of byssinosis in the cotton textile industry and sickness absenteeism due to accidents, and on a considerable volume of clinical research under the Clinical Research Advisory Committee.

AUTOMATIC COMPUTING ENGINE OF THE NATIONAL PHYSICAL LABORATORY

THE pilot model of the automatic computing engine (A.C.E.), recently demonstrated at the National Physical Laboratory, is a general-purpose automatic electronic digital computer employing mercury-tube ultrasonic delay-lines for the storage of numerical data and instruction sequences, and using a modified Hollerith reproducing-punch for the input and output of these data on punched cards. Calculation proceeds in the binary scale.

The delay-line storage units are of two lengths, the shorter containing 32 binary digits, referred to as comprising one 'word', and the longer containing 1,024 digits, that is, 32 words. The digit interval is 1 μsec.; the recirculation periods of the long and short delay-lines, namely, 32 and 1,024 μsec., are called 'major' and 'minor' cycles, respectively. There are eight long and eight short delay-lines, giving a total capacity of 264 words, equivalent to 264 numbers of nine decimal digits and a sign. Although only a pilot model, the machine is able to deal with many problems of worthwhile complexity in which the numbers of instructions involved and intermediate results to be stored are not too great. For a typical problem of this kind, three or four of the long delay-lines are in use for instructions.

The arithmetic units comprise an adder and a multiplier. The adder is connected in the recirculation path of one of the short delay-lines, known as the 'accumulator', so that any number transferred to the input of the adder is added to the number in the line. It is also provided with a second input through which a number may be subtracted from that in the line. Addition and subtraction thus take 32 μsec., the time occupied by the transfer. The multiplier is connected with three short delay-lines, one to hold the first factor and two connected in series to store the second factor, which is afterwards displaced by the product as multiplication proceeds. The latter two lines are available as an accumulator of two words capacity when not in use for multiplication. Multiplication takes 2 msec., but is automatic as soon as it is started, so that other operations can be carried out during the formation of the product.

In addition to the arithmetical operations, the machine is capable of performing certain logical operations. Two of the short delay-lines are connected with (*a*) a circuit the output of which is the digit 1 when the digits from the lines are both 1, but is 0 otherwise; and (*b*) a circuit the output of which is 1 when the digits from the lines are either (1, 0) or (0, 1), but is 0 when they are either (1, 1) or (0, 0). One of these short lines is also connected with (*c*) a circuit producing 0 when the line produces 1 and conversely, and (*d*) a circuit producing the same output as the line but delayed by one digit interval. The 'logical operations' (*a*) to (*d*) are the only manipulative facilities available internally to the machine besides addition, subtraction, multiplication, delaying the output of a long delay-line by one minor cycle, and selection of the last digit of certain of the short lines. The latter is used chiefly for sign-sensing when negative numbers are represented by complements with respect to 2^{32}.

All computation and manipulation of data are expressed as an equivalent sequence of simple transfers of words, one or more at a time, from one of 32 possible 'sources' to one of 32 'destinations'. Thus, addition of two numbers is achieved by transferring one of them from its current store-position to the accumulator, thereby displacing the previous word in the accumulator, and then transferring the other number to the additive input of the accumulator. Multiplication is initiated by use of a special destination, the factors having first been transferred to the appropriate short lines. Logical operations are performed by first transferring the operands to the associated short lines, and then transferring the result from the output of the appropriate circuit to the destination at which it is required. These circuits operate continually, whether they are in use as sources or not. The transfers are carried out serially, each being specified by an 'instruction' of one word, five of the digits of which determine the source and five the destination. The assimilation of each instruction by the control circuits occupies one minor cycle (32 μsec.), so that transfers can take place at the maximum rate of 16,000 per sec.

An instruction may be drawn from any of seven long lines and one short line, as specified by three digits of the instruction previously obeyed, and it in turn will determine where the next instruction is to come from. Each instruction also specifies a waiting period of an integral number of minor cycles before the transfer is to begin, and a transfer period for which it is to take place. These numbers lie in the ranges 0–63 and 1–64 respectively, and each is determined by six digits of the instruction word. The instructions are fed continuously to the control circuits from the delay line currently selected; but only the one running in during the last minor cycle of each transfer is accepted and carried out as the next instruction; it will depend upon the wait and transfer numbers of the current instruction. This dependence is modified by the use of a special (and essential) destination called the 'discriminator', when the subsequent course of the computation is to depend upon a result already obtained. When a word composed entirely of zeros is transferred to the discriminator, the next instruction is taken from the normal position in the delay line currently used for instructions; but when a word having some digit 1 is so transferred, the next instruction is taken from the position following the normal one, leading to a different sequence of instructions. All discrimination criteria are capable of expression as the presence or absence of a digit 1 in some word, specially constructed if necessary, so that the above procedure is always adequate.

In addition to the sources and destinations associated with the delay lines and those already mentioned, there are the following: sources of a few useful constant words such as 000 . . . 0, 100 . . . 0, 111 . . . 1; destinations which initiate a read cycle or a punch cycle in the Hollerith equipment; a source indicating (by emitting the word 111 . . . 1) that the input or output cards are in position for