SCIENCE NOTES AND NEWS

Award of Research Degrees

The Karnatak University, Dharwar, has awarded the Ph.D. degree in Physics to Shri B. G. Jyoti for his thesis entitled "Band spectra : Some Investigations on Problems of Active Nitrogen".

Osmania University has awarded the Ph.D. degree in Zoology to Shri Anand Kumar Jaiswal for his thesis entitled "Studies on the Morphology and Physiology of the Reproductive System of the Cockroach *Periplaneta americana* L."

Andhra University has awarded the D.Sc. degree in Chemistry to Shri S. Seetharamaraju for his thesis entitled "Some Aspects of the Analytical Chemistry of Molybdenum and Uranium" ; and the Ph.D. degree in Geo-physics to Shri M. P. Madduleti Reddy for his thesis entitled "Limnological Studies of the Chilka Lake and Wave Refraction Studies in Relation to Shoreline Development".

Raptakos Medical Research Board Fellowships for 1964

The Raptakos Medical Research Board will consider applications for the award of Fellowships for research work on medical and allied subjects in recognized institutions situated in the Union of India.

The awards normally consist of : (*a*) Rs. 3,000 per year for a Fellowship and Rs. 750 per year towards contingencies approved by the Board ; and (*b*) Rs. 6,000 per year for a Fellowship and Rs. 1,000 per year towards contingencies approved by the Board.

Applications in the prescribed form, which may be obtained from the Secretary and Treasurer, Raptakos Medical Research Board, Dr. Annie Besant Road, Worli, Bombay-18, should reach him before September 30, 1963.

Lady Tata Memorial Trust Scholarships and Grants for the Year 1963-64

The Trustees of the Lady Tata Memorial Trust announce on the death anniversary of Lady Meherbai Dorabji Tata, 18th June 1963, the awards of scholarships and grants for the year 1963-64.

International Awards of varying amounts (totalling £ 6,037) for research in diseases of the blood with special reference to Leukæmias are made to :

Dr. B. Lagerlof (Sweden), Dr. R. L. Blakley (Australia), Dr. S. Itzhaki (England), Dr. B. Pedersen (Denmark), Dr. J. H. Hale (Great Britain), Dr. K. M. Laurence (England), Dr. Jaqueline de Maeyer (Belgium).

Indian Scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from diseases are awarded to :

Mr. V. N. Gogte (Bombay), Dr. V. N. Ingle (New Delhi), Miss P. Malathi (Bangalore), Dr. Farooq Ashai (Patna), Dr. K. L. Batra (New Delhi), Dr. (Miss) G. Grewal (Calcutta), Dr. V. N. Sehgal (New Delhi).

The Matric Computor

The Matric Computor is a new electronic machine for the solution of problems in matric mathematics, such as the inversion and multiplication of numerical matrices ; the evaluation of numerical determinants ; and the solution of algebraic and differential equation systems. The new computor designed by Prof. P. M. Honnell of Washington University also solves all problems normally associated with analogue computors and differential analyzers, but unlike these it has no patching panels.

The theoretical basis of the machine rests upon the synthesis of an admittance network. Its information content is represented by an ensemble of digitally controlled admittances permanently interconnected through a system of entry and trace amplifiers ; prescribed mathematical constants of functions are represented by current-sources. In the synthesis network, of fixed configuration, the digitized admittances represent the entries in the problem matrices, and are in a 1-to-1 reciprocal correspondence with the matric mathematics. The dynamic equilibrium voltage responses of the network automatically yields the solution-vector of the matric problem being solved.—(*Washington University News.*)

Origin of the Earth's Magnetic Field

That the earth's magnetism may well be due to a high-pressure magnetic phase of iron in the central core of the earth has been suggested by R. J. Weiss in a communication to *Nature* (1963, 197, 1289). The earth' core which extends outwards from the centre to a distance of some 3,450 kilometres (radius of the earth is

6,350 km.) is believed to be predominantly iron. It can be divided into two distinct parts, namely, the outer core which is liquid since it does not transmit transverse seismic waves, and the inner one supposed to be solid whose structure is still in doubt. According to Bullen the interface between the inner and the outer cores occurs at a depth of about 5,000 kilometres, corresponding to a pressure of about $3{\cdot}3 \times 10^{12}$ dynes/cm.^{2}, and a temperature of 4000° K. It has been estimated that the density on the outer liquid side of the interface is 11·5 gm./cm.^{3}, and that on the inner solid side 15·2 gm./cm.^{3} This density change of nearly 30% is too large to be adequately explained if we consider that the change in the density of iron on melting is only 3·5%.

R. J. Weiss suggests that the inner core of the earth may well be a new phase of iron in which two of the 3*p* 'argon core' electrons are transferred to the '3*d*-4*s*' band and that such a phase may account for the origin of the earth's magnetic field. The transfer of two of the 3*p* electrons to the '3*d*-4*s*' band would add two more electrons to the six bonding electrons (the two magnetic electrons are in the anti-bonding states), and in analogy to the cases, of the rare earth metals cerium, europium, and ytterbium, this would change the atomic volume approximately in proportion to the number of overlapping electrons. In iron this new high-pressure phase would correspond to a density change of about 25%.

If the onset of the high-pressure magnetic phase of iron is supposed to take place at the pressure of $3{\cdot}5 \times 10^{12}$ dynes/cm.^{2}, then the following consequence arises regarding the magnetic fields of planets. If the planets contain cores similar in composition to the earth only those of mass approximately equal to or greater than the earth would develop sufficient gravitational pressure to create the high-pressure magnetic phase. Thus one would expect magnetic fields only in the case of the major planets Uranus, Neptune, Saturn and Jupiter, and no magnetic fields on Mercury, Mars, Venus and the Moon.—(*Nature*, 1963, **197**, 1289.)

Simultaneous Occurrence of *Corynebacterium tritici* (Hutch.) Burkholder and *Ustilago tritici* (Pers.) Rostr. in the Same Ear of Wheat

Messrs. S. C. Mathur and Z. U. Ahmad, Section of the Plant Pathologist, Uttar Pradesh Government, Kanpur, write :

Combined infection caused by *Corynebacterium tritici* (Hutch.) Burkholder and *Ustilago tritici* (Pers.) Rostr. in the same ear of wheat variety Pb. 591 was observed recently at the time of its emergence at the Government Research Farm. Kanpur. Five other smutted ears in the same plant showed neither the association of the nematode, *Anguina tritici* (Steinbuch) Filipjev nor the bacterium. The association of two unrelated pathogens, *viz.*, a bacterium (*C. tritici*) and a fungus (*U. tritici*) seems to be a new record.

Report of the National Chemical Laboratory, Poona, 1950-60

The National Chemical Laboratory, Poona, is among the first in the chain of research laboratories set up by the Council of Scientific and Industrial Research, New Delhi. It was declared open on January 3, 1950, and the Report, the first to be issued since then, reviews the progress of research that has taken place in the laboratory during the ten years 1950-60. In this period about 500 papers have been published giving the results of the laboratory's activities in the various branches of study. The choice of problems has been guided by the country's needs of chemical products and also by the specialized knowledge and interests of the working members of the staff. The report shows that 95 patents have been taken during the decade. It will be a welcome feature if the proposed idea of issuing an annual report reviewing the activities and achievements of the NCL during the year concerned is put into effect.

Indian Livestock

"*Indian Livestock*" is a quarterly journal that is being brought out by the Indian Council of Agricultural Research (ICAR), New Delhi. In a country which is predominantly agricultural livestock occupy a very important place in the national economy. With the successive Five-Year Plans being implemented by the Government there is a phased programme of research in the various aspects of livestock science such as breeding nutrition, control of diseases, production of dairy products, etc. It is necessary that the results of these researches should reach the man in the field, and this popular journal will go a long way in fulfilling this object.

The first number of the journal (January 1963, 64 pages) contains a number of popular articles on Cattle and Buffaloes, Poultry, Sheep, Fisheries, Dairying, Hides, Skins, and Leather; etc. A useful feature is 'Farm advice' which answers questions which will be of practical value to farmers regarding their day-to-day farm problems.

The Annual scbscription of the journal is Rs. 4.

Cultivated Plants and Their Wild Relatives

In 1950 Academician P. M. Zukovskij published a Russian manual of about 600 pages on "Cultivated plants and their wild ancestors", for use in the faculties of Biology and Soil Science in the USSR State Universities. His long association with the unique collections of plants at the Institute of Plant Industry at Leningrad has made him eminently suited to write on the subject. Particular emphasis is placed on the importance of China, Southern Asia and Asia Minor as centres of cultivated plants and a large number of species that have originated there are enumerated in this manual. What the author says, particularly with reference to the origins of the various plants, is of wide interest to botanists throughout the world.

The Commonwealth Agricultural Bureaux has brought out an abridged translation of this work at a very reasonable price. The translation has been done by Dr. P. S. Hudson of the Commonwealth Bureau of Plant Breeding and Genetics. This crown quarto, paper-cover book is of 107 pages and is priced 10 *s.* (U.S. $ 1.50). It can be had from the Commonwealth Agricultural Bureaux, Central Sales Branch, Farnham House, Farnham Royal, Bucks.

Ultrasonic Waves Rotated by Magnetic Field

Experiments at the Bell Telephone Laboratories have shown that the direction of polarization of transverse ultrasonic waves travelling in a crystal could be rotated by their interaction with a magnetic field. This work is significant because the rotation is non-reciprocal, that is, when the wave is reflected at the end of the crystal and travels back to the input it does not rotate back to its original direction of polarization. This envisages the possibility of a new family of ultrasonic devices such as circulators and isolators.

In the experiment a quartz disc is bonded to one end of a cylinder of single crystal yttrium iron garnet (YIG), and a *dc* magnetic field parallel to the axis of the cylinder is applied. The magnetic moments of the iron atoms in the garnet then line up parallel to the field. Next, piezoelectric oscillations are set up in the quartz disc generating an ultrasonic wave pulse. This 500 mc./s. pulse is polarized parallel to the (100) quartz axis.

The ultrasonic pulse travelling down the garnet cylinder strains the crystal lattice so that the iron atoms get alternately pulled apart from each other and squeezed together in a direction perpendicular to the magnetic field. Straining the atoms creates a second magnetic field, the *rf* field, which is perpendicular to the applied *dc* magnetic field. A component of the *rf* field interacts with the lined-up iron atoms and changes the direction of their magnetization. (This process is the inverse of magnetostriction whereby ferromagnetic materials elongate in the direction of a *dc* magnetic field and contract in a direction perpendicular to the field.)

The change in the direction of the magnetic moments of the iron atoms affects the direction in which they move as the pulse strains the YIG lattice. The motion of the iron atoms is linearly polarized in a plane perpendicular to the wave's direction of travel. The initial group of iron atoms move up and down in this plane. The next group of atoms move at an angle to the previous group in the perpendicular plane. This rotation is caused by the interaction of the *rf* field and the lined-up iron atoms and is analogous to the Faraday rotation of electromagnetic waves in ferrites. Each group of atoms is strained at an angle to the previous atoms strain and thus the direction of motion is rotated continuously. When the wave is reflected at the end of the YIG cylinder, rotation of the strain polarization continues in the original direction since the interaction between strain and the iron atoms is independent of the direction in which the wave travels.—(*J. Frank. Inst.*, 1963, 275, 258.)

Anhydrous Hydrazine—The New Space-age Fuel

The fuel that was instrumental in helping *Mariner II* reach Venus was anhydrous hydrazine, a relatively unknown space-age fuel. *Mariner II* was launched on August 27, 1962 (*see Curr. Sci.*, 1962, 31, 530). Eight days later it was travelling at 6,780 miles/hr. on a course that would have taken it to the distance of closest approach to Venus. The basic success of the probe hinged on a vital mid-course manœuvre that had to be executed by remote control at a distance of 1,492,500 miles from earth. This was accomplished on September 4, 1962, when three coded commands were sent to *Mariner II* and stored in its command and control system. The first ordered it to roll 9·33 degrees; the second called for a pitch manœuvre of 139·85 degrees; the third ordered the mid-course correction motor to burn for 29 seconds.

When receipt of the commands was verified, the Goldstone, California, tracking station

issued a signal executing the sequence of commands at specified intervals. The roll required 51 seconds, the pitch manœuvre 13 minutes 15 seconds. The latter turned *Mariner II* almost completely around so that the 29 second motor firing acted as a retro-rocket slowing the craft by 69·5 miles per hour to make the course correction. That this correction succeeded was proved on December 14 about 3–00 p.m. (E.S.T.) when *Mariner II* passed within 21,000 miles of the cloud-covered Venus.—(*Jour. Frank. Inst.*, 1963, *275*, 260.)

Single Crystal Growth from Aqueous Solution

Those with an interest in the growth of large single crystals from aqueous solution will find useful information in an article on the subject by Torgesen *et al.* in the *Journal of Research* Sec. C, National Bureau of Standards (1963, Vol. 67 C, p. 25). The growing of large single crystals of high quality from solution requires the precise control of supersaturation and the avoidance of thermal and mechanical shock. In the equipment assemblies described in the paper, the crystal growth bath is designed for uniform growth conditions and the exclusion of contamination. The temperature controller gives regulation of the temperature an order of magnitude more sensitive than those hitherto used and provides for stepless change of temperature. The crystals are thus free from liquid inclusions found to result from sudden acceleration of growth.

With the assemblies described single crystals of ammonium dihydrogen phosphate, potassium dihydrogen phosphate, uranyl nitrate hexahydrate, strontium dichromate, sodium chlorate, sodium nitrate, and cxalic acid dihydrate have been successfully grown. The crystals have been judged excellent on the basis of tests by X-ray diffraction, optical eaxmination between crossed polarizers, microscopic searches for discontinuities or inclusions, and the observation of reflections from cleavage surfaces.—(*Jour. O. Res., C, Nat. Bur. Std.*, 1963, 67 C, 25.)

U.S. Astronaut Gordon Cooper

An Atlas rocket launched into orbit the space capsule 'Faith 7', carrying U.S. astronaut Leroy Gordon Cooper off Cape Canaveral on May 15, 1963, at 1·04 G.M.T. After completing the scheduled flight of 22 orbital rounds in 34 hours 21 minutes, Cooper, who piloted his spacecraft manually during the final re-entry stage, landed safely in the Pacific ocean at the marked spot within sight of his rescue ship. The orbit round the earth ranged from 100 miles to 165 miles high, and the period of revolution was 88 minutes 45 seconds. Cooper is the tenth man to rocket into space since the first Russian astronaut Major Yuri Gagarin who orbited once round on April 12, 1961.

Second Russian Twin Cosmonauts in Space—First Woman Astronaut

Russia launched a spacecraft called Vostok V, carrying the 29-year-old astronaut Lt.-Col. Valery Federovich Bykovsky, on June 14, 1963, at 15·00 hrs Moscow time. Following this, two days after, on June 16, 1963, at 12·30 hrs Moscow time the spaceship Vostok VI was launched carrying the first woman astronaut, the 26-year-old Miss Valentina Tereshkova. According to official reports the two spaceships are orbiting the earth with only 12 seconds difference in their timing, Vostok VI taking the longer. All systems on board the spaceships have been functioning normally, and live TV transmissions from them have been observed on the Russian television network. The two pilots established radio contact with each other at 13·00 hrs Moscow time, 30 minutes after Vostok VI rose from the earth.

It will be recalled that the two spaceships, which were simultaneously in flight for the first time were launched on August 11 and August 12, 1962, carrying cosmonauts Nikolayev and Popovich who came close together while in orbit.—(*See Curr. Sci.*, 1962, 31, 360.)

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