

## RESEARCH ITEMS

### India's Population

In a paper entitled "Half a Century of Population Trends in India", in the *Geographical Journal* of Nov.-Dec., 1941, A. Geddes has worked out the population density of the administrative districts of India from the censuses of 1881 and 1931 and has plotted for each district not only the percentage change (increase or decrease) but also the variability or deviation from any steady rate of change. This entailed an examination of the figures of the intervening censuses. This method brings out many important considerations. Thus in Bengal the east shows high increase, with very low variability, in contrast to the west, which shows arrest without variability, or a state of stagnation. Rice lands of the south showed slight variability whether there was arrest, as in the Cauvery delta, or high increase, as in the deltas of the Kistna and Godavari. Broadly speaking, arrest or stagnation seems to be the outcome of deficiency of necessities and endemic diseases, while strong fluctuations about the mean, which might be accepted merely as arrest, are characteristic of the famine tracts. This is not a condition of stability, though, as Geddes points out, a careless reference to census figures might suggest that conclusion.

### Influenza A Virus

Leslie A. Chambers and Werner Henle, of the Department of Pediatrics and the Johnson Foundation for Medical Physics, University of Pennsylvania, described work on influenza A virus before the American Philosophical Society on November 22. The infectious agent of influenza A, as it occurs in emulsions of infected mouse lung, is associated with particles about 100 m $\mu$  in diameter. Particles of similar size, chemical composition, density, staining properties and electron-microscopic appearance are derivable from normal lung tissue. Virus contained in the extra-embryonic fluids of infected chick embryos is not associated with such large structures, but may be absorbed completely from such fluids by the particles derived from normal lung tissue. This, together with other evidence, indicates that a component of normal cells may act as carrier of a considerably smaller pathogenic agent. Concentration of the virus from extra-embryonic fluids was accomplished by precipitation with protamine. Analysis of the resulting infectious complex indicates that the virus consists largely, if not entirely, of nucleoprotein. Ultra-centrifugation at about 90,000 gm. for 9 minutes sedimented almost all the infective material from egg fluids. Sedimentation diagrams of the resuspended sediment showed two components to be present. One of these gave a well-defined boundary and had a sedimentation constant of  $31 \times 10^{-13}$ , corresponding with a particle size of about 12-14 m $\mu$  and a molecular weight of about 1,000,000. Fractionation by ultra-centrifugation, followed by protein analysis and infectivity tests, indicated that the heavier, less homogeneous component ( $S_{20} =$  about  $800 \pm 100 \times 10^{-13}$ ) consisted, almost entirely, of aggregates of the smaller units. The two sedimentable fractions were infectious in approximately equal dilutions. A minimal infectious dose contained about  $10^{-16}$  gm. and therefore consisted of less than a hundred particles. A size distribution curve based

on measurement of electronmicrographs of the isolated virus protein showed the particles to be essentially spherical and to have a modal diameter of about 11 m $\mu$ . This is in good agreement with the estimate based on the sedimentation constant,  $S_{20} = 31 \times 10^{-13}$ . In view of this evidence, the virus of influenza A is regarded as one of the smallest pathogenic agents yet isolated.

### Parthenogenetic Activation of Rabbit Eggs

HERBERT SHAPIRO, of Hahnemann Medical College, Philadelphia, described the parthenogenetic activation of rabbit eggs in the unoperated animal at a meeting of the American Philosophical Society on November 22. It has been shown in earlier work that cold is an effective agent in initiating artificial parthenogenesis in rabbit ova *in vitro*. By inducing rabbits to ovulate as the result of a course of pituitary extract injections, tubal eggs of known age could be cooled *in situ* in the anaesthetized animal, under sterile surgical conditions, by circulating cold water through a metal jacket into which the tube was inserted. This mode of treatment did in one instance lead to the birth of a normal parthenogenetic female, capable of normal reproduction. In the present series of experiments, rabbit eggs were activated parthenogenetically in the intact animal, without operating surgically. Rabbits were made to ovulate as usual by pituitary injections. Cooling of the entire animal was effected by applying an ice pack on the doe's flank, directly over the region of the Fallopian tube, as she lay anaesthetized on the table. Rectal temperature, respiration and pulse-rate were recorded at regular intervals. The uterine tube, which lies just under the abdominal musculature, was very likely brought to a temperature lower than that indicated by the rectal thermometer. Body temperature (normally about 39.7° C. in the rabbit) was lowered to points varying from 33.6° C. to 18.0° C. In all experiments, perfect recovery of the animals occurred. Eggs were secured at various intervals after the experiment by flushing the Fallopian tube, and they were then fixed and sectioned for microscopic study. Artificial parthenogenetic activation was obtained in two animals, one of which contained two eggs in the two-cell stage, when examined forty hours after the activating treatment, and another contained a young embryo in the early morula stage. More advanced stages in embryogenesis have not thus far been obtained.

### Leaf-Curl Virus Diseases

THREE leaf-curl diseases of plants in South Africa have been described by A. P. D. McClean (*Sci. Bull.*, No. 225, Dept. of Agr. and Forestry, Union of South Africa. Govt. Printer, Pretoria. Pp. 66; 6d. 1940). Leaf-curl virus of tobacco causes a yellow network on the leaves, followed by projection of the smaller veins, and finally the formation of leaf-like enations, with malformation of the foliage. It has been transmitted by White fly to a considerable range of Solanaceous hosts, and does not appear to be transmitted by mechanical means. Separate leaf-curl diseases have also been described on petunia and hollyhock. The former virus has been transmitted by grafting to tobacco, *Nicotiana glutinosa*, and tomato. It forms enations but no chlorotic pattern upon tobacco, and induces petal-like outgrowths from the corolla of petunia. Leaf-curl of the hollyhock induces chlorosis and emergent veins, but no enations.

#### Detection of Lactose and Maltose by means of Methylamine

W. R. FEARON described before the Society of Public Analysts and Other Analytical Chemists on February 4 a simple test based on the observation that when alkaline solutions of lactose or maltose are heated with methylamine hydrochloride under prescribed conditions a bright violet-carminic colour develops. The test shows concentrations of the sugars down to 0.05 per cent. The carminic colour is not given by other carbohydrates or related compounds tested, or by proteins, fats or biological secretions, such as saliva or urine. Other reducing sugars may be coloured yellow by the hot alkali, and in excess they may interfere more or less with the test by combining with the amine.

#### Decomposition of Carbonic Acid

THE evolution of carbon dioxide from bicarbonate by mixture with acid is usually supposed to go in two stages, a practically instantaneous ionic reaction  $\text{H}^+ + \text{HCO}_3^- = \text{H}_2\text{CO}_3$ , followed by a unimolecular time reaction  $\text{H}_2\text{CO}_3 = \text{H}_2\text{O} + \text{CO}_2$ . By using a calorimetric method in which the two solutions undergoing reaction are driven into a mixing chamber and thence into an observation tube in which the temperature is measured at several points, F. J. W. Roughton (*J. Amer. Chem. Soc.*, **63**, 2930; 1941) has shown that these two stages actually occur. The separate heats of reaction were determined over a range of temperatures and also the velocity constant of the second reaction. The values of the equilibrium constant,  $[\text{CO}_2]/[\text{H}_2\text{CO}_3] = 950$  at  $0^\circ$ , and of the first true ionization constant,  $a_{\text{H}^+}\text{HCO}_3^-/[\text{H}_2\text{CO}_3] = 2.5 \times 10^{-4}$  at  $0^\circ$ , were also calculated. The heat of the ionic reaction was found to vary with temperature in a manner characteristic of weak acids.

#### Atomic Weights of Silver, Bromine and Potassium

IN a study of the thermal decomposition of potassium bromate, with a precise correction for the moisture content of the salt, and the comparison of pure potassium bromide with silver by precipitation as silver bromide, R. K. McAlpine and E. J. Bird (*J. Amer. Chem. Soc.*, **63**, 2960; 1941) have obtained new values for the molecular weight of potassium bromide and the atomic weight of silver; and from these, by application of the ratio of bromine to silver from the work of Baxter and Hönigschmid, values for the atomic weights of bromine and potassium referred to the new value for silver have been calculated. The atomic weight of silver found is 107.879, agreeing within 1 part in 100,000 with the present accepted value. The atomic weights of bromine and potassium calculated from this and the ratio  $\text{Br} : \text{Ag} = 0.740786$  are 79.915 and 39.096, respectively. On the basis of the international value  $\text{Ag} = 107.880$ , the atomic weight of potassium would be 39.095. These figures provide an important check on the work of Hönigschmid and Sachtleben on the atomic weight of silver, in which the absence of moisture in the barium perchlorate and barium chloride used was proved only indirectly.

#### Lower Oxides of Boron

IN 1916 Travers, Ray and Gupta showed that when the residue from the repeated extraction of crude magnesium boride with water was treated with concentrated ammonia in an atmosphere of hydrogen the solution contained a substance of the composition  $\text{H}_{12}\text{B}_4\text{O}_6 \cdot 2\text{NH}_3$ , and when the ammoniacal solution

is evaporated to dryness in a vacuum and gently heated, an oxide  $\text{B}_4\text{O}_6$  remained, together with a small quantity of magnesia. R. C. Ray and P. C. Sinha (*J. Chem. Soc.*, 742; 1941) find that when the residue obtained by repeated and prolonged treatment with water of crude magnesium boride is kept in contact with successive portions of a fairly concentrated solution of ammonia in an atmosphere of hydrogen, and the filtrate concentrated in vacuum at room temperature, crystals separate from which, by fractional crystallization, two compounds,  $(\text{NH}_4)_2\text{B}_2(\text{OH})_2$  and  $(\text{NH}_4)_2\text{B}_4\text{O}_6$ , are obtained. When heated in a vacuum these formed powders of the oxides  $\text{B}_2\text{O}_3$  and  $\text{B}_4\text{O}_6$ , respectively:  $(\text{NH}_4)_2\text{B}_2(\text{OH})_2 = \text{B}_2\text{O}_3 + 2\text{H}_2 + 2\text{NH}_3$ , and  $(\text{NH}_4)_2\text{B}_4\text{O}_6 = \text{B}_4\text{O}_6 + \text{H}_2\text{O} + 2\text{NH}_3$ . The oxide  $\text{B}_4\text{O}_6$  is perfectly colourless but  $\text{B}_2\text{O}_3$  is slightly brown. The oxides are readily soluble in water, forming colourless solutions.

#### Sedimentation of Washed Red Blood Cells

THE gradual development of biophysics is evident in occasional papers in the physical journals. A recent example comes from the Engineering Department of the University of Manchester, where R. B. Whittington has studied the sedimentation of washed red blood-cells (*Phil. Mag.*, **33**, 68; 1942). The experiments were made as a first step towards a mechanical investigation of the red-cell sedimentation test, the sedimentation of whole-blood suspensions being too complex for direct mechanical study in the initial stages of the work. Although the red blood-cells approximate to elastic biconcave disks of diameter six times their thickness, they cannot be treated as non-biological material of the same dimensions. The suspending solution must be isotonic with blood-plasma. If the cells were suspended in a solution containing excess of salt they would shrink owing to loss of fluid by osmosis. A deficiency of salt would lead to swelling if not to rupture. Varying speeds of motion could not therefore be obtained by merely altering the specific gravity of the fluid unless it could be kept isotonic. Instead, a sodium chloride solution, 0.85 per cent by weight, was used throughout and the 'effective viscosity' was altered by varying the proportion of suspended cells. The drag-coefficients plotted logarithmically against the Reynolds' numbers gave a straight line graph.

#### Excessive Expansion of Dental Amalgams

DENTISTS have frequently been puzzled by an excessive expansion of dental amalgams. The normal expansion or setting is about 8 microns per cm. After 10–20 hours no further expansion should occur. Some specimens have, however, been found to expand more than two hundred microns in thirty days. The mystery has been solved by J. C. Schoonover and associates (*J. Franklin Inst.*, **232**, 579; 1941). Records show that the excessive expansions occur only with alloys containing zinc and only in the presence of salt solutions such as NaCl. Gas pockets were found in such expanding amalgams, and the gas has been identified as hydrogen. Non-zinc alloys do not show this abnormal expansion, nor do zinc-containing alloys if they are amalgamated in a clean mortar or a mechanical amalgamator and are not contaminated by handling. The problem arose from the accidental introduction of NaCl from the perspiration of the palms of the hands of dentists when handling the alloys in the course of normal dental operations.