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SCIENCE FIVE THOUSAND YEARS HENCE[1]

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I HAVE been asked to predict the condition of science five thousand years hence when the Time Capsule is dug out of the Flushing meadows—provided there are any meadows here in A.D. 6939. Land has been rising and falling in different parts of the globe within historic time, and within five thousand years the Time Capsule may be considerably below sea level or raised several hundred feet above where it is now.

While I speak *to* the youth of to-day, I am speaking *for* the youth that will be living one hundred and fifty generations hereafter, in other words to your great, great, one hundred and fifty times great grandchildren.

One can predict only in terms of what is known in the past. Let us compare what has actually occurred within these fifty centuries with what a man five thousand years ago might have predicted for the present. He could not have thought about development of world civilization because the world to him was only a limited region. Civilizations could develop and decline with little or no influence on one another because of lack of means of communication. His knowledge of the geographical world and of the laws of nature was so limited that it would have been impossible for him to predict the condition of the world in 1940. Science, as we understand this term, did not exist in B.C. 3060.

Are we to-day in our ignorance as incapable of predicting the future five thousand years hence as was the man five thousand years ago? In many ways probably yes; in other ways we have an advantage.

[1] Address before the American Institute of the City of New York at the World's Fair, September 23, in connection with the sealing-in of the Westinghouse Time Capsule. The address was broadcast in part over the NBC network.

inserting a double-pole-double-throw switch into the circuit of the galvanometer within the instrument. In one position of the switch the circuit within the meter is unaltered, in a second position the galvanometer in the meter is disconnected and an outside galvanometer is substituted without disturbing the adjustment of the meter.

A Leeds and Northrup galvanometer unit (2420-c) with a plane mirror and mounted on a heavy wood base is used for recording. A narrow beam of light reflected from the mirror moves across the slit of the camera placed at a distance of one meter. A potentiometer, inserted between the pH meter and the recording galvanometer, is used to control the excursion of the light beam for a given unit change in pH. The calibration on the record is obtained by moving the pH dial through a given interval, usually 0.1 pH, and photographing the resulting excursion of the light beam.

For rendering the blood incoagulable heparin has been used in some instances; but we have also found Pontamine Fast Pink BL or Chlorazol Fast Pink B, 200 to 250 mgm per kilogram, satisfactory.

This apparatus is quite rugged and stabile. Continuous records of the pH of the circulating blood can be made with an accuracy of at least 0.01 pH, and with good approximation to the third decimal place. The type of record obtainable is shown in Fig. 2. This

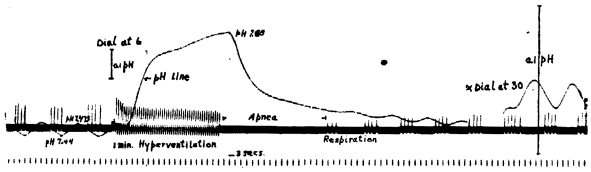

FIG. 2. A record of spontaneous breathing, hyperventilation, and the pH of the circulating arterial blood, obtained from a dog under barbital-sodium anesthesia. Dial readings refer to figures on the dial of the potentiometer between the meter and the recording galvanometer.

record was obtained from a dog under barbital-sodium anesthesia. The animal, as indicated, was hyperventilated for one minute. Prior to the hyperventilation, as well as after that procedure, the breathing was of the periodic type. The record shows, in addition to the marked rise in the pH of the arterial blood incident to the hyperventilation, a definite fluctuation in pH with each group of respirations. In a number of instances, in animals breathing slowly and deeply, we have observed and recorded measurable fluctuations in the pH of the circulating arterial blood coincident with each respiratory movement.

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A SIMPLE INEXPENSIVE DEVICE FOR ACCURATE DELIVERY OF SMALL AMOUNTS OF FLUID

To overcome the difficulties which are encountered when treating a large number of animals with small identical volumes of material, Dr. Robert T. Frank suggested that I devise an attachment for a tuberculin syringe which can be readily set and promptly made to deliver any desired amount of liquid. The device was not to interfere with quick assembly and cleaning.

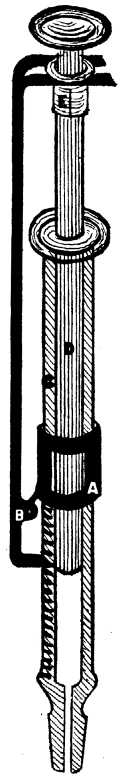

FIG. 1

The apparatus which has proved efficient consists of a spring clamp (A) encircling the barrel (C) with an arm (B) attached by a pivot. Both ends of this arm are bent at right angles. At the front end, facing the barrel, there is a sharp edge which engages the graduation lines etched into the barrel. The other end of the arm acts as a stop to the plunger (D) which carries a metal collar (E) with a flange to give a surface perpendicular to the stop. The amount delivered, when using this device, is as accurate as the graduation markings on the syringe. The device can be easily detached and applied to another syringe as required.

This device has been used with success by Dr. Robert T. Frank for injecting quantities as small as 0.02 cc.

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BOOKS RECEIVED

CHANDLER, ASA C. *Introduction to Parasitology; with Special Reference to the Parasites of Man.* Sixth edition. Pp. xiii + 698. 309 figures. Wiley. $5.00.

CONN, H. J. *Biological Stains; A Handbook on the Nature and Uses of the Dyes Employed in the Biological Laboratory.* Pp. 308. Biotech Publications, Geneva, New York. $3.40.

FRANKLIN, PHILIP. *A Treatise on Advanced Calculus.* Pp. xiv + 593. Wiley. $6.00.

HARROW, BENJAMIN. *Laboratory Manual of Biochemistry.* Pp. v + 119. 19 figures. Saunders. $1.50.

HEHRE, FREDERICK W. and GEORGE T. HARNESS. *Electric Circuits and Machinery. Vol. I, Direct Currents.* Pp. ix + 513. Illustrated. Wiley. $4.50.

MACDUFFEE, CYRUS C. *An Introduction to Abstract Algebra.* Pp. vii + 303. Wiley. $4.00.

POTTER, GEORGE E. *Essentials of Zoology.* Pp. 526. 204 figures. Mosby. $3.75.

TIMBIE, WILLIAM H. and VANNEVAR BUSH. *Principles of Electrical Engineering.* Third edition. Pp. ix + 540. 388 figures. Wiley. $4.50.

TRANSEAU, E. N., H. C. SAMPSON and L. H. TIFFANY. *Text-book of Botany.* Pp. xi + 812. 424 figures. Harper. $4.00.

WHITE, E. GRACE. *Principles of Genetics.* Pp. 352. 179 figures. Mosby. $2.50.