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MOLECULES[1]

By Professor N. V. SIDGWICK

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IT is commonly assumed that chemistry, like physics, can prevail everywhere, but on inquiry it can be readily seen that this is by no means so; it is only under rather exceptional conditions that chemical processes can occur. This is a matter which concerns every one, and not chemists alone, because it is only where chemistry is possible that life is possible. Indeed, that is one reason why the limitations of chemistry have not always been recognized, because we are enclosed within the same limits ourselves.

Chemistry is commonly called molecular physics: it is the investigation of the structure and behavior of those little groups of atoms which we call molecules, whose almost infinite repetition constitutes the chemical substances of our ordinary experience. The first point therefore is to know what molecules are, and in general terms why they are formed.

[1] The Maiben Lecture delivered before the meeting of the American Association for the Advancement of Science, Denver, June 23, 1937.

The matter of the universe consists of atoms, of some 90 to 95 different elements. Each atom is made up of a small positively charged nucleus, surrounded by a number of electrons equal to the number of units of positive charge on the nucleus. Now the electrons surrounding a nucleus can arrange themselves in groups of greater or less stability, and it often happens that two or more atoms can make a more stable arrangement of their electrons by pooling them or by transferring some of them from one atom to the other. If the extra stability so gained is great enough, the atoms will remain attached to one another, and a molecule will have been formed. It is only a few of the outermost electrons of any atom which take part in these rearrangements—the greater number are already sorted out into groups—and in consequence the number of atoms which forms a molecule is never large, often only two or three, and rarely more than a hundred.

in the tail bud stage to 75 and 35, respectively, in the feeding stage. The container is then taken out of the beaker, and most of the water removed by pipette, care being taken not to lower the level so much as to bring the animals in contact with the surface film. A convenient amount, usually 2.5 cc, of hemoglobin solution (1 cc of blood diluted to 2 liters with water) is added to the container with the animals and then sufficient water added to bring the fluid level up to the top of the narrowed neck of the bulb. A microburette is used to measure the hemoglobin solution. The Scotch tape is removed and a length of rubber tubing with a mouthpiece is connected to the open end of the capillary. The container is then inverted over a small beaker and the contents expelled by air pressure through the capillary. This prevents bubbling, and with a little practice the embryos can be removed from the bulb without injury, even in open neural plate stages. A standard solution is then made by repeating the procedure without the embryos, the additional volume being of course made up by water. The relative concentration of hemoglobin in aliquot parts of the standard and the unknown solution containing the animals is then determined with a colorimeter by the method of Bing and Baker,[1] using Bing's[2] modified reagent.

The results are calculated by a colorimeter formula as follows:

$$\frac{U}{S} \times V = V_1$$

U = reading of unknown solution
S = reading of standard solution
V = volume of container
V_1 = volume of liquid in unknown solution

and

$$\frac{V - V_1}{\text{Number of eggs used}} = \text{volume of one egg}$$

The advantage of the indirect method is that the actual concentration of reference substance in the standard solution is of no consequence. The greatest source of error is in the reading of the colorimeter. It is possible that a reference substance with a blue color might improve the accuracy. However, tests of this method on known volumes of mercury with hemoglobin as the reference substance showed it to be accurate to within 5 per cent.

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[1] F. C. Bing and R. W. Baker, *Jour. Biol. Chem.*, 92: 589–600, 1931.
[2] F. C. Bing, *Jour. Biol. Chem.*, 95: 387–388, 1932.

THE CULTIVATION OF VIRUSES ON THE CHORIOALLANTOIC MEMBRANES OF CHICK EMBRYOS

DURING the studies of the cultivation of the viruses of Myxamatosis of rabbits and Vaccinia on the chorioallantoic membranes of chick embryos, modifications of the technique as described by Woodruff and Goodpasture[1] were used. A stand for holding the egg, which was found superior to those made of plasticene, was devised by one of us (Elizabeth Osterman). It was made by soldering the bowl of an ordinary teaspoon on a piece of iron pipe, 1½ inches high and 1½ inches in diameter. This is easily cleaned and sterilized as well as being heavy enough to hold the egg steadily during inoculation.

The eggs were inoculated under a hood free of air currents and kept dust free by a continuously steaming pan of water. It was not necessary, therefore, to place the eggs in warm water during inoculation.

A grinder, known as the Handee Grinder, manufactured by the Chicago Wheel and Manufacturing Company, to which had been fitted a ½ inch Carborundum dental disk was found most efficient for opening the eggs. This has three advantages: first, that the disk can be easily sterilized by immersion in alcohol between operations; second, by use of it the number of eggs which can be opened in one hour is largely increased; and third, the cost ($10.25 for the disk and drill) is much less than a dental drill.

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ELIZABETH OSTERMAN
K. STEPHEN PILCHER

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[1] A. Woodruff and E. W. Goodpasture, *Am. Jour. Path.*, 7: 209–222, 1931.

BOOKS RECEIVED

CARLSON, ANTON J. and VICTOR JOHNSON. *The Machinery of the Body.* Pp. xvii + 580. 187 figures. University of Chicago Press. $4.00.

FRASER, C. MCLEAN. *Hydroids of the Pacific Coast of Canada and the United States.* Pp. 207. 44 plates. University of Toronto Press. $2.50.

GRAY, GEORGE W. *The Advancing Front of Science.* Pp. xiii + 364. Whittlesey House, McGraw-Hill. $3.00.

MENNINGER, KARL A. *The Human Mind.* Revised edition. Pp. xiii + 487 + xiii. Knopf. $5.00.

PIDDUCK, F. B. *Lectures on the Mathematical Theory of Electricity.* Pp. viii + 110. Illustrated. Oxford University Press. $3.25.

WEBB, HANOR A. and ROBERT O. BEAUCHAMP. *Workbook in General Science.* Pp. 312. Appleton-Century. $0.88.

WHITEFORD, G. H. and R. G. COFFIN. *Essentials of College Chemistry.* Pp. 514. 32 figures. Mosby. $4.00.