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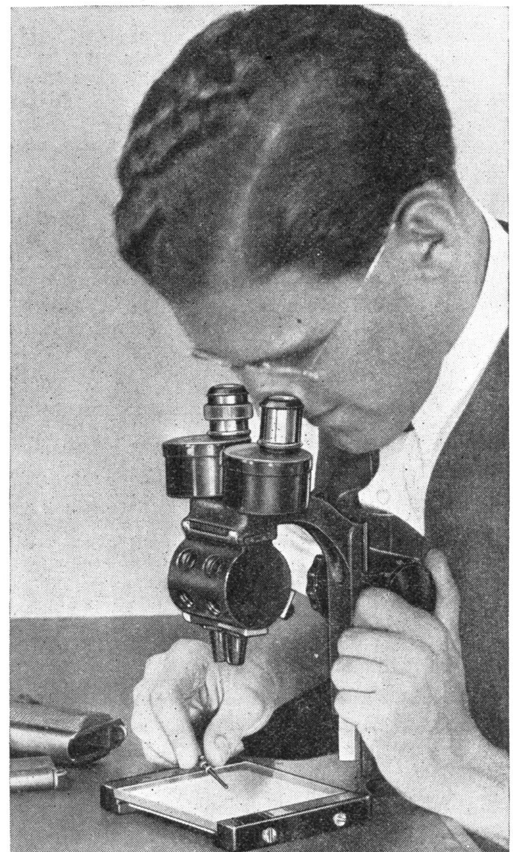

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MIXED CATALYSTS[1]

By Dr. VLADIMIR N. IPATIEFF

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IT has long been known that the presence of certain substances (*promoters*) in a given catalyst increases its activity. But to explain how they influence a catalyst in a given reaction presents innumerable difficulties. Unrelated facts, generally observed by accident, have trickled drop by drop into the body of this science to form the mass of data on which various people have based various explanations of this phenomenon. Most of these have been inspired by the physical changes which take place. Because the rate of chemical reaction depends on the area of the surface of the catalyst, scientists saw in the promoters a means of increasing the surface of the catalyst, and thereby either increasing the amount of active center or preventing the growth of crystals in the catalyst. No one paid much attention to the possibility of the promoters taking part with the catalyst in the rate of reaction, because it was not established that the catalyst itself could produce a definite chemical reaction with a catalyzed substance under suitable conditions (namely, such reactions as would agree with its chemical function). So, in order that one might see "chemism" in catalytic chemical reactions, and, with its help, try to understand them, it was necessary to discover a series of new reactions and their corresponding catalysts. Then by comparing the chemical properties of the catalyst and the substance on which it is to work, we can begin to understand the chemical reaction which will take place. This new knowledge will allow us soon to classify catalysts according to their catalytic actions based on their

[1] Willard Gibbs address, given at a meeting of the Chicago Section of the American Chemical Society, May 25, 1940.

Excess KOH is removed by several washings with tap water. The sample is dehydrated by allowing it to stand over anhydrous sodium sulphate for twelve hours. When filtered the material is ready for polymerization.

Polymerization is effected by a catalyst, benzoyl peroxide. A stock solution of the catalyst is made by dissolving 5 grams of benzoyl peroxide in 100 cc of the inhibitor-free monomer. This solution should be kept in a refrigerator. When the sample is ready for polymerization, this solution is added in the ratio of 1 part to 10 parts of the inhibitor-free monomer. The sample, now measuring 330 cc is placed in a well corked 500 cc Erlenmeyer flask. The flask is placed in a water bath at a constant temperature of 85° C. The flask should be continually agitated while in the water bath. Every two or three minutes the flask should be removed from the water bath, the cork removed to admit air, replaced and the flask well shaken. This treatment allows for a dissipation of the heat generated in the polymerization reaction. If this procedure is not carefully followed, the reaction will get out of control, a rapid boiling and hardening of the material will result in a loss of the entire sample. After 20 to 30 minutes of heating and shaking, the sample will be partially polymerized and will have a viscosity about like that of molasses. At this point, the flask should be well corked and the partially polymerized material placed in the refrigerator until needed.

Small, thin-walled glass preparation dishes holding about 25 cc make very good molds for these preparations. A dish of this type is filled to a depth of about ¼ inch with the partially polymerized material prepared above. The dish is well covered and placed in an oven at 50° C. for a period of 24 hours. This final heating results in a complete polymerization of the material and forms a solid base on which the object may be mounted.

The embryo to be mounted, for example, a 4-day chick embryo, is prepared in the same manner as for balsam mounting. The embryo is stained with borax-carmine or alum-cochineal, dehydrated with a series of alcohols and cleared in xylene. From the xylene it is placed in a small open dish of the partially polymerized material for a period of 30 minutes to allow for an evaporation of the xylene. From this medium it is transferred to the dish containing the polymerized base and well covered with the partially polymerized monomer. The dish is covered, returned to the oven at 50° C. and kept there until the preparation is thoroughly hardened. When completely hardened, the specimen is chilled with ice water or solid carbon dioxide, which loosens the cast from the glass mold. No satisfactory way of getting the cast from the mold has been found and, in most cases, the glass mold must be broken.

Preparations made in this way have many distinct advantages. When studied under the dissecting microscope or the lower magnifications of the compound microscope, the optical qualities of such a preparation are as good, or better, than those of balsam-glass preparations. The embryo may readily be studied from either side and the mount is unbreakable. This plastic material is more susceptible to scratching than is glass, but with reasonable care, this is not a serious objection to the method.

If it is desirable to make these mounts in the nature of microscope slides, this may easily be done. Polished sheet Plexiglas (methyl methacrylate) 0.08 inch in thickness and cut to standard microscope slide size, 3 × 1 inches, can be purchased from the Rohm and Haas Chemical Co., Philadelphia, Pa. Rings for making the cells in which the embryos will be mounted on the slide can be made in the following way. Polished Plexiglas rod, ¾ inch in diameter can be obtained from the company mentioned above. Using a lathe, this rod is converted into a tube with a bore of approximately ⅝ inch. Using the cutting tool of the lathe, this tube is now cut into rings of various thicknesses, ¼, 3/16 and ⅛ inches, dependent on the size of the object to be mounted. These rings are fastened to the Plexiglas slide with a cement, Acryloid B–7, which is a 20 per cent. solution of polymerized methyl methacrylate in ethylene dichloride. The object to be mounted is prepared in the same way as for mounting in a disc. It is transferred to the cell just described, well covered with the thick, partially polymerized ethyl methacrylate and placed in the oven at 50° C. to complete polymerization. There is some loss in volume during the polymerization process and fresh monomer must be added as the hardening process takes place.

W. O. PUCKETT

PRINCETON UNIVERSITY

BOOKS RECEIVED

BEAUCHAMP, WILBUR L., JOHN C. MAYFIELD and JOE YOUNG WEST. *Everyday Problems in Science.* Pp. xvi + 752. 532 figures. Scott, Foresman. $1.72.

CABLE, EMMETT J., ROBERT W. GETCHELL and WILLIAM H. KADESCH. *The Physical Sciences.* Pp. xvii + 754. 300 figures. Prentice-Hall. $5.00. To schools, $3.75.

LANE, ERNEST P. *Metric Differential Geometry of Curves and Surfaces.* Pp. viii + 216. University of Chicago Press. $3.00.

LINTON, EDWIN. *Trematodes from Fishes Mainly from the Woods Hole Region, Massachusetts.* Pp. 172. 26 plates. U. S. National Museum.

MIDDLEMISS, ROSS R. *Differential and Integral Calculus.* Pp. x + 416. 171 figures. McGraw-Hill. $2.50.

ORR, ROBERT T. *The Rabbits of California.* Pp. 207. 30 figures. 10 plates. California Academy of Sciences. $3.50.

SCHUCHERT, CHARLES and CLARA M. LEVENE. *O. C. Marsh, Pioneer in Paleontology.* Pp. xxi + 541. Yale University Press. $5.00.

ZIMMERMANN, ARNOLD A. *Origin and Development of the Lymphatic System in the Opossum.* Pp. 197. 92 figures. University of Illinois Press. $3.00.