

SCIENCE

Vol. 91

FRIDAY, JUNE 28, 1940

No. 2374

<i>Mixed Catalysts</i> : DR. VLADIMIR N. IPATIEFF	605	<i>Special Articles</i> :	
<i>Viruses and Their Part in Disease</i> : PROFESSOR W. G. MACCALLUM	608	<i>Coenzyme I and Riboflavin Content of Livers of Rats Fed Butter Yellow</i> : CHARLES J. KENSLE, DR. KANEMATSU SUGUIRA and DR. C. P. RHOADS. <i>Bovine Pseudorabies or "Mad Itch" Virus</i> : PROFESSOR ROBERT GRAHAM, C. C. MORRILL and DR. L. E. BOLEY. <i>Inhibition of Bacterial Metabolism by Synthetic Detergents</i> : DR. BENJAMIN F. MILLER and DR. ZELMA BAKER	623
<i>Obituary</i> :		<i>Scientific Apparatus and Laboratory Methods</i> :	
<i>Adrian John Pieters</i> : L. W. KEPHART; <i>Dr. Erkki Mikkola</i> : PROFESSOR RICHARD FOSTER FLINT. <i>Recent Deaths</i>	610	<i>Ethyl Methacrylate as a Mounting Medium for Embryological Specimens</i> : DR. W. O. PUCKETT	625
<i>Scientific Events</i> :		<i>Science News</i>	6
<i>National Research Fellowships in the Natural Sciences; The Washington Heights Health and Teaching Center; Nominations for Officers of the American Society of Mechanical Engineers; Promotions and Appointments at the Rockefeller Institute for Medical Research; Honorary Degrees Conferred by Harvard University</i>	612		
<i>Scientific Notes and News</i>	614		
<i>Discussion</i> :			
<i>The Relationship of Histamine to Anaphylaxis in the Rabbit</i> : PROFESSOR CARL A. DRAGSTEDT, MAX RAMIREZ DE ARELLANO and ALFRED H. LAWTON. <i>The Utilization of Iron by Anemic Rats</i> : PROFESSOR MARY S. ROSE. <i>The "Booboo Boy" of South Africa</i> : PROFESSOR JOHN P. FOLEY, JR. <i>Freezing of Hot and Cold Water</i> : ROBERT S. CASEY; DR. WILLIS R. WHITNEY	617		
<i>Scientific Books</i> :			
<i>The Hypothalamus</i> : PROFESSOR C. JUDSON HERRICK	619		
<i>Societies and Meetings</i> :			
<i>The Sixth Washington Conference on Theoretical Physics</i> : DR. EDWARD TELLER and DR. M. A. TUVE	621		

MIXED CATALYSTS¹

By Dr. VLADIMIR N. IPATIEFF

UNIVERSAL OIL PRODUCTS COMPANY, RIVERSIDE, ILLINOIS

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

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

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

Science

91 (2374)

Science **91** (2374), 605-626.

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