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<i>The Chronaxic Switching in the Nervous System:</i> PROFESSOR LOUIS LAPICQUE	151	<i>Scientific Books:</i> <i>Bailey and Spoehr on the Rôle of Research in the Development of Forestry in North America:</i> PRO- FESSOR HENRY S. GRAVES	170
<i>The American Association for the Advancement of Science:</i> <i>The Second Berkeley Meeting of the Pacific Divi- sion:</i> DR. ARTHUR G. VESTAL	154	<i>Scientific Apparatus and Laboratory Methods:</i> <i>New Forms of Dry and Wet Bulb Thermometers:</i> PROFESSOR ALEXANDER MCADIE	172
<i>Scientific Events:</i> <i>The Australian Institute of Anatomy; Malaria in India; Soil Surveys Approved by the Pacific Sci- ence Congress; The Philippine Research Institute; The Bermuda Oceanographic Expedition</i>	159	<i>Special Articles:</i> <i>Is Ossification Influenced Solely by Ultra-violet Light?</i> PROFESSOR R. ADAMS DUTCHER and H. E. HONEYWELL. <i>A Comparison of the Copper Con- tent of Oklahoma Wheat with Those of Other States:</i> JAMES E. WEBSTER and FRANK JANSMA.....	173
<i>Scientific Notes and News</i>	162	<i>Science News</i>	x
<i>University and Educational Notes</i>	166		
<i>Discussion:</i> <i>Need for an International Repository for Original Research Data:</i> PRESIDENT R. W. THATCHER. <i>Preservation of Natural Areas:</i> DR. WILLARD G. VAN NAME. <i>Insect Nutrition:</i> PROFESSOR E. F. PHILLIPS. <i>New Fossils from Maine:</i> PROFESSOR EDWARD S. C. SMITH	167		
<i>Special Correspondence:</i> <i>The Field Trip of the Ohio-Kentucky Academies of Science and the Seventy-fifth Anniversary of the Kentucky Geological Survey:</i> PROFESSOR CHAS. H. BEHRE, JR.	169		

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THE CHRONAXIC SWITCHING IN THE NERVOUS SYSTEM¹

By Professor LOUIS LAPICQUE

PHYSIOLOGY has until now paid but very slight attention to the important part which time, in the sense of duration of the stimulus, plays as a condition of excitation, and has given no thought whatever to the correlations of such time characteristics among functionally related cells. I shall not here inquire into the historical reasons for such an oversight or show in detail how Du Bois Reymond, the omnipotent master of electro-physiology for half a century, was to blame for this. But I must mention the pioneers, Fick, Brücke, Engelmann, who had begun to open the way seventy years ago, but whose valuable work on the time factor in excitation has long been buried in undeserved oblivion. Engelmann went so far as to use the phrase "physiological time" to indicate the difference between quick muscles and slow ones, noting

¹ Introduction to the Dunham Lectures at the Harvard Medical School, 1928-29.

that excitability was correlated with contractility in this respect. But he drew no further inferences from this relationship, and his remark awakened no echo.

In order to indicate the possible physiological significance of the time factor of excitation let me review some of the classical notions as to the mechanism involved in the central nervous system.

A spinal reflex is generally accepted as the elementary unit in terms of which the more complicated functions are to be explained. But, as Sherrington has emphasized, the ordinary flexion reflex of the decapitated frog, as it pulls up its leg when pinched, is by no means a simple phenomenon. Any reflex motion, as well as any voluntary motion, implies coordination. Every joint is provided with antagonistic muscles, which tend to move it in opposite directions when they contract, and if all should contract at the same moment motion would not result, but

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