

**IRRITABILITY: A
PHYSIOLOGICAL ANALYSIS
OF THE GENERAL EFFECT OF
STIMULI IN LIVING SUBSTANCE**

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Irritability: A Physiological Analysis of the General Effect of Stimuli in Living Substance by
Max Verworn

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WITH DIAGRAMS AND ILLUSTRATIONS



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THE SILLIMAN FOUNDATION.

In the year 1883 a legacy of eighty thousand dollars was left to the President and Fellows of Yale College in the city of New Haven, to be held in trust, as a gift from her children, in memory of their beloved and honored mother, Mrs. Hepsa Ely Silliman.

On this foundation Yale College was requested and directed to establish an annual course of lectures designed to illustrate the presence and providence, the wisdom and goodness of God, as manifested in the natural and moral world. These were to be designated as the Mrs. Hepsa Ely Silliman Lectures. It is the belief of the testator that any orderly presentation of the facts of nature or history contributed to the end of this foundation more effectively than any attempt to emphasize the elements of doctrine or creed; and he therefore provided that lectures on dogmatic or polemical theology should be excluded from the scope of this foundation, and that the subjects should be selected rather from the domains of natural science and history, giving special prominence to astronomy, chemistry, geology, and anatomy.

It was further directed that each annual course should be made the basis of a volume to form part of a series constituting a memorial to Mrs. Silliman. The memorial fund came into the possession of the corporation of Yale University in the year 1901; and the present volume constitutes the ninth of the series of memorial lectures.

PREFACE

The lectures on irritability here published were held at the University of Yale in October, 1911. When the authorities of that University honored me by an invitation to give a course of Silliman memorial lectures, I accepted with the more pleasure as it furnished me with the opportunity of summarizing the results of numerous experimental researches carried out with the assistance of my co-workers during the course of more than two decades in the physiological laboratories of Jena, Göttingen and Bonn, to unite therewith the results obtained by other investigators and thus present a uniform exposition of the general effects and laws of stimulation in the living substance. I have long entertained this plan and this for the following reason:

The physiologist, the zoölogist, the botanist, the psychologist, the pathologist, have to deal, day in, day out, with the effects of stimulation on the living substance. No living substance exists without stimulation. In the vital manifestations of all organisms the interplay of the most varied stimuli produces an enormous and manifold variety of effects. Experimental biological science employs artificial stimulation as the most important aid in the methodic production of certain effects of stimulation. The number of researches in which special effects of stimulation are treated is endless. Nevertheless the systematic investigation of the effects of stimulation have, curiously enough, been strangely neglected. Although countless results of individual effects of stimulation have been studied, the attempt has never been made to establish a general physiology of the laws of stimulation and consider it as an independent problem. This circumstance induced me to systematically investigate the general laws of the effect of stimulation. In the fifth and sixth chapters of my book on general physiology the results of these studies are recorded for the first time. Since then, especially during our own researches on the general physiology of the nervous system, a great number