

**AN INTRODUCTION TO
THEORETICAL AND APPLIED
COLLOID CHEMISTRY, "THE
WORLD OF NEGLECTED
DIMENSIONS"**

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An Introduction to Theoretical and Applied Colloid Chemistry, "The World of Neglected Dimensions" by Dr. Wolfgang Ostwald & Dr. Martin H. Fischer

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DR. WOLFGANG OSTWALD & DR. MARTIN H. FISCHER

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"THE WORLD OF NEGLECTED DIMENSIONS"

BY

DR. WOLFGANG OSTWALD

Privatdozent in the University of Leipzig

AUTHORIZED TRANSLATION FROM THE GERMAN

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1917

TO

Dr. Martin W. Sticher

Professor of Physiology in the University of Cincinnati

IN SINCERE FRIENDSHIP

PREFACE.

THIS small volume is the literary result of a series of lectures which I gave during the winter of 1913 and 1914 in the United States and Canada upon the invitation of a number of American universities. Originally invited by five universities, I found the interest in the science with which this volume deals so great that their number grew to sixteen while the actual number of lectures demanded of me during some seventy-four days was fifty-six. Lack of time and strength compelled me then to forego the pleasure of accepting further invitations. By way of expressing my thanks and my appreciation of the friendliness and the high honor of these invitations and in order to send greetings once more to my many scientific friends on the other side, I beg to list the universities and institutions in which it was my privilege to discuss colloid chemistry. They are the University of Cincinnati (where I spoke under the auspices of the Cincinnati Society for Medical Research and the Cincinnati branch of the American Chemical Society); the University of Illinois; Columbia University, the College of Physicians and Surgeons and the College of the City of New York in New York City; Johns Hopkins University and the Johns Hopkins Medical School in Baltimore; the University of Chicago; the Ohio State University; McGill University; the Mellon Institute of the University of Pittsburgh; the University of Nebraska; the University of Kansas; before the American Chemical Society in Indianapolis; before the National Academy and the American Chemical Society in Washington.

If I have omitted any institution or scientific body to which I had the pleasure of addressing myself and which in consequence did its share toward making possible the lectures given in this volume, I ask pardon. I admit that I had difficulty in remembering everything that happened

to me while living at what seems to be the customary American rate. I need to express my appreciation, also, of invitations received from the Massachusetts Institute of Technology, the University of California, Syracuse University and a number of others — invitations which I regret it was impossible to accept.

It hardly needs to be emphasized that upon such a tour the lecturer learns quite as much as his audience. The necessity of having his material so easily in hand that he may vary it according to the type and special wishes of his audience, or according to the time at his disposal, or to suit the viewpoint from which it is expected that his subject shall be handled — these things are of the greatest value to the lecturer himself. There is obviously much difference between the half-popular dissertation on colloid chemistry which is given twelve or thirteen hundred freshmen foregathered in a building ordinarily used for religious exercises and the talk which is given so select an audience as the American National Academy and the American Chemical Society meeting in the spacious halls of the Cosmos Club. And the theme of colloid chemistry is itself made to wear a different face, depending upon whether one talks the week through in Pittsburgh to workers interested chiefly in technical problems or whether one tries in two hours in the Johns Hopkins Medical School in Baltimore to discuss the relationships of colloid chemistry to biology and medicine.

Besides such possibilities for arranging and rearranging his materials, other advantages accrue to the lecturer. He is in this way enabled to determine by experiment, as it were, what is the best form and the most easily intelligible one in which he can present his remarks, and what are the facts and thoughts which interest his audience most. He needs but to observe how it reacts to his mode of presentation. He soon discovers what of that which he presents is not clear to his audience, is superfluous, or unduly long; what, on the other hand, interests them most; and in the discussions which follow a lecture he soon discovers whether

he has succeeded in making his main argument clear. These things are possible, of course, only when the psychological experiment can be made many times. How fruitful may be such an experiment tried in succession upon a series of new audiences is best evidenced, perhaps, by the fact that in the course of these lectures both the choice of material and its disposition in the various lectures underwent a steady change. It may fairly be said that what has been chosen for presentation in this volume is the product of this experience. This, and the generous request of American friends that I print them, has led me to select the five lectures which I gave most often, to dictate them and to bring them out in this form.

There already exist a number of strictly scientific textbooks treating of colloid chemistry and a number of more or less valuable introductions to colloid chemistry of a popular or semi-popular nature. So far as I know, however, *none of these has tried to establish the right of modern colloid chemistry to existence as a separate and independent science while emphasizing at the same time its great possibilities of scientific and technological application. The attempt to give a general survey of modern colloid chemistry as a pure and as an applied science and in a form readily intelligible to the general reader seems to be new.*

This volume makes its first appeal to such readers as have heard little or nothing of colloid chemistry. It was to several thousand of just such that I gave these lectures, and it was through frequent contact with them that I was led, time after time, to change my mode of presentation, and, I hope, to improve it. I had, however, another reason for thus addressing myself to such readers. There still exists, I think, too great an hiatus between the true significance, importance and application possibilities of modern colloid chemistry and the knowledge which the public has of this science. It is a fair statement that every scientifically cultured individual knows something about radio-chemistry. But that with radio-chemistry there was born

a twin science, the fruits of which are no less wonderful and the application possibilities of which to all possible branches of science, to technology and to industry are not only equal to but exceed those of radio-chemistry — this seems still largely unknown to the general public. I do not hesitate in consequence to designate this volume *a propaganda sheet for colloid chemistry*.

I am also presumptuous enough to believe that I shall, through this book, be able to render some of my colleagues in colloid chemistry a small service. It is a cause for rejoicing that the colloid chemist is being asked more and more frequently to address audiences upon the general fruits of modern colloid chemistry. These lectures may, perhaps, render him aid in such circumstances. I would especially emphasize the rather lengthy footnotes in which experiments are frequently discussed which have the great merit of always "going." I have also written into this volume a number of not previously published opinions and experiments which the expert worker in colloid chemistry will readily discover for himself; and in the footnotes I have often tried to give expression to suggestions which come into one's mind, one might almost say automatically, whenever one works long and hard in a given field. But the professional colloid chemist will, perhaps, be most interested in just what concepts and facts I chose for presentation, because they seemed to me to be especially characteristic of modern colloid chemistry.

Because of the wealth of colloid-chemical papers and books, I could not hope to give references to more than a few. In choosing those which I did, I have selected for the most part such papers and larger texts as contain summaries of investigations and are ready guides to further literature.

May this volume serve my readers as a guide into a long-existent but, until recently, scarcely recognized world of remarkable phenomena and wondrous mental concepts.

WOLFGANG OSTWALD.

GROSSBOTHEN, WALDHAUS
July, 1914.