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BY

JOSEPH McFARLAND, M. D.

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# BIOLOGY

GENERAL AND MEDICAL

BY

JOSEPH McFARLAND, M. D.

PROFESSOR OF PATHOLOGY AND BACTERIOLOGY, MEDICO-CHIRURGICAL  
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PHYSICIANS OF PHILADELPHIA

*WITH 160 ILLUSTRATIONS*

SECOND EDITION, THOROUGHLY REVISED

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TO MY MOTHER  
who first interested me in the  
LIVING THINGS  
and taught me to marvel  
at the  
WORKS OF GOD

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## PREFACE TO THE SECOND EDITION.

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THE cordial reception and favorable criticism accorded the first edition of this little book, prompted its author to exert every effort to eliminate such defects as were discovered by his reviewers, to accept the kindly suggestions of several of his readers, and, without considerably increasing its size, to introduce such new matter as would bring its contents up to date and increase its usefulness.

It is hoped that all this has been accomplished, and that future readers may find the book a reliable guide in the much-neglected field of biological science that borders upon and often overlaps the "Institutes of Medicine."

JOSEPH MCFARLAND.

PHILADELPHIA, PA.,  
*November, 1913.*





## PREFACE.

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IN preparing this book it has been the purpose of the author to acquaint his readers with the peculiar nature and interesting reactions of "Living Substance"; to help him trace it to its probable, though unknown, beginnings and follow it through its multifarious differentiations to its highest complexity.

In so far as this has been accomplished, the work is a *General Biology*. But more has been attempted, for the problems have been so considered as to show that man is no separate entity, apart from the general world of living things, but is a unit in the general scheme of things and subject to the same laws that apply throughout the universe.

Inasmuch as many of the subjects treated are of importance to students contemplating future medical studies, and inasmuch as all of them are of interest and importance to students of medicine and physicians, the work may, with justification, claim to be a *Medical Biology*.

All of the problems of medical science are in a sense biological, and many of the problems of biological science medical. Medical science is, in fact, a branch of biology and should be studied as such.

Each chapter treats of some subject or subjects upon which the pen would gladly linger and upon which a volume might be written, and professional biologists will, no doubt, be disappointed at the brief treatment their pet theories receive as well as astonished at the space devoted to other, and to them less important,

matters, but this is the inevitable result of the particular point of view of the author.

Nearly all of the subjects treated are of controversial nature, but that is the present state of biological science. Attempts to crystallize incomplete information into laws lead to theory rather than to fact, and the subject passes from theory to theory in search of the fact. This explains why the consideration of certain subjects may lead the reader to a final interrogation point or may end without a personal expression by the author in favor of one or the other side of the question.

It is hoped that the problems of Blood-relationship, Infection, Immunity, Parasitism, Inheritance, Mutilation, Regeneration, Grafting, and Senescence, which have been presented at greater length than in other writings upon Biology, may be useful to the reader.

It is hoped that the writing will not be found too technical to be beyond the comprehension of any intelligent reader, though it must be admitted that some acquaintance with the sciences will be of decided advantage to him.

The author expresses his sincere thanks to his friend and colleague, Professor Charles H. Shaw, A.M., Ph.D., for many valuable suggestions and criticisms.

PHILADELPHIA, PA.

JOSEPH McFARLAND.

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THE UNIVERSITY OF CHICAGO



# BIOLOGY: GENERAL AND MEDICAL.

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## CHAPTER I.

### THE COSMICAL RELATIONS OF LIVING MATTER.

To study the problems of life apart from their cosmical relations is to lose much of their significance. It is only by an appreciation of the endless changes—integrations and disintegrations—that pervade the universe that one comes to realize that those qualities by which we recognize living substance more or less closely correspond to the qualities of all substance, and those forces by which it is animated to those forces by which the universe itself is controlled.

All the demonstrations of physics arrive at one conclusion: that the universe consists of matter that is indestructible, controlled by forces that are persistent. Beyond this it is not in the power of the human intellect to penetrate.

We know nothing and probably never can know anything of the origin of matter or force, and are obliged to content ourselves, as our antecedents have done, with the knowledge that both exist, and that we can only recognize the existence of force as it influences matter, and only know matter as it is affected by force.

The planet upon which we live consists of matter in a highly differentiated state which the chemists are able to resolve into a certain number of forms so stable as not to be susceptible of further analysis, and therefore called

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