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THE ELEMENTARY SCIENCES
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NUMBER V.

ELEMENTS

OF

VEGETABLE AND ANIMAL

PHYSIOLOGY.

In Two Parts.

BY

G. HAMILTON, M. D.

EDITED BY D. M. REESE, M. D., LL. D.

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Presenting a complete view of the Animal Kingdom as a portion of external nature. As the composition of one of the most eminent physiologists of our age, it possesses an authority not attributable to such treatises in general.

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The subject is here presented in its two aspects of interesting and important. Interesting, inasmuch as it exhibits the progressive conditions of the earth from the remotest periods, and reveals the character of the plants and animals which have successively adorned and peopled its surface; and important, as it determines the position of those metals and minerals upon which the arts and manufactures so intimately depend.

Entered according to Act of Congress, in the year 1849, by
A. S. BARNES & CO.,
in the Clerk's Office of the District Court of the Southern District of New-York.

INTRODUCTION

BY

THE AMERICAN EDITOR.

THE subject of this volume, which appropriately follows that of Animal Physiology, is perhaps the most difficult to adapt to the object of this series, of either of the departments of physical science. This difficulty arises not from any intrinsic obscurity in the subject itself, nor in any lack of interest in the topics of inquiry, for the subject is both easy and delightful, and is uniformly found to awaken enthusiasm in the young, especially if pursued practically. But the obstacle in the way of adapting it to the use of schools, is found in the multitude of technical terms which, whatever we may do in other sciences, can neither be substituted nor dispensed with in this. The minute and complicated anatomy of plants abounds in variegated organs, appendages, tissues, and other peculiarities of structure, the discrimination of which requires the use of a multitude of technicalities, such as have, for the most part, no synonyms. They are, however, very significant, and will soon become familiar by repetition. The physiological department, strictly such, will be found encumbered with no less difficulty, which, as in the former case, admits of no remedy, and must therefore be met and overcome.

The author appears to have done all that is practicable in the way of definition and illustration, and hence very little improvement of the text has been attempted. The teacher who will use this volume for the purpose of instruction, will find upon every page an analysis of the subjects treated, in the

form of catechetical questions, which will afford him facilities. And if he will accompany his pupils upon botanical excursions, and assist them in the dissection of plants and flowers, and the preparation of Herbaria for collecting and preserving specimens, he will find such practical exercises greatly to facilitate the study. The copious index appended will serve as a glossary, nor is any other needed.

In the hope that this edition will be useful in prompting to the cultivation of this beautiful subject in schools, it is respectfully submitted to teachers of youth as worthy of their adoption.

THE AMERICAN EDITOR

PREFACE.

THE following Treatise is intended to present an outline of an interesting, but as yet imperfectly investigated, Science —that which refers to the Economy of Plants. In vegetables, though the organs be of simple structure, the mode in which these perform their functions is so obscure that Physiologists have been able to ascertain only a few of their more obvious operations. Besides, VEGETABLE PHYSIOLOGY, as this branch of knowledge is technically entitled, is of comparatively recent origin—it being scarcely half a century since the vital actions of plants became the subject of actual experiment; earlier botanists contenting themselves with vague analogies, drawn from the more apparent functions of Animal Organization. In this imperfect but progressive state of the science, all that is aimed at in the subsequent pages is to convey to the learner an idea of the General Structure and Functions of Plants—their various Organs, and the Terms by which these are respectively distinguished—their modes of Growth and Reproduction—their Geographical Distribution—and their extensive Utility in the Scheme of Creation. In doing so, we have endeavoured to avoid technicalities as much as is consistent with accuracy, and to present, in a familiar manner, only the principal facts admitted by modern botanists, in order that the Treatise might answer the end intended—namely, for Use in Schools, and for Private Instruction.

The Classification and Description of Plants, having reference more to individual types and resemblances than to the general principles of Vegetation, are reserved as the subject of another volume, under the title of SYSTEMATIC BOTANY.

Edinburgh, January, 1844.

CONTENTS.

VEGETABLE PHYSIOLOGY.

GENERAL ECONOMY OF VEGETATION.

NATURE AND FUNCTIONS OF PLANTS.

1. VEGETABLE PHYSIOLOGY is that department of natural science which explains the organization and vital functions of plants.

2. *Plants, animals, and minerals*, are all formed by the chemical combination of certain elements. In minerals these elements combine by the force of chemical affinity only, but in plants and animals they are held in combination by vital action.

3. *Vitality* enables plants and animals to absorb and assimilate food, consisting of the elements necessary for their increase, and also to reproduce beings of their own kind, by means of certain organs: hence they are said to be *organized*, and the substances of which they are composed are known by the general name of *organic matter*. Minerals not possessing vitality have no organs, and consist only of *inorganic matter*

4. *Animals* feed partly on other animals, and partly on plants; and plants feed partly on organic matter when decomposed, and partly on inorganic. Thus minerals, by the beautiful economy of nature, contribute towards the support of animals through the medium of plants.

5. *The elements* of which organized bodies are composed, separate or decompose as soon as life has fled,

1. Define vegetable physiology.
2. Difference between the combination of elements.
3. Modifications resulting from vitality.
4. The food of animals and plants, respectively.
5. What brings organic matter under the laws of chemical affinity?