

THE
BIOLOGICAL BASIS
OF HUMAN NATURE

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TO CALVIN B. BRIDGES

*to whose profound and constructive investigations all
students of Genetics are deeply indebted*

PREFACE

This volume is an attempt to present those aspects of modern experimental biology that are of most interest in considering the problem of human personality and society. It deals with the origin, development and nature of the traits which distinguish individuals, and which in man make up character; and with some of the relations of these matters to social questions. The material is drawn mainly from the relatively new sciences of Genetics and Experimental Embryology. An effort is made to present it in non-technical language, though for a few important things unknown to common speech the technical terms are the only ones available.

The first five chapters summarize the biological foundations for the matters dealt with later. They are necessarily more technical than the others; they are compelled to present certain points that have not yet become familiar, but which in time will be a part of the every-day knowledge of all educated persons. Understanding of the more general questions dealt with in later chapters depends absolutely on a grasp of the matters presented in these chapters.

Chapters six to eight deal with the relations of this fundamental knowledge to certain more problematical questions of life and mind, chapter eight presenting certain historical aspects of these matters. Chapters nine to twelve inclusive take up the application of this knowledge to some social problems. Chapter thirteen stands by itself; it is speculative. The three final chapters are devoted to aspects of the problem of evolutionary change.

References to sources, and other comments, are gathered into notes at the end of each chapter. They are designed merely as keys by which the reader may follow further any subjects which interest him. The books or papers referred to

will usually be found to contain titles of other works along the same line, through which the entire field of knowledge may be explored.

For permission to make use of material previously published in the form of articles or addresses, the author is indebted to the *Forum*, *Plain Talk*, *Science*, and the *Survey-Graphic*. He is indebted for important aid in the preparation of the volume to Louise B. Jennings, Ruth Stocking Lynch, and Harold Heath.
Baltimore, January 4, 1930.

INTRODUCTION

What has biology to say that is of interest to men, not as zoologists or botanists, but as human beings? What has biology to contribute to the understanding of our lives and of the world in which we live?

Human beings are samples of the things with which biology deals. They appear as individuals, and the rest of the material of biology appears also, in the main, as individuals. The greatest questions of biology deal with the origin and nature of individuals, their characteristics, their likenesses and their differences. The diversity among living individuals is the most striking fact about them, the fact of most practical importance; and it is the matter on which biology has most to say. Human individuals are diverse—in their appearance, and in their behavior. And each has a separate consciousness, a separate identity; so that the inward experience of any one of them is a distinct thing from that of all others. In some or all of these respects they are typical of the material of biology.

How does it happen that individuals are thus diverse, both outwardly and inwardly? Why has my neighbor tastes and opinions so different from my own? Why does he conduct himself in a manner that may seem to me undesirable; a manner so diverse from that which I would practice under the same conditions? Why is one man fitted for one sort of work, another for another sort; and some for none at all? Why do precise experiments in the laboratory of psychology give with different individuals diverse and inconstant results? Why are my own children so diverse from me and from each other? What is it that makes the behavior of human beings so incalculable, inconsistent, astonishing? These are the most practical questions of life; and the most interesting in theory.

On these questions biology has much to say. It has worked

out a systematic science of the differences between individuals; a science far from complete, but illuminating so far as it goes. There are two main classes of differences between individuals. On the one hand, individuals are in many ways diverse at the very beginning of their separate existence, when they are single cells; these diversities come directly from their parents. Many of the later differences between developed individuals are due to these original differences. Knowledge of the original diversities, of how they are produced, of their nature and consequences, has advanced far. It constitutes what is called the study of heredity, or more properly, the science of Genetics.

On the other hand, as everyone knows, individuals may become changed by the experiences that they pass through; by the conditions under which they live and develop. This therefore is another source of differences between individuals. An individual that has developed at a high temperature may be diverse in some respects from one that has developed at a low temperature. A person that has learned something is diverse from one that has not; a person that has undergone a great emotional shock is diverse from one that has not.

By the interplay of the differences existing at the beginning of life with those that arise through later experience are brought about all the infinitely numerous kinds of diversities that we find among the individuals we meet in the world. By the interaction of the diverse individuals so produced, with each other and with their organic and inorganic environments, arise societies and civilizations. By the changes in the inborn characteristics as generations pass, together with the changes in the outer environment, arise the transformations of organisms in succeeding ages; arises the process of evolution. To understand individuality, to understand human nature and animal nature and vegetable nature, to understand society and civilization, the two classes of diversities must be examined separately, then in their interaction and consequences; and in their changes with the passage of time. This is the task of the present volume.

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I

THE ORIGINAL DIFFERENCES BETWEEN INDIVIDUALS; AND THEIR CONSEQUENCES

IN higher organisms, including man, the individual originally exists as two separate minute pieces, which come from two pre-existing individuals that we call the parents. Its life as a single individual begins with the union of these two pieces into one cell. The fact that we are each formed from parts of two diverse individuals has extraordinary and momentous consequences.

In its earliest condition the new individual is a single cell with a single nucleus (figure 1), it is the fertilized egg. This cell, as everyone knows, divides repeatedly, producing many cells; producing ultimately the entire body, composed of millions of cells.

The Genes

Observation and experiment have shown that the original cell contains a great number of distinct and separable substances, existing as minute particles. The development of an individual is brought about by the interaction of these thousand substances—their interaction with each other, with other parts of the cell, and with material taken from outside. It is known that different individuals start with diverse sets of these substances, and that the way a given individual develops, what he becomes, what characteristics he gets, what peculiarities he shows, depend, other things being equal, on what set of these substances he starts with. Different individuals are made as it were on diverse recipes; and the diverse recipes give different results. Much is known of the results of altering