WHY WE BEHAVE LIKE HUMAN BEINGS

BY

GEORGE A. DORSEY, PH.D., LL.D

Formerly Associate Professor of Anthropology
University of Chicago, and
Curator of Anthropology
Field Museum of Natural History

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PREFACE

HUMAN beings are the most interesting objects on earth, and to know themselves and get along with one another is their most important business. That business drags because they do not know where they come from, how they get here, what they bring with them, what they do with it, and what they could do if they stopped quarreling among themselves and used their brains to solve their common problems. It will speed up when the raw materials of human nature and the possibilities of intelligent behavior are more generally understood. The facts for such an understanding are known, but they belong to several sciences and are scattered through many libraries. To pick them out, put them in order, and make them tell a complete and up-to-date story that can be held in one hand and read without a dictionary is the object of *Why We Behave Like Human Beings.*

"Complete" is a large word and must be taken with a grain of salt. Nothing is really complete in this world of ceaseless change and expanding horizon. The earth itself is not the earth it used to be when I first went to school. Man's story will be *complete* when there is no human being left to tell the tale. Keibel and Mall's *Human Embryology,* with 1,600 pages, is more complete than Minot's, with only 800. Quain's *Human Anatomy,* with 2,000 pages, is more complete than the average textbook of anatomy, with only 1,000. This is not a textbook; the changing human body, from a rejuvenated ovum to senile decay, and its origin from primordial protoplasm, are part of this story.

Nor is "up-to-date" to be taken too literally. Science moves fast these days. I may state that the hormone of a certain

gland is "not yet known"; Professor John Abel may have isolated it yesterday and announce the fact next year. When I studied anatomy under Thomas Dwight—to whom I owe much—I was told nothing about a certain little gland in our throat without which we cannot live. The activating principle of that gland has been discovered, and the secretion of another vital gland has been isolated, since I wrote the first word of this book. No one had heard of a vitamin a few years ago, nor had any vitamin been isolated when I began this book; one, and possibly two, has since been isolated.

By "complete" I mean comprehensive. This is the most comprehensive account of human beings that I know of. It is as up-to-date as I can make it. It moves as fast as I can make it, and avoids blind alleys which lead nowhere. It does touch many problems not yet solved or only partially guessed at; its handling of such problems is as sound and sane as I can make it with the help of many friends. This does not commit them for my errors of omission and commission, nor lessen my responsibility for statements of fact or inferences from facts and hypotheses—nor signify that they approve an anthropologist's use of their materials for his story.

The paleontologist, for example, claims fossils. But when he finds a skull which he says belonged to an ape-man or to a man-ape, that skull belongs to me also; when he finds a set of dinosaur eggs, I am not interested: there are no dinosaurs in our family album. The bacteriologist and a dozen other 'ologists, as well as the family doctor and dentist, deal in bacteria; as do I also, in setting forth the rôle these amazing little imps have played in organic evolution and in the life and death of human beings. The physiologist—and presumably every scientist—is interested in the news about the endocrine glands. The news is startling; but much that is not yet known or is known to be false has been so capitalized by quacks and marvelmongers that I have tried to separate the glands from the grafters. Different scientists

specialize in psychic behavior. Psychics and pseudo-psychologists exploit it; they too belong to the story of why we're human. In short, my attitude is that any science which holds itself aloof from life and nowhere comes in contact with human beings is as barren as a Vestal Virgin and as dry as a prayer for rain for the purpose of this book; but that the scandalmongers of science who would fill their lamps at the expense of the gullible, and who illumine no path of life nor sustain any living germ, should be illuminated.

This book does not presume to offer a Philosophy of Life or suggest Science as a substitute for Religion. But as philosophy was moonshine until it began to investigate the elementary properties of matter and energy, so, I suspect, religion will be subject to quackery and hypocrisy until humanity itself becomes more humane than human nature and religion itself ceases worrying about heaven and hell and devotes its energies to making this earth a paradise.

Nor, in ascribing "mind" to a specific irritability of protoplasm and human actions to definite forms of energy, does this book pretend to "resolve life." Life is more easily destroyed than resolved, or even defined. Nobody knows what life is. Much is known of living processes. Of the electric change accompanying irritability, of the action of X-rays on living protoplasm and of heat, light, and sound waves on sensitive human bodies, not much is yet known. But those energies and the living mechanisms which react to their stimuli can be investigated. The few crumbs that science can offer are more nourishing than the no-bread of speculation which works without oxygen, ignores carbon-compounds, and defies the lightning.

Parts of the chapter on the "Processes of Living" will be difficult for those unfamiliar with H_2O and CO_2. Some may even sympathize with the French Republic of 1794 for having beheaded the man who said that life is a chemical function. But Lavoisier was right: life is a chemical function—and

living actions are largely concerned with conjugating the verb *to eat.* Without some idea of oxidation processes, of the chemical structure of food, and of the chemical reactions in digestion, *visceral* behavior is a blank. And without some understanding of visceral behavior, *psychic* behavior is up in the air. Life became a science when interest shifted from the dissection of dead bodies to the study of action in living beings and the nature of the environment they live in.

To those scientists who have given me of their time and learning I am profoundly indebted and here offer my grateful thanks: to Dr. W. I. Thomas, who read the entire MS.; to Dr. Adolph H. Schultz, of the Carnegie Institution of Washington, Department of Embryology, Johns Hopkins University, who read Chapter I; to Professor Franz Boas, of Columbia University, who read parts of Chapter I; to Professor George Grant MacCurdy, of Yale University, who read parts of Chapters I and II; to Professor W. E. Castle, of Harvard University, who read Chapter II; to Professor Richard Swan Lull, of Yale University, who read Chapter II and parts of Chapter I; to Professor Walter B. Cannon, of Harvard University, who read part of Chapter III; to Dr. McKeen Cattell, of the Cornell University Medical School, who read Chapter III; to Professor A. J. Carlson, of the University of Chicago, who read Chapter IV; to Professor C. Judson Herrick, of the University of Chicago, who read Chapter V; and to Dr. John B. Watson, who read Chapters VI and VII.

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Two names I wish especially to mention: Professor Franz Boas, unfailing source of inspiration to all American anthropologists; my wife Sue, untiring and indispensable ally in all that has gone into the writing of this book.

GEORGE A. DORSEY.

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CHAPTER I

THE INDIVIDUAL LIFE CYCLE AND THE HUMAN RACE

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1

WE know of only three kinds of living beings: bacteria, plants, animals. All living beings have a physical body or structure made up of a few of the more common chemical elements. This body is called *protoplasm*, the stuff of all living things. Living protoplasm occurs only in units called cells. Every living being is or has been a cell. Cells are always small and generally cannot be seen except under the microscope.

Many animals consist of just one cell, and hence are called unicellular organisms. Yet that cell suffices for them to live; they eat, they excrete, they grow, they multiply; they obey all the laws of living organisms. For living purposes they are complete. Higher animals have bodies of many cells, and are called Metazoa to distinguish them from the Protozoa, or unicellular animals.

We are animals and belong to the Metazoa group. Our body consists of about twenty-six thousand billion cells. Each cell is alive and must be nourished or it dies.

The cells which make up our body are of different forms and shapes and, except the free floating cells carried by the

blood, are united into different kinds of tissue to form the organs and systems of our body. But a section cut anywhere from the body—from bone, muscle, eye, tongue, skin, heart—would under the microscope be seen to consist of tiny cells, each a complete unit of protoplasm.

Our body begins its individual growth and development as one cell, the germ-cell or fertilized ovum (egg). By fertilization, the ovum, an old cell, is stimulated to begin a new life; it is made young again. Being rejuvenated, it can grow, and grow old.

The germ-cells (female, or ova; male, or spermia) are readily distinguishable under the microscope. Ova are much larger and less active than spermia. The latter are very active, and propel themselves by a whip-lash tail. Both are complete living organisms and in their combined bodies carry immortality. In general features, size, structure, etc., human germ-cells closely resemble those of other mammals.

The human ovum was first discovered in 1827. Although it is the largest of the cells in the body, fifty thousand could be mailed across the continent for a two-cent stamp; one hundred could ride on an inch-long spider web.

In both sexes, the germ-cells mature normally only from the beginning of puberty. The ova develop in little pockets or follicles of the ovaries. There are about 70,000 follicles at birth. By the eighth year there are less than 40,000; of these only about 200 develop into true *Graafian follicles.* One of these, containing a single ovum, matures each lunar month of life between puberty and the menopause. It escapes through the ruptured wall of the ovary and enters the Fallopian tube, presumably two weeks before the onset of menstruation. For each mature ovum thus released each lunar month, the male develops about 850,000,000,000 spermia.

One spermium only enters into the body of the matured ovum, leaving its tail outside. The ovum is now *fertilized.* It divides into two cells; these two divide and become four,

etc. In nine months, one fertilized ovum has grown five million per cent and increased in volume one billion times; by maturity it will have increased in volume fifteen billion times.

After the fertilized ovum has by division become many thousands, certain cells under the microscope may be distinguished from the others. These are to become the *germ-cells* of new individuals, tiny sparks of immortality, endowed with the capacity to hand life on to the next generation.

The other cells of the tiny embryo are called *soma*, or body cells. They also grow and multiply by division, and assume special shapes to fit them to form the tissues and organs of the body—nerves, eyes, bone, teeth, heart, muscle, blood, etc. Having specialized or become differentiated, they cannot unite with other cells to start new lives—they are not germ-cells.

2

We hear much of *adaptations*. Every living animal is "adapted" or it could not live. What it is adapted to and what it adapts itself with depend on the animal and the stage of its development. The tiny germ-cell in the hen's egg is adapted to an environment of yolk and albumin. It draws on these for its nourishment. The human ovum has no such store of food to draw upon. It is adapted to a different environment. For 280 days it is to live the life of a true parasite. It must therefore attach itself to a living wall, from which it can derive its supplies for living and for growth. These early adaptations of the human ovum are of great interest.

But the interest will be increased if we have before us a law of biology which says that *individual* development rehearses or recapitulates the life history of the *species*. This means that our individual prenatal and postnatal growth up to the time of adolescence is a *résumé* of the evolution of the

human race. It does not mean that at one stage of development the fetus is a fish, or a reptile; it does say that the ovum develops along the road our ancestors traveled in becoming human.

We begin our individual existence as a protozoon or single-celled animal; not until the end of the third month has the fetus the essential parts of a fairly complete human being. During the last six months the fetus grows more human; the parts begin to mature, and for years after birth keep on maturing.

The embryo begins at once to develop from its own body the two *fetal membranes* or envelopes. The inner one, or amnion (lamb), fills with a pint or more of water. In this the embryo floats, and consequently any pressure to which it is subjected becomes more evenly distributed. By a special growth called *placenta* (cake, because of its shape) of the outer membrane or chorion (skin), the embryo attaches itself to the wall of the uterus.

Through this placenta the parasite embryo derives food and oxygen. But it develops its own blood and its own circulatory and digestive systems: they are at all times quite distinct from its host's. She supplies what the chick embryo receives from the hen egg: support, protection, water, food, fuel, oxygen.

Both fetal membranes and placenta follow the child at birth. The child is freed from the placenta by severing its umbilical cord; our navel is the scar.

In other mammals these membranes are not formed so early, but the upright gait of man seems to put more strain on the abdominal viscera and presumably subjects the embryo to greater pressure. It needs all the protection it can get, hence this marvelous intrauterine adaptation to the upright posture. Anthropoid apes have the human type of uterus and a near-upright gait; their fetal membranes are also formed earlier than in other mammals.

To return to the embryo proper. The ovum divides, the

two daughter-cells divide. Four, eight, sixteen, thirty-two, etc. As a result of this rapid division, multiplication, and growth, the embryo passes through certain definite *stages* of development. Much is still conjecture. For this reason: The earliest stages of embryonic development of fishes, amphibians, birds, and of such domesticated mammals as the guinea-pig, rabbit, sheep, and pig are known, and much may be inferred as to the course of development of the human embryo from what is known to take place in these animals. But no one has yet seen a fertilized human ovum, nor has anyone yet seen a human embryo that had not already had ten days' growth—and it measured about one one-hundredth of an inch in length. Even of the second week of human development almost nothing is definitely known, and of embryos of the third week the Carnegie Laboratory of Embryology has been able to assemble only fourteen specimens. What actually goes on, then, during the first eighteen days of man's intrauterine existence can as yet only be inferred from known facts of lower mammalian embryonic development.

First of the hypothetical stages is the *morula* (little mulberry): the embryo is a minute cluster of cells. Next is the *blastula* stage, or blastoderm (germ-skin); the embryo is supposed to form a hollow sphere. This caves in on one side, forming a U-shaped affair, and represents the *gastrula* (stomach) stage. By this infolding, certain cells which were on the outside now lie inside the body; the embryo consists of two layers. By further infoldings, there is an additional layer between these two. Thus we have the famous and important *germ-layers:* the outer or *ectoderm;* the inner or *endoderm;* the middle or *mesoderm.*

Each germ-layer gives rise to certain organs and systems, a fact of far-reaching consequence in medicine and hygiene and in an understanding of our body. The three layers and their derived structures are:

I. Ectoderm: skin and skin accessories; entire nervous

system; special sense organs; pineal gland and part of the pituitary and adrenal glands.

II. Endoderm: alimentary canal and appendages; thyroid and thymus glands; larynx, trachea, and lungs.

III. Mesoderm: voluntary or skeletal muscles; urogenital system and sex glands; part of the adrenal glands.

In addition to these three layers, a particular type of tissue develops, chiefly from the mesoderm. Its cells are branched and form a network of *connective tissue.* From it are derived the heart, blood, blood vessels, and lymphatic system; skeleton; and visceral or involuntary muscles.

All one-cell animals consist of an outside and "insides." Through their outside membrane or cell wall they keep in touch with the world. Our keep-in-touch-with-the-world mechanisms (skin, hair, nails, all skin-glands and organs, lining of mouth, enamel of teeth, special sense organs, and entire nervous system) are all derived from the outside cells of the original hollow body when it caved in to bury certain cells inside the body. From those inside cells we develop "insides"—food and air canals. Muscles and skeleton, blood, sex organs, etc., did not appear until animal life had made much progress in evolution.

During our early prenatal days we live fast; we can be certain of that. In a few days we have developed structures that were evolved only after tens of millions of years.

3

Within two weeks the embryo has become a minute plate-like structure with a streak across it. By the third week this streak opens into the plate at both ends. One opening becomes the mouth. The cavity within the embryo will divide and become the thoracic and abdominal cavities.

Meanwhile, a series of lines appear, dividing the plate-like embryo into segments. *Segmented* animals, such as worms and insects, retain these segments; as do fishes in muscles,

ribs, and vertebræ; as do we in our ribs, vertebræ, and the muscles between the ribs. Our floating ribs are simply incomplete ribs, but we have vestiges of ribs all the way down our spine. Those below the chest fuse with outgrowths from the vertebræ and are called lateral processes.

The vast majority of animals have no backbone, and are called Invertebrates. One of the greatest steps in evolution was a backbone or vertebral column. Three types were tried out before Vertebrates developed a true backbone. All three types or stages appear in the developing human embryo. The *notochord* or permanent body axis of the lowest fishes appears early; later it is obliterated by the bodies of the vertebræ, but traces of the notochord may persist and lead to tumors in adult life. Our bony vertebræ proper are preceded by cartilage, the only backbone sharks have. This is replaced by bone.

Our skull and limb bones also begin as cartilage—and in some fishes the skull remains cartilage. Much of our long bones and skull is still cartilage at birth; hence the pliancy of the new born's head.

Shark embryos have five gill-arches with openings, or gill-clefts, between, and two branchial arches from which the shark forms its poorly developed lower jaw.

Most of these arches and the branchial clefts between appear at the third week in the human fetus. The way the clefts disappear and the arches develop into the extraordinarily complicated human throat is possibly the most interesting and confused chapter in human embryology.

From one of the two arches which develop into jaws in sharks, the human fetus develops its lower jaw and two of the three tiny bones of the inner ear; from the other arch, the third bone of the inner ear, the styloid process at the base of the skull, and the cartilage of the external ear. The hyoid apparatus which supports our tongue develops also from this and from the first gill-arch. The second and third