

IMMORTALITY AS A BIOLOGIST SEES IT

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THE mysteries of life and the fears of death have actuated the activities of man since the first fragmentary records of his existence and, without doubt, dominated the behavior of his prehuman ancestors in a manner similar to observable reactions of modern animals. Three activities, (a) self preservation which retains life, (b) food getting which sustains life, and (c) reproduction which perpetuates life, constitute practically the sum-total of animal existence. With the dawn of reason, these primitive instincts were conditioned by studied desires and the fear of death was alleviated by conceptions of immortality.

The older ideas of immortality probably preceded any notion of a soul or spirit and the *body* was supposed to continue its existence in some realm beyond the earthly life. Thus the burial of food, weapons, a horse, and even the servants and wives of the deceased was practiced wholly or in part by many primitive peoples. The idea of the soul or spirit seems to have arisen spontaneously in many creeds. The immortality of the soul was for a time considered with the resurrection of the body, but the rising tide of observation which marked the late Middle Ages, discountenanced the restoration of a body which had decayed and dissociated into its constituent elements, and the conception of an immortal soul and a temporal body gained general recognition in the Renaissance, though not without attendant danger to its early adherents. Descartes and Pascal were of one judicious opinion in the expression that, "The soul is not a part of the body and therefore does not perish with the body, and since it is not conceivably capable of perishing in any other manner, it must be immortal"; a splendid argument to those who grant the premises leading to the conclusion. Rosseau cites the necessity of an after life to give

restitution for the earthly trials of the just and the triumphs of the wicked. The ideas of these three philosophers are quite generally held by Christian adherents today, but the Catholics and many Protestants still drone a meaningless credo in which the resurrection of the body is included.

But whether immortality be that of body or soul, the place of the after life is ever a region where earthly desires and pleasures are continued and amplified; in witness of which, consider the Happy Hunting Ground of the American Indian, the peaceful Nirvana of the lethargic Hindu, the seventy heavenly wives of the sensual son of the desert as promised by Mohammed, and the golden streets and pearly gates of the avaricious Hebrew. It is to be presumed that the money grabbing propensities of the modern Christian have held him faithful to the Jewish vision in spite of the allurements of rival sects?

Historically, the idea of immortality seems to have prevailed nearly all religions. Confucius mentions a heaven but is non-committal regarding immortality. His teachings are, however, more properly a philosophical system than a religion. In five tedious pages of characteristic Hindu harangue, Buddha declines to explain whether or not the world is eternal, whether or not the soul and body are one, and whether or not there is an existence after death; this without any admission of ignorance on his part and the reputation of the Enlightened One remains unscathed. Creation or a creator are likewise ignored by Buddha and his transmigrations of the soul end in Nirvana, an extinction of existence and hence no immortality. Herodotus recounts an elaborate belief in transmigration among the Egyptians during the fifth century B. C. Here the soul was supposed to pass through all types of animals and return to man during a course of 3000 years. The influence of some of the Egyptian beliefs was to be noted among the Greeks whose ideas of Hades for departed souls were vague and ill-defined. The Epicurean school denied all after life and proceeded to live accordingly. Plato, by a queer twist of the philosophy of dualism, makes Socrates to say, "Since for each life there is death, for each death there must be life." Cicero voices a Roman conception of a soul which was imperishable and separate from the body, and the Roman dead were often burned by way of disposal.

The long struggle between science and the firmly entrenched

dogmas of Medieval religion is a familiar story which needs no recounting here. The church has conceded many points formerly contested, but the nature of such concessions might be well summarized in the following extracts from the Catholic Vatican Council of 1870. "The Church has the divine right and duty of proscribing false science, lest any should be ensnared by philosophy and vain fallacy. All Christians are forbidden to defend as legitimate conclusions of science such opinions as are known to be contrary to the teachings of faith, more especially if they have been condemned by the Church. . . . The Church does not forbid that any science should in its own circle use its own principles and methods; but while recognizing this liberty, it is vigilantly on the alert lest sciences, by opposing the divine teaching, should take to themselves errors, or, skirmishing beyond their own spheres, should usurp and disturb the functions of faith."

Thus would be closed to science the only avenues whereby an approach to evidences of an immortality might be made. Religion would ask us to accept immortality through faith in revelation, but revelation has no place in scientific procedure: the lust for first causes would demand an investigation and analysis of the revelator, so the only method of approach is through the forbidding door of psychical investigation. The practices and results of such investigations are at present so connected and infused with chicanery of every sort that sensible or scientific conclusion can hardly be deduced.

It is not the purpose of this paper to go into detail concerning the postulates of probability of an imperishable soul which survives the body. A word from Dr. Leighton, Professor of Philosophy at The Ohio State University, summarizes a rather extensive philosophical view of these contentions. "The possibility of the continued existence of the self after bodily dissolution clearly depends on the nonidentity of the conscious or spiritual individual with the body. . . . The self, as an active synthesizing principle, is an immaterial, rational, or spiritual individual which is so intimately associated with the body as to form with it a complex individual whole. The mental self is partially dependent on the body and *perhaps* partially independent of it. From this standpoint individual immortality is *possible*." This quotation is passed with the remark that the question here raised does not admit of scien-

tific treatment. To the scientific mind there is absolutely no evidence to indicate the material continuity of any part of the living body, nor is it possible for the present informant to conceive of the continuity of any self, personality, spirit, or separate activity without the material attributes which we associate with life. If, then, religion and philosophy can do no better than to create a doubt as to the non-existence of an immortality, where shall we turn for the evidence which man has long sought? May not biology, that science which deals specifically with the many intricate processes of life, be entrusted with the problems which concern its perpetuation?

Although founded upon a vast collection of specific investigations, the ultimate philosophies of biology are of necessity generalized. Therefore, any evidence of immortality from this source must be collectively applicable to various species rather than to groups or individuals. Not for one moment does biology tolerate that colossal egotism which makes of man the life apart, and reaches its culmination in the creation of manlike gods who determine the course of the universe. To paraphrase a familiar line, "Hath not a man eyes, limbs, organs, dimensions, senses, affections, passions? Is he not fed with like food, hurt by like weapons, subject to like diseases, healed by like potions, warmed and cooled by the same summer and winter as are other creatures of the animal kingdom?" Or to modernize the statement, is not man burned by the same acids, suffocated by the same gases, shocked by the same voltages, or buoyed up in water according to the infallible principle of Archimedes? Why then should life, the sum of the chemical and physical reactions of an organism, find in man any expression different from that found elsewhere in the living world?

To our previous objections for considering the individual as a unit for immortality, must be added the biological question as to the nature of the individual. Is a tree an individual? If so, what of its numerous twigs which may each reproduce the whole if thrust into moist soil? The hydra, a tiny animal familiar to all students of elementary biology, may be cut into twelve pieces each of which will become a complete hydra, and even a fragment of a leaf of a Begonia plant will send up several entire plants. Is not the fertile egg or seed the new individual? From a single egg may develop a dozen or more tapeworms, each with its own problem of individuality, since its recurring segments may each have a complete set of

the sex organs which constitute the major portion of a mature section. The egg of the armadillo develops into quadruplets, always of the same sex, and how familiar are the identical twins, likewise from a single egg, in human families. If such twins are individuals, what of Siamese twins or two headed monstrosities not infrequently reported in human and other mammalian births?

Biologically we must consider every living organism the present representative of a continuing stream of life proceeding from a single source or many sources in the veiled, mysterious past and extending in unbroken line to its recent expression. But not without change. The physical basis of every living thing is *protoplasm*, that unstable and complicated material which causes Huxley to remark, "Paradoxically, the most constant feature of living material is its eternal changefulness." There must be in this remarkable, changing protoplasm some exceeding stable element which determines the continuity of a species through periods of time that blur into vague eons. Many *Globigerina*, small, one celled, beautifully shelled animals, found in all seas today, are identical in form of shell to those which formed the chalk cliffs of England, millions of year ago, and Baltic amber (fossil resin) estimated to be six million years of age, contains perfectly preserved specimens of ants so like modern species that only an expert can detect differences. Any part of the protoplasm which determines this relative fixity of species must of necessity proceed from generation to generation and *per se* becomes the agent of immortality.

This continuity of material is best observed in its simplest form as found among one celled organisms or *Protozoa*. Here the common method of reproduction is simple division of *fission*. One cell divides to form two smaller organisms which grow to the size of the original cell, this again divides and so *ad infinitum*, or at least for over nineteen thousand generations as Dr. Woodruff of Yale has demonstrated for a particular Protozoan, *Paramecium*. Here, then, we have an actual immortality since life is continuous through all generations and natural death is unknown. Fortunately, accidental deaths are frequent as Dr. Woodruff estimates that his *Paramecia*, had all been able to live and reproduce by fission during the sixteen years he has observed them, would now exceed the bulk of the earth by several thousand times. But among the many celled animals or *Metazoa*, simple division gives way to the formation of

specialized reproduction or *germ* cells, usually enclosed within the the body of *somatic* cells. In some lowly organisms any cell may apparently become specialized and perform functions of reproduction, but early in the animal series, particular groups of cells assume the reproductory role. Might we not better date the fall of man from that remote period when he sacrificed his actual immortality by becoming a Metazoan, rather than to some comparatively recent indiscretion in his choice of fruits?

The elaboration of a temporal body from the reproductive tissues is the common procedure among multicellular animals. This body may vary from the fragile, watery form of a jellyfish to the enormous, complicated bodies of some vertebrates. But in any instance the body is a temporary structure and the products of the generative organs are unique in their potential immortality. When these products are united in the act of fertilization the resulting fertile egg or seed is a new individual, capable of producing other reproductive cells in an infinite series. The question as to the origin of the body cells might well be raised at this point. Are not such body cells likewise derived from germinal tissue and hence immortal? All cells must of necessity arise from the fertilized egg or seed in organisms employing sexual reproduction. But in the complicated processes of differentiation which lead to specialized organs, such somatic cells lose the power of reproduction and are hence end products of living material. Death is the price of specialization.

But even the germ cells do not yield the ultimate secret of our immortality. Fragments of the microscopic sperm and pollen cells perish in the process of fertilization. The eggs of birds and the seeds of plants are largely food material which will be absorbed by the growing embryo. Only by an examination of the architecture of the germinal tissues can we hope to discover the ultimate units of immortality. Briefly described, the egg or female germ cell consists of the essential parts of a typical cell plus a varying amount of yolk or food material. The essential cell parts of a *cell wall* enclosing the *cytoplasm*, a semifluid substance of varying amount and the recognized seat of many cellular activities. Embedded in this cytoplasm is a *nucleus*, composed of a fluid bearing granules of dark staining *chromatin* enmeshed in fibers. The sperm or male germ cell is many times smaller than the egg, has no yolk material,

and comparatively little cytoplasm, but is equal to the egg in the amount of nuclear substance.

On account of the great difference in the amount of cytoplasm exhibited in the egg and sperm of a given species and for other reasons which we may ignore in this brief sketch, the cytoplasm is rejected as the possible carrier of the heredity units wherein we seek our immortality. The nucleus, by reason of its constant and similar size in sperm and egg and because of its peculiar behavior at critical periods in the life of both germ and body cells, is considered the seat of the perpetual units. If such self-perpetuating units be within the nucleus, it is apparent that they must be capable of reproduction and transfer at each division of the cell into similar or dissimilar components. The behavior of the chromatin of a dividing cell meets this requirement; this chromatin becomes threadlike, then breaks into definite units called *chromosomes*. These split equally and the halves are distributed to the new cells arising as a result of division. But the ultimate unit of immortality is not yet defined. The next step in our search takes us beyond the range of direct observation and into the field of experimentation. Chromosomes are conceived to be made up of numerous smaller units known as *genes*. A gene may be defined as that portion of a cell which is responsible for an hereditary characteristic. Thus, for each character in the makeup of an organism there is in general a corresponding gene in most somatic cells and all the germ cells. The proofs for this contention are involved and will have to be treated briefly. Let us consider a group of characteristics which we usually regard as racial traits. According to the unit character conception of heredity, the straight hair, black hair, sparse beard, slant eyes, and high cheek bones of the oriental races are all due to specific genes in specific chromosomes, found in the fertilized egg from which the individual arises. Likewise the antitheses of these traits, as found in the Nordic peoples, are also due to similar genes in exactly the same regions as those mentioned for the oriental race. Now what will occur in crossing of races? Since every individual is double in his inheritance, having received a complete set of chromosomes from each parent, the hybrid of two races will have contrasting genes for many traits. Of the contrasting traits, some will blend and others will appear in their entirety or be completely masked. The racial

colors black and white blend to form the mulatto; the slant eyes of the oriental appear in the Mongolian-Caucasian hybrid; the blue eyes of the Nordic are masked by the brown eyes of the Mediterranean peoples when these groups blend. In the mating of these hybrids the original racial characteristics appear in a definite ratio. All of these problems lend themselves to ready solution when we study the behavior of the chromosomes of the germ cells preceding and during the initiation of a new individual in the form of the fertilized egg or seed.

Let it be understood that the gene as a unit is indiscernible and therefore a hypothetical structure. Certain knots of material appear definitely on many chromosomes at particular stages. These are termed *chromatophores* but efforts to associate their presence with specific genes have met with dubious success. Three questions relative to the gene hypothesis are especially deserving of our attention.

(1) What is the nature of the gene? To this query the *geneticists* are admittedly in the dark. Certainly the basis is chemical and molecular but any attempt at analysis is lost in the mysteries of protoplasm. Whatever their chemical nature, the constituent molecules must be exceedingly stable to pass unchanged through thousands of cell divisions in each of a succession of individuals reaching through remote geological epochs. On the other hand our second question deals with the instability of the gene.

(2) Since new traits and hence variations are essential to the conceptions of evolution which now dominate the sciences of the animate world, whence these changes if not from new genes? Many variations are known to be due to chromosome deficiencies and thus to accidental loss of genes. Breaks in chromosomes, extra chromosomes in the germ cell, triple sets of chromosomes and other abnormalities have registered their influence on the resulting organism. As to the actual addition of new genes, such must occur, but no conclusive explanation of their source is at present acceptable.

(3) If this hypothetical gene be our ultimate unit of immortality, what adjustments in our philosophical conceptions of life are essential to the acceptance of this view? Individuals become mere incidents in the scheme of life; mere rocks and banks which confine the stream yet without which the stream would not exist. The *summum bonum* of philosophical endeavor becomes not the suppression of desires of the humble Buddhist nor the doing of an ill-

defined good of the pious Christian but the perpetuation of those racial or individual traits worthy of continuity. The abolition of the religious conception of an after life where awards and inflictions are duly applied, is not a question whose merits properly fall within the scope of this discussion. If we accept William James' statement that religion *is* the hope of immortality, the disruption of the above idea would not be without far-reaching consequences.

The cult of the geneticist owns no published or publicly acclaimed creed. Were such to be expressed in the light of present knowledge, it might well follow, "Believing that these traits which I possess by reason of my inheritance are worthy of continued racial expression, I transmit them to my offspring, in the fervent hope of their further perpetuation for the good of mankind." Those who ascribe to this belief may supplement the words of Cornelia and say of their children, "These are my jewels, my life, and my immortality."