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PREFACE TO A SCIENCE OF MAN

Over the last few decades the biological sciences have developed a strong new branch which lays down certain important prerequisites for any conception of human nature. This is the science of behavior which has found a place half-way between its sister sciences, morphology and physiology, who are often very far apart from one another. The new science has given some of its representatives the will to try out new conceptions of the organism. "Behavior" combines structure and function in a new whole, and it promises to overcome the separation between individual and environment, for a larger synthesis brings more comprehensive phenomena into view. It also promises to overcome the isolation of the individual, for it makes it possible to comprehend the individual as an integral part of a whole which is of necessity supra-individual.

Jakob von Uexküll conceived of the organism as an active and not just a passive subject—an active center of relatively autonomous acts—and it was he who made the organism, so conceived, again a legitimate object of biological research. His concept of a "circle of function" enabled him to grasp the interaction between organism and environment, and he also saw

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that the specific nature of the environment is only one of a wide range of possibilities which each living form selects as its experience through the given structure of its external organs—of motor organs as well as sense organs. Jakob von Uexküll's influence nowadays reaches very far even where his work is no longer mentioned.

The changes brought about by the recognition of the subjective nature of the organism are perhaps reflected in the use of a word like *Stimmung* (mood). While Jakob von Uexküll still referred to a mood, around 1913-1920, as an inner state which partly determined behavior, he was always careful to speak of it as a "chemical mood:" He did not want biologists to take him to be too much of an animal psychologist. The slow approach, persistence and gradual decline of such moods in the organism seemed to him to be due to the secretion, accumulation and elimination of certain substances. Contemporary biologists give a more searching account of moods: They are a fundamental fact of experience, and their reality rests as much on the organization of sense organs and nerve centers as on the collaboration of substances of various origins. Among more recent accounts of animal behavior we find attempts to discover hierarchies of moods, conceived as the ultimate facts a scientist can produce to explain the order in animal behavior. Even where efforts are made to reduce moods to physiological states, mood is still recognized as a principle of order.

The translators are at a loss to find a word in another language which would render this light, musical, German expression. The word *Stimmung* may well have the same fate as the word *Lied*. I think this should be a cause for rejoicing rather than the source of so many complaints about the difficulties in the way of the exchange of ideas. We are fortunate to have linguistic differences; hence the gift of verbal creations which in a unique way divine something of the unsaid, of the secret at the bottom of the world of experience, and which enable us to say what could perhaps only be said so fittingly in a particular cultural setting and in a special linguistic mode. Every language makes us a present of such treasures—if only we will pay attention to it. Who knows how many word formations, destined to delight men of many tongues, will come to us out of the

stored experience of those peoples who are now striving for a place in the sun.

The discoveries of the science of behavior are giving new currency to an old conception—the view that the organism is designed from the start for the highest form of life—an active relationship with the world: It comes equipped, through its hereditary dispositions, with its active relationships—not just with "reactions," but also with the rudiments of "actions." This insight raises, of course, new problems concerning the development of such relationships. But we should not restrict our investigations prematurely to the question of their origin. For we need to find out first of all what is here and now inherited and what acquired; we need to find out more accurately what the phenomena are as we find them today before we can even say more precisely what a theory about their origin is supposed to explain.

Our recently acquired knowledge of this complicated hereditary preparation for the world is already having an impact on the science of man which is developing in relative obscurity. The brain of the bee and the eye that is correlated with it make active use of the polarized sunlight and the daily course of the sun even though they cannot directly perceive the sun. The bee, like many other insects, uses the sun for purposes of orientation. The brain of the tiny beach crab *Talitrus*, a creature barely 2 cm long and with hardly 1 mm^3 of nerve substance, succeeds in "computing" the time of day, the course of an hour and the angle formed by the axis of its body and the position of the sun, and it accomplishes all this without any trace of intellectual effort. Since we know all this and much else besides, we are more clearly aware that the animal's relationship with the world is organized prior to its individual experience. The animal experiences significant connections in its intercourse with the world; whether consciously or unconsciously, life thus takes its place in the world order. No one can call such a relationship a "simple" one.

It is certain that birds use the position of the sun or the stars as aids in navigation. However disputed the details may be, this is further corroboration for the astonishing fact that heredity determines the integration of the organism in certain spheres of

life. We stand only at the threshold of this unexplored territory. But anyone who is still inclined to doubt the detailed results of these studies of orientation is at least faced with the incontrovertible fact that many organisms have the ability, assured by heredity, to make use of the course of the sun and the time of day, and that an important part of such an organization of relationships, viz., an "inner clock," is given even to "animals without brains," viz., plants.

An engineer may puzzle over the question how the tiny brain of a crab, no bigger than 1 mm^3, can erect a cybernetic structure in the fluid equilibrium of its plasma where a man would have to construct a huge apparatus. We do not yet have cybernetic machines made of plasma, but every animal ovum builds its own. We do not often realize what an extraordinary thing we are saying when we casually pronounce the magic formula: An ovum forms its own brain.

The investigation of behavior has brought to light a great many forms of behavior in the social life of animals for which there are very far-reaching parallels in the case of man—a fact which could easily be exploited to paint a convincing picture of the common nature of man and the higher animals. To emphasize this aspect would be to secure even more firmly the conviction of the unity of all living things. But the evidence for this unity is already overwhelming; there is for example the biological evidence concerning metabolic functions, the embryological evidence concerning developmental processes, and the genetic evidence for the common basis of heredity and mutation in plant, animal and man. It seems therefore less important today to use the facts of behavior exclusively for the purpose of demonstrating our inclusion in nature, and more important to reexamine those facts which may direct our attention to differences rather than to similarities. Both directions are complementary and therefore equally necessary.

In the direction which I am here choosing we are faced once more with the fact that creatures with a central nervous system far less developed than ours achieve a very complex relationship with the world and thereby take their place in space and time. A biologist would conclude from this that our brain with its weight of 1500 grams or more (which was also formed by our

plasma) was surely no less well provided with inherited patterns of behavior than the brain of the tiny flea crab. But we enjoy neither the inherited way of being guided by the course of the sun or the time of day, nor the ability, secured by heredity, to navigate by the position of the stars. Nor can we do anything with polarized light as long as we are unversed in engineering and mathematics. And yet we must not conclude from this "deficiency" that we are more poorly equipped—that we are disinherited paupers. Several attempts to interpret the special nature of man have overemphasized such deficiencies in our physical equipment, as compared with the specific abilities of many kinds of animals, and have looked at the development of practical intelligence as a compensation, demanded by natural selection, for the deficiencies of our natural organs. The history of mankind should be a reminder that our relationships with the world have been more comprehensive, exceeding the mere need for practical thought probably since earliest times, and that the important sources of human strength are to be sought elsewhere in our mental equipment than in the mere satisfaction of organic needs. We know that it is our ability to have an open and constantly widening relationship with the world which constitutes our specific inherited capital, that our "openness to the world" is the measure of our greatness, and that it represents a giant step forward from the bondage to nature in which the higher animals find themselves—a far greater step than a mere practical mastery of the requirements of self-preservation. This insight raises some difficult problems for the geneticist who knows on the one hand that the anatomic structure of a human being, his bodily functions and his behavior are partly determined by genetic structures corresponding to those of all other animals, but who also knows on the other hand that the plasticity of our relationship with the world must be based on a very special relation of these genetic structures to the human plasma. A geneticist who is aware of the connection between his subject matter and purely biological laws will have to take this special situation into consideration.

The study of "behavior" has enabled zoologists to develop a new accent and to overcome the separation between different areas of specialization. The science of man has also begun to

conceive man again as an "agent," thus drawing one of those diagonal lines which connect what was once separated (A. Gehlen, A. Remane). Man as an agent is no new discovery, and I shall make no attempt to trace the history of this idea. What is important here is the new resolve to regard agency again as central. Intention and act, plan and execution, are thus becoming the focus of attention. The creative participation of our organs—of hand and sense organs and our erect posture—in the realization of possible actions, in the experience of the world and in the linguistic molding of this experience, becomes from this point of view a single constituent in the more comprehensive unity of action.

An investigation into the origin of social behavior leads deep into the structural unity of the human agent. In 1947, Spitz and K. Wolf in New York, and more recently, Jeanne Aubry, showed that maternal love is a developmental factor in infancy, both physically and psychologically. Since then, we are confronted with the full significance of the mother-child relationship. But with it we must also recognize the primacy of social life, which is a reciprocal affair: It gives the individual his full value while it makes of the group a creative reality. As early as 1944, I portrayed the role of the group as that of a second uterus, a second womb, and we shall have to return to this point.

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An inquiry into the origin of our earliest social behavior takes us straight into the field of the "diagonal" studies I just mentioned. There is experimental evidence to show that the first response of the new-born baby to the human face is elicited in a peculiar manner: In the first few months it is strikingly stereotyped, and during the first half of the first year, the qualities of facial expressions play no part in it. The smile of the infant is elicited solely by the frontal view of forehead, eyes and nose (without participation of the mouth). But in the second half of the first year, the infant's adversion or aversion is increasingly influenced by facial expressions. We know of similar responses elicited by "implanted" features in the case of

animals, where the existence of such stimuli has been demonstrated again and again. And even though such innate patterns of behavior are now thought to be much more plastic than they were taken to be even two decades ago, the firmness and rigidity of many patterns of social behavior among the animals is nowadays beyond dispute. Some instances, like the effect of the red belly of a sexually mature male stickleback on a rival or on a pregnant female of its kind, have attained the status of paradigm cases. The famous early studies of J. H. Fabre have done much to call attention to the hereditary preparation of behavior and to pave the way for more thorough studies like the ones now being conducted by K. Lorenz, N. Tinbergen and their associates.

So also in the case of human beings, we are led to interpret the smile of the infant in response to the frontal view of the face as an inborn system of social behavior. It is true that it is hardly possible to give a strict proof in our case where there can be no question of rigorous experimentation. But it is highly probable that this and other forms of social behavior are inherited.

The probability that there are such inherited relationships gives rise to some further reflections. Students of human experience have been led to suppose that certain essential features of our intellectual interpretation of the world are due to inherited structures. The extent and nature of this inner world of archetypal forms has been under discussion for years. It would be premature to take sides and there is no need to do so. It seems to me more important for our evaluation of our relationship with the world to point out once more that behavioral research has made it probable that many animals are guided by the daily course of the sun, and that birds are also guided by the nightly changes in the starry heavens. If we are to grasp our peculiar intercourse with the things of this world and the peculiar way in which we fit into the whole of life, we must bear in mind the astonishing fact that a herd of seals, after many months of traversing the high seas and thousands of miles from their place of birth, set their course on the tiny bay of an arctic or antarctic island—the island on whose shores they first saw the light of day. We have no idea how they do it, but

there is certainly nothing "spooky," nothing supernatural, about it.

We may perhaps presuppose in what follows that man, with respect to his relationship with the world, is equipped in a way which in the final analysis must not be judged to be more deficient than that of a song bird, beach crab or a migratory fish or seal. Thus we must be prepared to allow (and research bears this out to some extent) that our central nervous system is also prepared, though in a very special way, for our relationship with the world. I think it is one of the most important metamorphoses in our thinking in recent times that a more thorough exploration of animal behavior has tremendously increased our confidence in such an assumption. But does this mean that we now uncritically suppose that there are hereditarily determined archetypes at work whenever we are at a loss to understand a given phenomenon? Assuredly not; it is simply a matter of keeping open different areas of specialization; it is a matter of courage to make bold assumptions which must then be submitted to severe experimental tests. How important it is to know the part heredity plays in preparing the individual for his relationships, is shown by the remark of a leading developmental physiologist on the occasion of the public lectures at the great Darwin centennial in Chicago in November, 1960. In speaking of the need of a group to pass on to each individual its traditionally acquired cultural values, Waddington expressed the conjecture that such transmission presupposes in the growing individual a willingness, based on heredity, to acknowledge authority. In recalling Freud's idea of the structure of the super-ego, he postulated a hereditary basis on which such a structure could be raised. We shall return to this matter; what is important at the moment is only that a biologist engaged in experimentation should have come to such conclusions, and that Sir Julian Huxley should have singled out Waddington's hints several times during the subsequent discussions in Chicago as an exciting new idea. Waddington compared this archetypal willingness to believe with the structurally unknown, but effective, hereditary mechanism which is responsible for "imprinting" in animals. The most famous instance of this phenomenon is the case of the goslings who adopt a man as a

"parent figure" and who owe their worldwide reputation to K. Lorenz.

The discussion about archetypes is in progress. We already see how difficult it is to give a conclusive proof of a completely archetypal structure even in the case of such simple behavior as the smile of an infant in response to a human face. How much more difficult is it then in the case of complex relationships which are manifested only later in life! We must look at the whole range of variants and try to separate the basic relations belonging to the primordial structure of relationships with the world from the equally effective relations arising from the individual's connection with a given group. Gaston Bachelard has isolated some of these "cultural archetypes"—these culture-bound forms of the mind's conquest of nature; but his contribution is insufficiently appreciated, at least outside the French-speaking countries. He has also shown that there are primordial forms of relationships in the realm of the imagination—in the way certain experiential components interact with sense impressions. It is no accident that Bachelard has turned especially to the study of alchemy—one of those fields on which C. G. Jung gathered such a rich harvest of primordial dispositions to interpret nature in certain ways.

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The hereditary preparation for the world, so characteristic of animals, must be valued very highly; we need to think highly of what is "bestial." Only a higher conception of subhuman life will enable us to see the peculiar nature of our own lives in proper perspective. But this recognition of the level on which man must be compared with the higher animals is not the only contribution of biology to a future science of man. In the last few decades we have learned from experimental genetics that the specific nature of human life, the "historicity" of man, must be regarded as a special way of evolution.

As already noted, this is first of all the result of genetic studies in evolution—the result, unexpected for many scientists, of intensive genetic research on the fruit fly *Drosophila* and on other creatures quite remote from man, and of a more careful comparison of the biological development of organic forms with

the transformations of those human forms of life which we call "history." A "natural history of man" is now being written which would come as a surprise to quite a few biologists of the early period of Darwinism if they could listen to what their legitimate successors of the neo-Darwinian school had to say.

Of course, the first and foremost fact of genetics is now, as it was then, that all genetic processes—mutation and the processes of selection and transformation which depend on it—occur not only in the case of plants and animals where there is very impressive evidence for them, but also in the case of man in whose evolution they also play their parts. I want to state this fact by way of a preface to show that there is nothing "spooky" about the species *Homo sapiens* either, and that the emphasis on our special nature on which I will now have to insist just as firmly does not spring from mere wishful thinking or from an uncontrollable urge to dismiss man at any price from the ranks of the other organisms.

One look at the current talent hunt for the future of scientific research is enough to make us see the special aspect which evolution assumes in the human sphere. However firmly we may all be convinced of the efficacy and importance of the role played by all the genetic factors in the nuclei of our cells, those who are charged with recruiting talented successors will never look for specific genetic factors for cyberneticists, physicists or biochemists. Nor will they try to compare genealogies, but examine instead the intellectual accomplishments of the almost fully developed individual. Individual abilities, developed within the tradition of the group, are the object of selection—an object whose outlines are indeed partly determined by organic hereditary factors, but whose final form and whose dynamic effects are largely determined by the tradition and the whole culture of the group. Society selects an object belonging primarily to the realm of history. The "gene" peculiar to mankind, with which evolution is now achieving its greatest successes, is the heritage which is active in the individual as a spiritual reality. Heredity is essentially social and not genetic. "Man has developed cultural heredity—or 'culture.' " This statement is to be found in a biological treatise by T. Dobzhansky on the evolution of man. Mankind has added "to biological heredity the transmission

of cultural inheritance; the latter process is, however, much more effective than the former."

It is also no secret that the rules governing this kind of selection are very different from the ones envisaged by the rabid man-breeders of the golden age of early Darwinism as well as by their more recent disciples. In the most advanced societies, social heredity does not simply operate, as people once dreamed it would, through the elimination of the "biologically unfit," genocide and eugenic selection. It makes use instead of the obscure possible correlations between genius and physical handicaps, and it recognizes the meaning of extremely valuable intellectual contributions on the part of men who, in those infamous words, are "unfit for life" according to the rules of natural selection. The politics of early Darwinism which tried to supersede natural elimination became once more a terrifying reality in the stupendous tragedy of the Third Reich in Germany. We now see through it and its diabolical nature.

Geneticists are, of course, sometimes slow to acknowledge the full implications of their own insights. Thus many of them hope in the foreseeable future for such a thorough insight into the mechanism of organic heredity that selection on the basis of organic criteria would also become practicable in the case of human beings. This would be eugenics proper, as developed by the classical geneticists of the first two decades of this century. J. Huxley still believed a few years ago that eugenics, though now primarily theoretical, would become of immense practical importance in the near future. I must confess that I do not share this optimism, and I even incline to the view that there is such a yawning abyss of ignorance between the mechanism of heredity and the full development of the forms and processes controlled by it that any interference in the human sphere would land one in extremely difficult, even insoluble, problems of responsibility and would amount to self-incrimination.

J. Huxley himself has incidentally stressed, during the discussions in Chicago which I have already mentioned, that the eugenic program strongly advocated by the geneticist I. Müller could only be justified in a carefully revised version. He still insisted in the concluding discussion that our goal should, of course, be a kind of conscious eugenic selection. But this work

had to be postponed for a later time. Only when we had solved our immediate problems should we pay much attention to the improvement of human heredity. In view of the urgency stressed by the more resolute eugenicists, Huxley's plea for delay is welcome support for the view that there are at present more pressing problems elsewhere.

If we reflect on all the great intellectual achievements of the past which went together with bodily malformation or suffering and also with great mental or emotional stress, we should hardly conclude after such a survey that all the great minds on that list should really have been annihilated at conception or made impossible by a more "correct" choice of mates in the preceding generation. We are beginning to see that, if the breeding of men were regulated by the rules of plant or animal breeding, the result would have to be a highly objectionable standardization according to a few easily grasped characteristics of the average man. For such human breeding would be denied the freedom to provoke mutations at will, which is what gives the non-human breeder the great opportunity to find new forms of cultivated plants or useful animals. This limitation, which even the most rabid geneticist is willing to respect today as far as man is concerned, is one of our last—our very last—barriers of awe before that which we cannot invent ourselves.

The latest works on the biological theory of evolution acknowledge the special position of man. Such an emphasis might perhaps be misconstrued as an attempt to salvage some traditional view of human life—as if it were for instance a question of preserving the Christian foundations of Western society. For this reason it may perhaps be necessary to state that whoever speaks of a special nature must begin with a more comprehensive form of life to which it belongs, for only in such a whole can something special appear as such.

Man's special genetic position rests on the fact that, in his case, selection makes use of characteristics whose form is decisively determined by tradition, though with the full participation of genetic factors. It is also a biological fact that this kind of selection alters the form of life of the human species much more rapidly than any natural selection could. Even more important, our method of "social inheritance"—the transmission

of social heritage through education—is of an effectiveness of which contemporary technical progress provides sufficiently striking examples. As Dobzhansky has said, "biological inheritance can only be handed down from parents to children; culture can be passed on to anyone. The development and transmission of culture have lent man as a species a degree of 'fitness' never before attained... Man's biological preeminence is unique and unequaled; no other species is in a position to challenge it... In the case of man, natural evolution by means of the crossing-over of genes, selection and mutation can take place simultaneously with cultural evolution. But the cultural mode has come to be the more effective and dominant mode. The time is past when natural evolution could rival or even surpass the cultural evolution of mankind. Today already, the opposite appears to be the case."

The biologists' recognition of the special nature of human evolution—their recognition of the special domain of history—has been one of the most important advances in the biological sciences in the last two decades. This unobtrusive process has nevertheless created a danger which is not to be underestimated: It blurs the differences separating the evolution of organic life and prehistorical developments from the specifically human mode. The fact that history appears as an evolutionary factor in the framework of biological explanations has the consequence that we do not focus sharply on its differences from the natural evolution of life, but are satisfied with a blurred picture of evolution in general. As war is the continuation of politics by other means, so the "history of mankind" becomes simply the continuation of evolution by slightly different means. And when the emphasis is on the fact that these different means are much more efficient, the current emphasis on "efficiency" helps to push the uniqueness of the human mode still further into the background.

If I advocate a sharper emphasis on contrasts and the preservation of differences, the reason is that awareness of these contrasts remains essential to both biological and historical research. The study of prehistory requires a delicate balancing of the parts played by both manners of development; for we need to find the organic variations in heredity which made the new,

traditional, mode of development possible. We also need to establish at which stage the new mode, characterized by thought, insight and language, began decisively to accelerate human evolution. What is in question is the origin of our "openness to the world," and it is perhaps becoming clear that the answer can never be read off with certainty from skull profiles, dental structures and other skeletal characteristics. We have here a central problem concerning the origin of man. If we do not see this problem, we will be badly disappointed even in the future when the number of fossil records will be much greater than it is now and when we will be in a position to attempt to form series to an extent which is still far beyond our means. Only then will it appear that the real riddle of the origin of man is too great and serious to admit of such an easy solution.

When I tried, in 1944, to distinguish carefully between the two different forms of evolution, the organic and the human, my attempt was at the time regarded as a rejection of the theory of evolution and is still sometimes so interpreted. The full acknowledgement of man's special nature on the part of geneticists should put this matter in a different light. But there is the accompanying danger that the neo-Darwinians, in adopting the human form of evolution, tend to place the emphasis on general similarities and to blur important differences. Thus I shall have to insist even today—just because we are all working within the framework of evolution—on the need for sharp conceptaul distinctions.

Such unlike spirits as, for example, Julian Huxley and P. Teilhard de Chardin agree in their evaluation of the historical determining factors of human evolution. This is a turning-point in biological thinking. It signifies nothing less than the insight on the part of natural scientists that our openness to the world —our unique way of being in the world—is not just an airy realm of the spirit all by itself, created as an epiphenomenon by organic living matter, but that this way of being is deeply rooted in our organic nature.

The change which led to the recognition of the need for a complementary view of man was necessary for the growth of the infant science of anthropology. The area we once tried to mark off by some such name as "human biology" is slowly

but inevitably growing to the point where, because of the nature of its subject matter, it exceeds the framework of biology and where its methods break down biological barriers and even transform the biological aspect of man into "anthropology" proper. It was possible and reasonable to confine it within the customary limits of biology as long as all the evidence seemed to point to corresponding features in man, animal and plant, and our participation in the whole of life appeared to be the proper task of biological research. Since we realize that it is also part of the duties of a biologist to investigate the special nature of man, we are made to see this whole area separately and as standing out from the rest as the science of anthropology.

As long as it was just a matter of showing that chromosomes followed the same laws in the process of transmission whether we were dealing with peas, flies or human beings, genetic questions were as a matter of course treated as purely biological ones. But as soon as it becomes a question of describing the mating behavior of sexual partners or the full development of the genetic characteristics which regulate our relationship with the world, we must set to work with a combination of research tools which will enable us to deal with other properties than those of animals and plants—both in the analysis of factors and in the synthesis of results.

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It is not just the reexamination of the theory of evolution which points in this direction; ontogenetic research points the same way. This agreement in the results confronts us all the more clearly as studies in the history of the development of the human condition have produced the same results in complete independence of the work in genetics and the theory of evolution.

The ontogenetic studies in which I have been engaged since 1937 (and whose most important results were already fixed in outline around 1942) arose out of comprehensive comparative studies of reptiles, birds and mammals, as well as from a broader view—a general examination of evolutionary changes in ontogenetic processes.

My point of departure was an examination of a strange

parallelism between the postnatal phases of birds and mammals. In both these warm-blooded animal groups, the postnatal phase may take either of two forms which are very different from one another and have long been familiar to us as "flighty" and "nestling" respectively. In both groups, we find helpless nestlings like the young of rats and song birds, but also quite highly developed and active "flighty" animals, like newly hatched chickens and new-born foals.

Morphological analysis brought to light an unexpected difference: In the case of birds, the very "flighty," independent, type is the prototype in the evolution of the group, as it is already characteristic of the reptiles; but in the case of mammals, this type can be shown to have evolved later and to be a secondary form of the postnatal phase. The helplessness of the young, their premature birth with their eyes closed, originated among birds in the later phases of evolution and independently in several groups. But as far back as we can trace the history of the mammals through the geologic ages, their genealogical series begin invariably with this developmental type. That this helpless state is the primary one in the case of mammals is shown by the strange fact that the "flighty" young of mammals all go through a prenatal stage in the womb in which they are actually prepared for a premature birth. This stage is designed to protect the sense-organs, still in the midst of their development, from drying out: The eye-lids grow together and similarly the opening in the ear. None of the "flighty" young of the birds goes through such a prenatal stage in the egg. The two very similar forms of the postnatal stage in the two highly developed warm-blooded groups are opposites in the order of evolution; their relative positions, their different "morphological values" in the formally similar young, are as firmly established as any fact in this area can be.

I am not here going to follow up the many ramifications of this morphological examination. What is important here is that it has led to a reexamination of the facts concerning man and those animals whose form of life closely resembles ours, and in particular, to a comparative study of the ontogenesis of primates. Parallel with these studies went others concerning

the degree of cerebral development or the height of cerebral differentiation.

To single out just a few results, among the higher mammals like dolphins and whales, hoofed animals and seals, lemurs and monkeys (omitting for the moment the anthropoid apes), we found a postnatal stage characteristic of the higher mammals: Their "flighty" young are highly developed and sensorily alert; their proportions and the sizes of their limbs resemble the adult state; their brain volume has reached one-half or more of the brain weight of an adult of the species; and they can perform all the motor functions of the adult animals. In camels and horses, lemurs and monkeys, the brain increases from birth to maturity by a factor of 2 or less (as low as 1.4), as compared with a factor of between 8 and 10 in the case of "nestlings." Where does man stand in this comparison?

I had to find first a typical postnatal stage which would correspond to a typical "human mammal"—a typical higher mammal with our brain volume and the human form. This stage is reached by us only a full year after birth: Only then does the increase in brain volume reach a factor of 1.5, and it is then that a child's posture becomes characteristic of the species and his form of life begins to conform to that of the group. If such a "human mammal" existed, he would have to be carried in the womb for a period of 20 to 22 months (assuming our rate of development) before he could come to the world with the posture characteristic of the species. Our development is different: We are born a year sooner. And during this first year outside the womb, a year spent in social intercourse, we develop what the above-mentioned higher mammals have to acquire through maturation in the monotony of the womb—viz. the posture and movements characteristic of the species as well as a relatively high state of cerebral maturity. The first year plays a strikingly different role in our development. This difference is underscored by the fact, discovered in 1903 but given little serious notice since then, that the infant's rate of development throughout his first year coincides with the fetal rate and is only afterwards replaced by the slow growth rate of the child which is then maintained for years.

Let us postpone for the moment a comparison with the

highest primates and try to see the significance of this process.

Any interpretation of our manner of development has to proceed according to the rules governing any analysis of ontogenetic processes. Whether we are examining physiological causal connections or comparing different animal types, we must always presuppose that the process of formation is to be related to its known end and to be understood in the light of it: To examine the heart is to explore a system of processes genetically designed to form a functional heart, and to study the kidneys is to explore the development of an organ of secretion.

So also, if we are to understand the successive phases of our ontogenetic development, we must view it, even in a first exploratory study, as a process genetically designed to attain the state of maturity. This is the inevitable "teleological" component in any biological study, and it is incidentally the unformulated principle behind any physiological or genetic investigation. It is so much a matter of course that it is no longer even mentioned and as it were dimmed down when we come to the causal investigation of parts. But we must always bear in mind this presupposition of goal-directed genetic preconditions, for it is precisely the obvious which is always in danger of being forgotten.

If we look at our individual growth in this light, we can see with what precision our manner of development has been designed for the attainment of that special form of life whose special nature has also begun to be emphasized by the latest studies in evolution.

To mention the most striking correlation first, to the long effort required to absorb the traditional heritage of the group through practice, and to the great amount to be mastered, corresponds our long childhood which extends from the second year almost into the tenth and during which time our growth is strikingly retarded. This retardation must not be viewed as a disturbance of the more rapid growth of the animals, but as a genetic factor correlated with that special mode of development—through "social heredity," that social integration of the individual which is specifically human. The long interruption of sexual maturation must be seen as another factor correlated with it in the same way. The nature of the internal factors

which account for this connection between form of life and ontogenesis is a problem all by itself and poses its own problems for the investigator. Among the other important factors which influence our manner of development are our predominantly imaginative experience of the world during our long childhood and the marked strengthening of all our rational functions at the time of puberty.

Let us note one more set of correlations between manner of development and the characteristics of the mature form: We saw that a "human mammal" would have to be born one year later than an actual human being. The formation of his characteristic posture, experience of the world and social behavior would be an essentially pure process, regulated only by hereditary factors and occurring only in the womb; he would mature without the direct influence of his future environment. As a young whale leaves the womb when he is 6 to 7 meters long and all ready to swim; as a young hoofed animal is at once ready to follow his mother and a young monkey is at once ready to hold on to his mother without her help; so our fictitious human mammal should come into the world ready to stand, to utter the characteristic sounds of the species and to engage in inherited social behavior.

We all know the distance that separates the new-born baby from this state. He inherits only a few patterns—those that regulate the act of sucking and his very earliest social behavior. His genuinely human behavior is acquired in a way which combines genuine maturation of neuro-muscular structures, regulated only by genetic factors, with the determining influence of the environment which must complement the process of maturation if the genetic dispositions are to be fully realized. Our posture, speech, all our ways of looking at the world rest on this peculiar initial state of our inherited dispositions. They depend on the collaboration of peculiarly open inherited dispositions with the cultural heritage created by the social group—a heritage which, from speech through posture to gesture, needs to be firmly implanted in the growing individual. The collaboration is essential, but is for this reason already prepared in advance. Ontogenesis does not only miscarry when there is a malfunction in the hereditary factors; it also miscarries when

there is, at the start, a failure of cooperation between the growing individual and the group, as when there is an early lack of attention, of harmony in the nursery, of emotional warmth. Psychologists and pediatricians have documented the shocking consequences of the absence of human relationships or the lack of emotional warmth at home.

Animals as well as men are in need of emotional contact, but in our case the need becomes more urgent because our cultural heritage can only reach the child through interpersonal contact throughout his formative period. The unity of a human being which can only artificially be broken up into feelings and intellect, mind and body, is particularly obvious in our first extra-uterine year.

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In this account of the development of the human individual, I started out with the fact that monkeys (or primates in the widest sense) are the only group of animals which can be considered our close relations. We saw that these animals are highly developed at birth and that, compared with them, a human child is born in a much more dependent and helpless state. But in this survey I left out the anthropoid apes, for I wanted to find a standard by which to judge man—a basic condition which would be characteristic of the majority of higher mammals.

The anthropoid apes are a difficult object of comparison: They are so close to us in many of their characteristics that one's judgement will invariably be influenced by one's attitude to the theory of common descent and its corollaries. The most convenient, and perhaps also for this reason the most common, way is to point out certain beginnings, traces, single features in the anthropoid apes which are also to be found in the development of a human being, and thereby to confirm for the n^{th} time the thesis that these animals, the *Pongidae* of the zoologists, are steps on the way to man. I think it is more profitable to adopt a different point of view and to look for characteristics which are appreciably different from ours, and thus to come to grips with the question what a theory of the

origin of man is after all supposed to explain—which portions of the evolutionary process and which special phenomena. This, to me, is the important procedure, since for a long time now it has simply been unnecessary to produce new evidence to show once again that man and the anthropoids are formally similar and capable of analogous accomplishments. For nobody can seriously maintain that we needed the evidence from serum reactions to demonstrate that the anthropoid apes were related to ours species. Long before Darwin, every observer had been certain of this relationship, no matter how different his explanation of it may have been.

Let me begin my search for differences with formal characteristics, for these allow of greater certainty than properties of behavior. Young anthropoid apes are born with about half the brain weight of the new-born human child (with 1500 to 1800 grams instead of 3200). But if we plot the increase of their brain weight on a curve, we find that it cuts across the human growth curve, after no less than 1.5 years in the case of gorillas and no more than 6 years in that of chimpanzees, with orangutans between the two extremes. Thus all anthropoid apes reach their final characteristic brain weight much more rapidly. This difference is connected with the characteristic delay in human growth after the first extra-uterine year.

The low initial brain weight of the anthropoid apes does not result from their shorter period of gestation. Compare the average weight for a new-born chimpanzee (1500 grams) with that for an equally old human fetus (which is still 2500 grams on the average). Their low initial brain weight is, however, related to their brain weight which at birth amounts to only about one third of the typical initial weight of the human brain.

There is a further difference: The brain of the anthropoid apes approximately doubles its weight from birth to maturity. The factor varies from 1.6 to 2.4 and thus corresponds to that of the baboon or the macaque, while our own central nervous system has to increase its mass 4.3 times before it reaches maturity. Should there be further need for proof that the proper time of birth for a true "human mammal" would be at the end of our first year, then cerebral development affords such a proof: At the end of the first year, the human brain

is so far advanced that it need only double its weight; the factor varies from 1.5 to 2 and has thus fallen to the level characteristic of the higher mammals.

It is also significant (though little noted) that the limbs of all anthropoids are so proportioned at birth that they hardly differ from the adult form, whereas human arms and legs diverge considerably (and each in different ways) from the adult proportions. The legs in particular grow in a peculiar way, slowing down at first and then catching up towards the end of the first year—a phenomenon which is still being paid too little attention.

The fact that the behavior of a young anthropoid shows many traits which indicate a close attachment to his mother should not be allowed to obscure the fact that the physical development of anthropoid apes is of the same form as that of the higher mammals, while the growth pattern of a new-born human child represents a higher level and constitutes a departure from the basic mammalian norm.

The discussion of the new prehistoric finds of, say, the last two decades has gradually been moving towards the conclusion that the evolutionary line of the anthropoid apes has been distinct from that of the hominids since the oligocene, which leaves a period of about 25 to 30 million years for the separate development of the two lines. If we are to try to reconstruct their ancestral relationships, we must begin with the more primitive kinds of monkeys, for only they can offer us the typical features which such an ancestral form must have possessed. We must assume, as the common starting-point for the separate development of *Pongidae* and *Hominidae*, a stage in which the young were highly developed, approximated the adult type in their bodily proportions, and increased their brain weight by a factor of about 2. (A range of 1.4 to 2.4 has actually been demonstrated.) It is from this common prototype that man and anthropoids developed their postnatal phases, and though they shared a common heredity, the changes were nevertheless independent. By lengthening the period of gestation, the anthropoids retained the original brain-weight increase factor as well as the close approximation of the bodily proportions of the new-born to those of the adult. But they achieved

a very much stronger dependence on their mother than was characteristic of the ancestral type, and their neuro-muscular maturation was retarded. These features evolved in a separate line—separate from the line of the *Hominidae*: If the anthropoids resemble us in our dependence on mother and group, it is because the evolution of their ontogenesis paralleled ours and not because this was a common ancestral feature. Such similarities raise new questions; they do not answer the old question of what the *Hominidae* were like in the early phases of their evolution. This is why I call such features "parahominid" and why I am very sceptical about their classification as "prehominid."

It is only very slowly and with great effort that we are beginning to see the true nature of the anthropoid apes. Once they were taken to be in some way deficient human beings, the retarded brethren of the "noble savage." Thus in the eighteenth century they were represented as the "men of the woods" who walked erect on a kind of shepherd's staff. In the middle of the nineteenth century, they turned into wild beasts armed to the teeth with flintstones and clubs, and the old woodcuts show them cracking the rifle barrel of the unfortunate hunter. Once they were humanized, then brutalized—a change in attitude arising not so much from new important insights as from a radical change in the spirit of the times and its view of nature.

A new picture is now emerging slowly. Karl Akeley's early studies of the gorilla and, more recently, Schaller's studies have filled in some of the details of this new conception, and A. Kortlandt's observations on chimpanzees have added to it in recent years. Are we finally going to succeed in letting these creatures have a form of life of their own? Or will these new observations, too, succumb to the powerful pressure exerted by the age-old polar opposition which makes us see, in the strange mirror which the anthropoid ape will always be for us, either the subhuman creature whom we ought to overcome in ourselves or else the bewitched prince who is waiting to be liberated from his spell?

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It is now becoming possible to neutralize such old contrasts as that between biology and psychology or such old divisions as that into body, soul and mind—to recognize their classificatory value while still preferring more productive conceptual schemes. The possibility and great heuristic value of such an attitude is beginning to be recognized, and it is taking the form of a new attitude to a science of man. For instance, many physicians of the psycho-somatic school are now realizing that their use of the word "psycho-somatic" indicates a kind of dualism which they would like to overcome and replace by a more unitary conception of the human form of life. It is therefore no accident that already more than ten years ago, shortly after the end of World War Two, the name "anthropotherapy" was proposed (by A. Mitscherlich) for the psychosomatic school of medicine.

I myself have tried to show that the spread of scientific discussion over the whole planet, far beyond the frontiers of Western civilization, demands a scientific account of the basic human condition, and in 1955 I tentatively called this science "basic anthropology." The need for it is apparent from the attention that is now generally being paid to the special nature of man, even in experimental biology—genetics and the theory of evolution.

Such a basic anthropology seeks to go beyond the many warring conceptions of our place in the world to bring out our essentially human traits; it can be neither Christian nor Marxist nor Buddhist, and it is no new attempt at syncretism. All these attitudes claim to be final and conclusive, even when they pretend to be "scientific" in their respective spheres. Every one of these efforts must be labeled a "terminal" anthropology, as opposed to a "basic" one: Each wants to put the cope-stone on a finished intellectual edifice, whereas the science of man which we are now proposing and now working for can only be a servant and not a dogmatic ruler.

Such a basic anthropology will not proclaim this or that historic form of coexistence to be the only "correct" one. On the contrary, it will bring out the fact that our inherited social

dispositions are always open and it will show that human social life is as much characterized by the ever-present need to find a relatively stable social form as by the freedom of decision as to what that form shall be. The permanence claimed by any social system (and so necessary for creative activity) must be understood to be relative. Every social structure must leave openings for the spontaneous unfolding of social life and for its own transformation. It must also leave an opening for intellectual freedom within the limits of the self-preservation of the social structure. A basic anthropology will also be able to show that the preservation of individual freedom is as necessary a condition of collective life as the curtailment of individual licence. But it cannot thereby claim to anticipate the formula for a correct balance, nor can it remove all the risks involved or relieve us of our responsibility.

A basic anthropology will also show its "basic" character—its conscious repudiation of all "final solutions"—when it comes to the great question of the meaning of life. It will be able to show that it is a function of human life to give meaning to it, that this is a powerful urge, and that the lack of meaning in our lives leads to various kinds of break-down. But it will also be able to show that the loss of faith in all interpretations of the meaning of life offered at a given time belongs as much to the essential tools of social life, for this doubt is one of those openings in the social structure by which our species prepares for change.

Such a basic science of man will also show that, with the increasing organization fo living things, the special value of the individual increases in proportion to the increase in the possibilities of realizing a common end. But the science we are here envisaging will not try to establish any one end or solve the problem of the meaning of life in any final way. Such modesty is not to be construed as indecisiveness or as scepticism about the possibility of an answer. It arises from a single source—the recognition of the fundamentally enigmatic nature of human life which makes the quest for the meaning of life a task which no generation can dispense with and of which it cannot be relieved.

We no longer live in an age—which some of us might

want to call golden—where the division between the natural and the social sciences could spread a deceptive glow of enlightenment. By recognizing the historical mode of evolution as a "second nature," the neo-Darwinians are mobilizing for the forcible annexation of history by natural history. Not that theirs would be the last word on the matter; but we must at least carefully reexamine certain fundamental propositions concerning man and cultivate a basic anthropology instead of one of the many and often barely conscious varieties of "latent anthropology" (as H. Kunz once called them).

The basic science of man, which is beginning to form in obscurity, lays claim to universal validity. But it is by its very nature a servant; it serves to connect what seems to be disconnected, but is no substitute for a vanishing faith. It is no religious doctrine of man, because it is aware of the realm of freedom—the realm which is at the same time ruled by an inner necessity to shape this very freedom. We are aware how serious these decisions are, and since a basic anthropology recognizes the difficulty of the requirement, it cannot claim prophetic knowledge and presume to structure this realm before the fact and once and for all. The kinds of anthropology that seek to rule will also venture again and again into this realm of freedom. They will reach some goals and miss others, and they will decay or change. If there is to be anything permanent about them, it must be built on the foundations now being laid by a genuine science of man—by a basic anthropology.