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# *The Study of Race**

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THE Executive Board has asked me to give my address on the subject of race, and, reluctantly and diffidently, I have agreed to do so. I am not a specialist on this subject. I have never done research on race, but I have taught it for a number of years.

Discussion of the races of man seems to generate endless emotion and confusion. I am under no illusion that this paper can do much to dispel the confusion; it may add to the emotion. The latest information available supports the traditional findings of anthropologists and other social scientists—that there is no scientific basis of any kind for racial discrimination. I think that the way this conclusion has been reached needs to be restated. The continuation of antiquated biological notions in anthropology and the oversimplification of facts weakens the anthropological position. We must realize that great changes have taken place in the study of race over the last 20 years and it is up to us to bring our profession into the forefront of the newer understandings, so that our statements will be authoritative and useful.

This paper will be concerned with three topics—the modern concept of race, the interpretation of racial differences, and the social significances of race. And, again, I have no illusion that these things can be treated briefly; I shall merely say a few things which are on my mind and which you may amplify by turning to the literature, and especially to Dobzhansky's book, *Mankind Evolving*. This book states the relations between culture and genetics in a way which is useful to social scientists. In my opinion it is a great book which puts the interrelations of biology and culture in proper perspective and avoids the oversimplifications which come from overemphasis on either one alone.

The races of man are the result of human evolution, of the evolution of our species. The races are open parts of the species, and the species is a closed system. If we look, then, upon long-term human evolution, our first problem must be the species and the things which have caused the evolution of all mankind, not the races, which are the results of local forces and which are minor in terms of the evolution of the whole species. (A contrary view has recently been expressed by Coon in *The Origin of Races*. I think that great antiquity of human races is supported neither by the record nor by evolutionary theory.)

The evolution of races is due, according to modern genetics, to mutation, selection, migration, and genetic drift. It is easy to shift from this statement of genetic theory to complications of hemoglobin, blood groups or other technical information. But the point I want to stress is that the primary implication

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of genetics for anthropology is that it affirms the relation of culture and biology in a far firmer and more important way than ever in our history before. Selection is for reproductive success, and in man reproductive success is primarily determined by the social system and by culture. Effective behavior is the question, not something else.

Drift depends on the size of population, and population size, again, is dependent upon culture, not upon genetic factors as such. Obviously, migration depends on clothes, transportation, economy, and warfare and is reflected in the archeological record. Even mutation rates are now affected by technology.

Genetic theory forces the consideration of culture as the major factor in the evolution of man. It thus reaffirms the fundamental belief of anthropologists that we must study man both as a biological and as a social organism. This is no longer a question of something that might be desirable; it must be done if genetic theory is correct.

We have, then, on the one hand the history of genetic systems, and on the other hand the history of cultural systems, and, finally, the interrelation between these two. There is no evolution in the traditional anthropological sense. What Boas referred to as evolution was orthogenesis—which receives no support from modern genetic theory. What the geneticist sees as evolution is far closer to what Boas called history than to what he called evolution, and some anthropologists are still fighting a nineteenth-century battle in their presentation of evolution. We have, then, the history of cultural systems, which you may call history; and the history of genetic systems, which you may call evolution if you want to, but if you use this word remember that it means selection, migration, drift—it is real history that you are talking about and not some mystic force which constrains mankind to evolve according to some orthogenetic principle.

There is, then, no possibility of studying human raciation, the process of race formation, without studying human culture. Archeology is as important in the study of the origin of races as is genetics; all we can do is reconstruct as best we can the long-term past, and this is going to be very difficult.

Now let me contrast this point of view with the one which has been common in much of anthropology. In the first place, anthropology's main subject, the subject of race, disregarded to an amazing degree the evolution of the human species. Anthropologists were so concerned with the subdivisions within our species and with minor detailed differences between small parts of the species that the physical anthropologists largely forgot that mankind is a species and that the important thing is the evolution of this whole group, not the minor differences between its parts.

If we look back to the time when I was educated, races were regarded as types. We were taught to go to a population and divide it into a series of types and to re-create history out of this artificial arrangement. Those of you who have read *Current Anthropology* will realize that this kind of anthropology is still alive, amazingly, and in full force in some countries; relics of it are still alive in our teaching today.

Genetics shows us that typology must be completely removed from our thinking if we are to progress. For example, let us take the case of the Bushmen. The Bushmen have been described as the result of a mixture between Negro and Mongoloid. Such a statement could only be put in the literature without any possible consideration of migration routes, of numbers of people, of cultures, of any way that such a mixing could actually take place. The fact is that the Bushmen had a substantial record in South Africa and in East Africa and there is no evidence that they ever were anywhere else except in these areas. In other words, they are a race which belongs exactly where they are.

If we are concerned with history let us consider, on the one hand, the ancestors of these Bushmen 15,000 years ago and the area available to them, to their way of life, and, on the other hand, the ancestors of Europeans at the same time in the area available to them, with their way of life. We will find that the area available to the Bushmen was at least twice that available to the Europeans. The Bushmen were living in a land of optimum game; the Europeans were living close to an ice sheet. There were perhaps from three to five times as many Bushmen ancestors as there were European ancestors only 15,000 years ago.

If one were to name a major race, or a primary race, the Bushmen have a far better claim in terms of the archeological record than the Europeans. During the time of glacial advance more than half of the Old World available to man for life was in Africa. The numbers and distributions that we think of as normal and the races whose last results we see today are relics of an earlier and far different time in human history.

There are no three primary races, no three major groups. The idea of three primary races stems from nineteenth-century typology; it is totally misleading to put the black-skinned people of the world together—to put the Australian in the same grouping with the inhabitants of Africa. And there are certainly at least three independent origins of the small, dark people, the Pygmies, and probably more than that. There is no single Pygmy race.

If we look to real history we will always find more than three races, because there are more than three major areas in which the raciation of our species was taking place.

If we attempt to preserve the notion of three races, we make pseudo-typological problems. Take for example, again, the problem of the aboriginal Australian. If we have only three races, either they must be put with the people of Africa, with which they have nothing in common, or they must be accounted for by mixture, and in books appearing even as late as 1950, a part of the aboriginal Australian population is described as European, and listed with the Europeans, and the residue is listed with the Africans and left there.

The concept of race is fundamentally changed if we actually look for selection, migration, and study people as they are (who they are, where they are, how many they are); and the majority of anthropological textbooks need substantial revision along these lines.

Since races are open systems which are intergrading, the number of races will depend on the purpose of the classification. This is, I think, a tremendously important point. It is significant that as I was reviewing classifications in preparing this lecture, I found that almost none of them mentioned any purpose for which people were being classified. Race isn't very important biologically. If we are classifying races in order to understand human history, there aren't many human races, and there is very substantial agreement as to what they are. There are from six to nine races, and this difference in number is very largely a matter of definition. These races occupied the major separate geographical areas in the Old World.

If one has no purpose for classification, the number of races can be multiplied almost indefinitely, and it seems to me that the erratically varying number of races is a source of confusion to student, to layman, and to specialist. I think we should require people who propose a classification of races to state in the first place why they wish to divide the human species and to give in detail the important reasons for subdividing our whole species. If important reasons for such classification are given, I think you will find that the number of races is always exceedingly small.

If we consider these six or nine geographical races and the factors which produced them, I think the first thing we want to stress is migration.

All through human history, where we have any evidence of that history, people have migrated. In a recent ANTHROPOLOGIST there is a suggestion that it took 400,000 years for a gene that mutated in China to reach Europe. We know, historically, that Alexander the Great went from Greece into Northern India. We know that Mongol tribes migrated from Asia into Europe. Only a person seeking to believe that the races are very separate could possibly believe such a figure as that cited.

Migration has always been important in human history and there is no such thing as human populations which are completely separated from other human populations. And migration necessarily brings in new genes, necessarily reduces the differences between the races. For raciation to take place, then, there must be other factors operating which create difference. Under certain circumstances, in very small populations, differences may be created by genetic drift, or because the founders are for chance reasons very different from other members of the species.

However, the primary factor in the creation of racial differences in the long term is selection. This means that the origin of races must depend on adaptation and that the differences between the races which we see must in times past have been adaptive. I stress the question of time here, because it is perfectly logical to maintain that in time past a shovel-shaped incisor, for example, was more efficient than an incisor of other forms and that selection would have been for this, and at the same time to assert that today this dental difference is of absolutely no social importance. It is important to make this point because people generally take the view that something is always adaptive or never adaptive, and this is a fundamental oversimplification of the facts.

Adaptation is always within a given situation. There is no such thing as a gene which has a particular adaptive value; it has this value only under set circumstances. For example, the sickle-cell gene, if Allison and others are right, protects against malaria. This is adaptive if there is malaria, but if there is not malaria it is not adaptive. The adaptive value of the gene, then, is dependent on the state of medicine and has no absolute value. The same is true of the other characteristics associated with race.

I would like to go over some of the suggestions which have been made about the adaptive values of various structures in human beings, because I think these need to be looked at again.

I have stressed that the concept of race which comes from population genetics is compatible with what anthropologists have thought. I think that this concept represents great progress. But when I read the descriptions of the importance of adaptive characteristics, I am not sure that there has been any progress since the nineteenth century.

In this connection I should like to speak for a moment on the notion that the Mongoloids are a race which are adapted to live in the cold, that these are arctic-adapted people.

In the first place, in marked contrast to animals which are adapted to live in the arctic, large numbers of Mongoloids are living in the hot, moist tropics. Altogether unlike animal adaptation, then, the people who are supposed to be adapted to the cold aren't living under cold conditions, and I think we should stress this. For thousands of years the majority of this group have not been living under the conditions which are supposed to have produced them. They are presumed, as an arctic-adapted group following various laws, to have short extremities, flat noses, and to be stocky in build. They are, we might say, as stocky as the Scotch, as flat-nosed as the Norwegians, and as blonde as the Eskimos. Actually, there is no correlation, that is, none that has been well worked out, to support the notion that any of these racial groups is cold-adapted.

Let me say a few more words on this lack of correlation. If one follows the form of the nose, in Europe, as one moves north, narrow noses are correlated with cold climate; in Eastern Asia low noses are correlated with cold climate. In neither case is there the slightest evidence that the difference in the form of the nose has anything whatsoever to do with warming the air that comes into the face. Further, if we look at these differences expressed in this way, we see that they are posed in terms of nineteenth-century notions of what a face is all about.

Let us look at it differently. The nose is the center of a face. Most of a face is concerned with teeth, and bones, and muscles that have to do with chewing. The Mongoloid face is primarily the result of large masseter muscles and the bones from which these muscles arise (malar and gonial angles). This is a complex structural pattern related to the teeth, and a superficially very similar pattern may be seen in the Bushman, whose facial form can hardly be attributed to adaptation to cold.

The face of the Neanderthal man has recently been described also as cold-adapted, though it does not have the characteristics of the Mongoloid face. We are told that the blood supply to the Neanderthal face was greatly increased because the infraorbital foramen was large, bringing more blood to the front of the face. In actual fact, most of the blood to our face does not go through that artery. The artery that carries most of the blood to the face comes along the outside, and even our arteries are far too large to go through the mental or infraorbital foramen of Neanderthal man. This kind of statement, as well as the statement that the maxillary sinus warmed the air and that the function of a large orbit was to keep the eyes from freezing, seems to me an extraordinary retrogression to the worst kind of evolutionary speculation—speculation that antedates genetics and reveals a lack of any kind of reasonable understanding of the structure of the human face.

The point I wish to stress is that those who have spoken of the cold-adaptation of the Mongoloid face and of the Neanderthal face do not know the structure of the human face. We have people writing about human faces who are anatomically illiterate. I am genetically illiterate; I do not know about the hemoglobins. I am not asserting that all of us should be required to be literate in all branches of physical anthropology. As Stanley Garn points out, the field has become complicated, but people who are writing about the structure of the human face should learn the elements of anatomy.

The adaptive value of skin color has been repeatedly claimed, but recently Blum has indicated that the situation is more complicated than it appeared. In the first place, he points out the melanin in the skin doesn't do what anthropologists have said it has done. The part of the skin which mainly stops ultraviolet light, the short-wave length light, is a thickened *stratum corneum*, rather than melanin.

Again, the chimpanzee and the gorilla live in precisely the same climatic conditions in Uganda, but the gorilla has one of the blackest, most deeply pigmented skins of the primates and the chimpanzee has a very light skin. It simply is not true that skin color closely parallels climate. The point here is that racial classification tells us very little. The classification poses problems; it does not solve them.

In scientific method, as I see it, one looks at relevant data and when these data are laid out, as in, say, the classification of races, one may then find a correlation which is helpful. But after that, one has to do an experiment; one has to do something that shows that the correlation has validity. And it's no use continuing to correlate nose-form or skin color with climate. The crude correlations were made many years ago, and to advance the study of race requires new methods and more sophisticated analyses.

When I was a student, there were naive racial interpretations based on the metrical data. When these became unacceptable politically the same people used naive constitutional correlations to reach the same conclusions of social importance. Today we have naive concepts of adaptation, taking the place of the earlier interpretations, and a recrudescence of the racial thinking.

All along the line there have been valid problems in race, valid problems in constitution, and valid problems in adaptation. What I am protesting against strongly is the notion that one can simply take a factor, such as a high cheekbone, think that it might be related to climate, and then jump to this conclusion without any kind of connecting link between the two elements—without any kind of experimental verification of the sort of material that is being dealt with. If we took really seriously this notion that a flat face with large maxillary sinuses, deep orbits, and big brow ridges is cold-adapted, it is clear that the most cold-adapted animal in the primates is the gorilla.

Race, then, is a useful concept only if one is concerned with the kind of anatomical, genetic, and structural differences which were in time past important in the origin of races. Race in human thinking is a very minor concept. It is entirely worth while to have a small number of specialists, such as myself, who are concerned with the origin of gonial angles, the form of the nose, the origin of dental patterns, changes in blood-group frequencies, and so on. But this is a very minor, specialized kind of knowledge.

If classification is to have a purpose, we may look backward to the explanation of the differences between people—structural, anatomical, physiological differences—and then the concept of race is useful, but it is useful under no other circumstances, as far as I can see.

When the meaning of skin color and structure is fully understood, it will help us to understand the origin of races, but this is not the same thing as understanding the origin of our species. It will help in the understanding of why color was important in time long past, but it will have no meaning to modern technical society.

I turn now to a brief statement on the influence of culture upon race. Beginning with agriculture and continuing at an ever-increasing rate, human customs have been interposed between the organism and the environment. The increase of our species from perhaps as few as five million before agriculture to three billion today is the result of new technology, not of biological evolution. The conditions under which the races evolved are mainly gone, and there are new causes of mutation, new kinds of selection, and vast migration. Today the numbers and distribution of the peoples of the world are due primarily to culture. Some people think the new conditions are so different that it is better no longer to use the word race or the word evolution, but I personally think this confuses more than it clarifies.

All this does not mean that evolution has stopped, because the new conditions will change gene frequencies, but the conditions which produced the old races are gone. In this crowded world of civilization and science, the claim has been made repeatedly that one or another of the races is superior to the others. Obviously, this argument cannot be based on the past; because something was useful in times past and was selected for under conditions which are now gone, does not mean that it will be useful in the present or in the future.

The essential point at issue is whether the abilities of large populations are so different that their capacity to participate in modern technical culture is

affected. Remember in the first place that no race has evolved to fit the selective pressures of the modern world. Technical civilization is new and the races are old. Remember also that all the species of *Homo* have been adapting to the human way of life for many thousands of years. Tools even antedate our genus, and our human biological adaptation is the result of culture. Man and his capacity for culture have evolved together, as Dr. Dobzhansky has pointed out. All men are adapted to learn language—any language; to perform skillful tasks—a fabulous variety of tasks; to cooperate; to enjoy art; to practice religion, philosophy, and science.

Our species only survives in culture, and, in a profound sense, we are the product of the new selection pressures that came with culture.

Infinitely more is known about the language and culture of all the groups of mankind than is known about the biology of racial differences. We know that the members of every racial group have learned a vast variety of languages and ways of life. The interaction of genes and custom over the millenia has produced a species whose populations can learn to live in an amazing variety of complex cultural ways.

Racism is based on a profound misunderstanding of culture, of learning, and of the biology of the human species. The study of cultures should give a profound respect for the biology of man's capacity to learn. Much of the earlier discussion of racial inferiority centered on the discussion of intelligence; or, to put the matter more accurately, usually on that small part of biological intelligence which is measured by the IQ. In the earlier days of intelligence testing, there was a widespread belief that the tests revealed something which was genetically fixed within a rather narrow range. The whole climate of opinion that fostered this point of view has changed. At that time animals were regarded as primarily instinctive in their behavior, and the genes were supposed to exert their effects in an almost mechanical way, regardless of the environment. All this intellectual climate has changed. Learning has proved to be far more important in the behavior of many animal species, and the action of the complexes of genes is now known to be affected by the environment, as is, to a great degree, the performance that results from them. For example, Harlow has shown that monkeys learn to learn. Monkeys become test wise. They become skillful in the solution of tests—so monkeys in Dr. Harlow's laboratories are spoken of as naive or as experienced in the use of tests. To suppose that humans cannot learn to take tests is to suppose that humans are rather less intelligent than monkeys.

Krech and Rosenzweig have shown that rats raised in an enriched environment are much more intelligent and efficient as maze-solvers than rats that have been given no opportunity to learn and to practice before the testing. To suppose that man would not learn through education to take tests more efficiently, is to suppose that our learning capacities are rather less than those of rats.

The human is born with less than a third of the adult brain capacity, and there is tremendous growth of the cortex after birth. There is possibly no mammalian species in which the environment has a longer and more direct

effect on the central nervous system than man. We should expect, then, that test results are going to be more affected by the environment of man than in the case of any other animal. Deprivation studies of monkeys and chimpanzees and clinical investigations of man show that the lack of a normal interpersonal environment may be devastating to the developing individual.

Today one approaches the study of intelligence expecting to find that environment is important. The intellectual background is very different from that of the '20's. The general results on testing may be briefy summarized as follows:

> The average IQ of large groups is raised by education. I believe the most important data on this are the comparisons of the soldiers of World War I and of World War II. More than 80 per cent of the soldiers tested in World War II were above the mean of those tested in World War I. This means a wholesale massive improvement, judged by these tests, in the sons of the people who fought in World War I.

In the states where the least educational effort is made, the IQ is the lowest. In fact, as one looks at the review in Anastasi, it is exceedingly difficult to see why anyone ever thought that the IQ measured innate intelligence, and not the genetic constitution as modified in the family, in the schools, and by the general intellectual environment.

I would suggest that if the intelligence quotients of Negroes and Whites in this country are compared, the same rules be used for these comparisons as would be used for comparisons of the data between two groups of Whites. This may not seem a very extreme thing to suggest, but if you look at the literature, you will find that when two groups of Whites differ in their IQ's, the explanation of the difference is immediately sought in schooling, environment, economic positions of parents, and so on, but that when Negroes and Whites differ in precisely the same way the difference is said to be genetic.

Let me give you but one example of this. Klineberg showed years ago in excellent studies that the mean test scores of many Northern Negro groups were higher than those of certain groups of Southern Whites. When these findings were published, it was immediately suggested that there had been a differential migration and the more intelligent Negroes had moved to the North. But the mean of Northern Whites test results is above that of Southern Whites. Are we to believe that the intelligent Whites also moved to the North?

There is no way of telling what the IQ would be if equal opportunity were given to all racial and social groups. The group which is sociologically classified as Negro in the United States, about one-third of whose genes are of European origin, might well test ahead of the Whites. I am sometimes surprised to hear it stated that if Negroes were given an equal opportunity, their IQ would be the same as the Whites'. If one looks at the degree of social discrimination against Negroes and their lack of education, and also takes into account the tremendous amount of overlapping between the observed IQ's of both, one can make an equally good case that, given a comparable chance to that of the Whites, their IQ's would test out ahead. Of course, it would be absolutely unimportant in a democratic society if this were to be true, because the vast majority of individuals of both groups would be of comparable intelligence,

whatever the mean of these intelligence tests would show.

We can generalize this point. All kinds of human performance—whether social, athletic, intellectual—are built on genetic and environmental elements. The level of all kinds of performance can be increased by improving the environmental situation so that every genetic constitution may be developed to its full capacity. Any kind of social discrimination against groups of people, whether these are races, castes, or classes, reduces the achievements of our species, of mankind.

The cost of discrimination is reflected in length of life. The Founding Fathers were wise to join life, liberty, and the pursuit of happiness, because these are intimately linked in the social and cultural system. Just as the restriction of social and economic opportunity reduces intelligence so it reduces length of life.

In 1900 the life expectancy of White males in the United States was 48 years, and in that same year the expectancy of a Negro male was 32 years; that is a difference of 50 per cent, or 16 years. By 1940 the difference had been reduced to ten years, and by 1958 to six. As the life expectancy of the Whites increased from 48 to 62 to 67 years, that of the Negroes increased from 32 to 52 to 61 years. They died of the same causes, but they died at different rates.

Discrimination, by denying equal social opportunity to the Negro, made his progress lag approximately 20 years behind that of the White. Somebody said to me, "Well, 61, 67, that's only six years." But it depends on whose six years it is. There are about 19 million people in this country sociologically classified as Negroes. If they die according to the death rate given above, approximately 100 million years of life will be lost owing to discrimination.

In 1958 the death rate for Negroes in the first year of life was 52 per thousand and for Whites 26 . Thousands of Negro infants died unnecessarily. The social conscience is an extraordinary thing. A lynching stirs the whole community to action, yet only a single life is lost. Discrimination, through denying education, medical care, and economic progress, kills at a far higher rate. A ghetto of hatred kills more surely than a concentration camp, because it kills by accepted custom, and it kills every day in the year.

A few years ago in South Africa, the expectation of life for a Black man was 40 years, but it was 60 at the same time for a White man. At that same time a White woman could expect 25 more years of life than a Black woman. Among the Blacks the women lived no longer than the men. People speak of the greater longevity of women, but this is only because of modern medicine. High birth rates, high infant mortality, high maternal mortality—these are the hallmarks of the history of mankind.

Of course there are biological differences between male and female, but whether a woman is allowed to vote, or the rate that she must die in childbirth, these are a matter of medical knowledge and of custom. Biological difference only expresses itself through the social system.

Who may live longer in the future—Whites or Negroes? There's no way of telling. Who may live longer in the future—males or females? There is no way of

telling. These things are dependent on the progress in medical science and on the degree to which this progress is made available to all races and to both sexes.

When environment is important, the only way genetic difference may be determined is by equalizing the environment. If you believe in mankind, then you will want mankind to live on in an enriched environment. No one can tell what may be the ultimate length of life, but we do know that many people could live much longer if given a chance.

Whether we consider intelligence, or length of life, or happiness the genetic potential of a population is only realized in a social system. It is that system which gives life or death to its members, and in so doing changes the gene frequencies. We know of no society which has begun to realize the genetic potential of its members. We are the primitives living by antiquated customs in the midst of scientific progress. Races are products of the past. They are relics of times and conditions which have long creased to exist.

Racism is equally a relic supported by no phase of modern science. We may not know how to interpret the form of the Mongoloid face, or why Rh° is of high incidence in Africa, but we do know the benefits of education and of economic progress. We know the price of discrimination is death, frustration, and hatred. We know that the roots of happiness lie in the biology of the whole species and that the potential of the species can only be realized in a culture, in a social system. It is knowledge and the social system which give life or take it away, and in so doing change the gene frequencies and continue the million-year-old interaction of culture and biology. Human biology finds its realization in a culturally determined way of life, and the infinite variety of genetic combinations can only express themselves efficiently in a free and open society.

## REFERENCES

ANASTASI, ANNE
1958 Differential psychology: Individual and group differences in behavior. New York, The Macmillan Company.

BLUM, HAROLD F.
1961 Does the melanin pigment of human skin have adaptive value? The Quarterly Review of Biology 36:50–63.

COON, CARLETON S.
1962 The origin of races. New York, Alfred A. Knopf.

DOBZHANSKY, THEODOSIUS.
1962 Mankind evolving: The evolution of the human species. New Haven and London, Yale University Press.

DUBLIN, LOUIS I., ALFRED J. LOTKA, and MORTIMER SPIEGELMAN
1949 Length of life: A study of the life table. (Revised Edition.) New York, The Ronald Press Company.

KLINEBERG, OTTO
1935 Race differences. New York and London, Harper & Brothers.

KRECH, DAVID, MARK R. ROSENZWEIG, and EDWARD L. BENNETT
1962 Relations between brain chemistry and problem-solving among rats raised in enriched and impoverished environments. Journal of Comparative and Physiological Psychology: 55:801–807.