The CASHINAHUA and the Study of Evolution

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Cooperative research by physical and cultural anthropologists among small, isolated populations such as the Peruvian Cashinahua, who are still largely untouched by western civilization, can be valuable in analyzing the ways in which human groups have in the past and are still evolving. The conditions under which the Cashinahua live today, i.e., small village units with limited outside contacts and an intimate relationship with their natural environment, are those which have characterized those of evolving man throughout most of the course of his evolutionary history. By examining the forces which cause evolutionary change in the Cashinahua, as well as other such peoples, by relating the forces to each other, and by comparing the dynamics of the Cashinahua to those of other groups, we will begin to get a picture of just how mankind has and is developing in terms of the responsible mechanisms.

Since the modern theory of evolution holds that this process occurs through the modification of the genetic structure of populations, we must focus our attention on the genetic structure itself. This involves a number of dimensions and parameters, all relevant to the total picture. First of all, it consists of recording the genes present; that is, we must first characterize the Cashinahua in terms of the genes they possess for certain characteristics, or when they display a number of forms of a single gene for a particular trait, our characterization becomes a recording of the relative frequency of these forms: such a variable system is called a polymorphism. At present, our knowledge of human genetics is such that we can only speak of genes for traits which can be determined from the blood of individuals. For this reason, we have taken blood samples from approximately 250 Cashinahua and have carefully analyzed them.

The next step in the analysis is to record those factors which will cause the relative frequencies of the genes to change to new proportions from one generation to the next. The most graphic illustration of this is, of course, Darwin's principle of natural selection, in which certain genes become more frequent, relatively, in the next generation because the traits they control are selected for, or the other forms of the traits

Pae took second place to her sister in their husband's affection until she gave birth to the son she is holding.

Pensive and shy, this little miss will become a noisy terror as soon as the camera and the foreigner behind it are out of sight.

Mario, whose letter appeared in an earlier issue of Expedition, *with his wives and children. Mario's wives are sisters. His oldest daughter (second from right) married several months after this picture was taken and has since given birth to a child which died within two weeks.*

Brothers Cashinahua style: the boy in the middle is the son by a previous wife of the husband of the mothers of the other boys, each by a previous marriage. They share neither biological fathers nor mothers but are "brothers" because the father of one is the husband of the mothers of the others.

An energetic, hard-working husband for one's daughter is the goal of every father, not because he wants security for his offspring but to assure himself of proper care in his old age. Sisidia nabbed her husband shortly after he migrated from Brazil.

are selected against. In a population such as the Cashinahua, it is clear that agents of disease, for example, will be powerful agents of selection. Individuals in a population who display any genetic resistance to a particular disease, principally an acute one, will have the genes responsible for the resistance selected for.

In all populations, additional kinds of factors will affect the proportions of genes from one generation to the next and thereby bring about evolutionary change. Many of these factors are part of the cultural patterns of the people and serve to emphasize the importance of human behavior in creating new channels of evolution. It is these factors which have occupied our attention to a large extent in our most recent analysis of the data on the Cashinahua and it is their action which we would like to discuss briefly here.

One of the most obvious agents of genetic change in the Cashinahua is migration. As we have reported earlier in *Expedition* there has been a rather steady migration of Cashinahua into Peru from their Brazilian homelands over the past ten years, adding to those individuals already living mainly in Peru for perhaps sixty or so years. The migrants come in extended family groups numbering about ten to fifteen people. They settle in one of the villages and become incorporated therein in a very short time. This periodic introduction of genes into the pool of the Peruvian Cashinahua alters the frequencies of what we observe. In theory this would not be the case. If those who left Brazil represented a 'random' sample of the Brazilian Cashinahua and if they settled, as individuals, randomly in Peru, then the frequencies of the genes would remain the same, with only slight fluctuations. However, the behavior of humans is probably never a random event and is certainly not so for Cashinahua migration. They leave Brazil as a family; since families contain individuals who are more closely related to each other than to the population as a whole, they represent constellations of genes, rather than a random sampling. Their eventual settlement in Peru is again patterned by cultural values. They settle as families in a particular village, hence introducing 'blocks' of genes into that village; since their genes are alike, as they are family members, they introduce blocks of identical genes into the village they select. This sudden influx of genes will alter the genetic structure of the village and can cause it to diverge from neighboring ones.

We have documented these changes over the past ten years for the Peruvian Cashinahua, by studying the genetic constitutions of individuals who migrated from Brazil in specific years. Not only does the gene frequency change in that village from year to year due to migration, but the villages often tend to diverge from each other. It is important to understand that this divergence will not necessarily be the same for all genetic systems. The genes which control a particular trait will usually operate quite independently of those which control another. Thus, the villages may diverge, due to migration, in the relative proportions of the genes which control the ABO blood groups, but may not diverge at all (or may diverge even more) in the frequencies of the genes responsible for the Rh groups. The point is that the changes are dictated solely by the constitutions of the migrations.

Cultural values become important here in determining where a particular migrating family settles. Just as in our own society, a Cashinahua family head's decision on which village to make his home is affected, if not controlled, by a number of complex social factors, involving kinship ties, local politics, marriage arrangements, and land. The primary consideration is kinship ties; a man wants to settle in the village where he has the closest kinsman, preferably a sibling or a first parallel cousin. Lacking these, he will look for a close kinsman of his spouse, a sibling of one of his parents, and only then will he consider residence with a more distant kinsman. If a man is politically ambitious, he will also take into consideration where and how he can best settle in order to establish close ties with the local headman, the head of a strong faction, or assume the leadership of a weak faction, all of which are predicated on ties of kinship or marriage. The availability of potential spouses for himself and his children, particularly if such marriages are politically advantageous, is frequently a factor. And finally, although not the least important consideration, is the availability of food and land for garden making.

Our first area of study, therefore, concerns the migration pattern in the Cashinahua, the effects upon the genetic structure and the conscious or unconscious decisions which control this entire process.

Another important set of cultural values affecting the differentiation and evolution of the Cashinahua is that which regulates marriage. Among the Cashinahua, marriage is regulated in a number of ways, each of which can have its effect upon the transmission of genes. For example, the Cashinahua are endogamous with respect to the village; that is, they value most highly marriages which take place between individuals of the same village. (We should mention

Frank Johnston with the old headman and his wife and their granddaughter.

here that they are totally endogamous with respect to the 'tribe' itself; marriage to a non-Cashinahua is unthinkable.) Our data indicate that 85% of Cashinahua marriages are endogamous, which is a remarkably high rate, compared to other peoples. From a genetic standpoint, village endogamy tends to reinforce the differentiation caused by migration, since it rather effectively restricts the flow of genes among the villages. Thus, wherever the pattern of migration described above results in inter-village differentiation, these differences tend to persist as the result of village endogamy. Our analysis of these mechanisms of change takes on a new dimension in that the various forces become interrelated and one cannot be considered apart from the others.

Cashinahua marriages are also regulated by other social factors. Although the frequency of such unions is not high, there is a clear preference for marriage with a first cross cousin, i.e., with the children of one's mother's brother or one's father's sister. All marriages, however, must be with persons who are members of a particular kin class which includes all of one's cross cousins, one's daughter's daughter and her parallel cousins, and one's paternal grandmother and her parallel cousins. There is a strong preference for sororal polygyny and the levirate, so that half siblings share one parent in common, while their other parents are siblings. Each of these factors tends to interrupt the randomness of gene exchange within the Cashinahua and can act as an agent resulting in further differentiation.

Cultural values operate in other areas of genetic importance as well. The Cashinahua practice infanticide as well as inducing abortions. Infants are killed for a number of reasons, primarily in the event of a congenital deformity. Not permitting children to live who display obvious deformities, regardless of our own views, nonetheless serves to eliminate harmful mutations. This is particularly important in a small group where such mutations can persist more easily and where this persistence is emphasized by the fact that everyone in the population is married by the onset of puberty.

What, then, is our model of genetic change in populations such as the Cashinahua, living in virtual isolation from other populations? From our observations it appears that cultural values act very effectively to channel genes, acting largely to create differences not only between larger 'tribal' groups, but also among the closely associated villages of a single group. Thus, even though the three villages studied, which largely comprise the Peruvian Cashinahua, lie within five miles of each other, and though they maintain a large number of social contacts and group activities, they display a remarkable degree of genetic differentiation. This, of course, is the picture for both tropical South America and Oceania, where isolated groups still remain. Differentiation of this sort confounds the taxonomically-oriented investigators who find it extremely difficult to characterize a large geographical area where there are so many exceptions. On the other hand, this sort of picture seems to be what existed in the Paleolithic, and even later, before man lived in towns and urban centers.

Culture may, therefore, be viewed as a potent evolutionary force in creating inter-population diversity. One of the long-term results may be to provide this diversity at the population level, maximizing the variability available to cope with environmental pressures and giving natural selection a wide range of choice. As we continue to study the Cashinahua, not only in Peru but also in Brazil, and as other investigators carry out similar studies in Venezuela and Bougainville, we will begin to finally reach an understanding of the ways in which populations can differentiate through time, and of the contributions of culture to the process.