VIII. SUMMARY AND CONCLUSIONS

Most populations in the world today reside in more or less man-made environments. Relatively few have remained in the natural ambiance in which they had developed for hundreds or even thousands of years, continuing to maintain direct ties with it. One of the latter, as we have shown, is the South Sinai Bedouin group which adopted the arid areas of the Middle East as its permanent residence, adapting to this extreme environment biologically, socially and behaviorally.

The first chapter introduced the study, especially the influence of the marriage patterns on the growth and development of the child in human isolates. The relevant published literature on the subject is also reviewed. The aims of the study are stated, namely, to elucidate the connections between historical, demographic and social variables on the one hand, and the biological structure of the human population on the other. Following was a study of growth and development, perforce by the cross-sectional method. Next, the characterizing features of the studied population are considered, namely, isolation, inbreeding, uniformity of the environment, uniformity of the population, small-size of population, transitory aspects and tribal organization. Penultimately, the sample is described, comprising 563 boys between the ages of 5-13 years and deriving from nine different tribes in South Sinai. Finally, the `tools' of the study are enumerated, including techniques of anthropometric measurements.

The second chapter reviews possible links between cultural variables (historic, ethnographic and demographic) and biological variables (organization of the genotypes into the various social frameworks).

In the historical area, we have provided the testimonies of numerous investigators and travellers, commencing in the 19th century (Burckhardt, 1822), as regards the origin of, and the ethnic ties between, the various tribes, thereby reconstructing possible biological relationships among the tribes. Our study revealed that the Bedouin tribes of South Sinai initially immigrated from various other regions, albeit having a historic depth of 800 to 1000 years in their present region. The origin of most of the tribes was found to be the Arabian peninsula. They comprise four major groups, represented by the Gebeliya (mixed origin: North Africa, Middle East, Europe); the Muzeina; the Aleigat-Hamada tribes; and the group comprising the Awlad Said, Gararsha and Sawalcha tribes. Conclusions were evaluated in light of genetic evidence gleaned from various studies aimed at establishing similarity or disparity between the tribes in gene frequencies of various biochemical systems.

In the ethnographic portion of the second chapter we defined the organizational levels of the social institutions, namely, tribal suprastructure, tribal affiliation, tribe, sub-tribe, clan (khamula), extended family, and biological or nuclear family. The organizational-social structure of each of two tribes (Muzeina and Gebeliya) was discussed at length. These two tribes were frequently compared. In the biological context, we discussed all the "affiliated families" adopted by the various tribes and, with time, incorporated by them. We have shown that such families, albeit becoming part of the organizational framework of the tribe, were not always integrated into its biological framework, i.e. females from these families were not taken as brides by members of the tribe. Special emphasis was placed on the means of studying the Hams, the "blood feud" group. We have shown that the Hams, despite constituting only a judicial framework, serves as the best source for studying intratribal social dynamics and reconstructing marital patterns going back five generations. The information gathered from the study of some 55 "blood feud groups" (genealogical lines, comprising about 3000 individuals) revealed that the Sinai Bedouins comprise an endogamous society at the tribal level, 97% of marriages in the Muzeina tribe taking place within the tribe, with a certain preference for consanguineous marriages, 14.6% of the marriages being between first cousins.

In the demography portion of the second chapter we presented the main demographic characteristics of the South Sinai tribes. The average number of sub-tribes per tribe was found to be 4.2; the mean number of members per tribe was 1150 (range 183-3000); the number of nuclear families ranged from 56 in the smallest tribe to 880 in the largest. Cited are the revolutionary demographic changes that took place among the South Sinai Bedouins as a result of Israeli Defence Forces presence in the area from 1967 to 1982. The three main changes were first, the cessation of Bedouin movements westward to Egypt; second, a rise in rates of fecundity and a decrease in mortality and a consequent rise in average life expectancy, and thirdly, the foundation of families at a relatively early age (marrying age of males dropping from 26 to 20). Such "changes" inevitably led to a rapid numerical increase of the population (from 0.62% per year prior to 1967, to 2.2% at the time of the study). We have presented detailed demographic data on the composition and size of the social frameworks, discussing also the connection between size of the social framework and its genetic composition. We presented and analyzed the demographic characteristics of the entire Bedouin population in the Sinai, for example, age and sex distribution, fertility and mortality patterns, social regulation of fertility, etc. It was noted that curbing excessive growth of the Bedouin population would be dependent largely on external factors (e.g. birth control), since the socio-economic infrastructure after

1967 encouraged birth. We discussed the problem of a high male to female sex ratio among the Bedouins, showing that the most convincing explanation for the phenomenon is the so-called X-heterosis.

The main findings in the final, demographic part of the second chapter were:

1) the population tended to be young, as many as 44% being in the 0-14 years age group (G_{15}+G_{16}); 2) a high male to female sex ratio of 106.9 (G_{16}); 3) as much as 6.9 percent of families, beyond the reproductive period and without children (G_{15}); 4) a high proportion of remarried women (17%); 5) prevalence of second marriages; 6) a low marrying age both for females (17.5 years) and males (23.0 years) (G_{15}+G_{16}); 7) a high mean number of living children per family (5.0 by the time of menopause); 8) overall familial fecundity of 6.98 children; 9) on average, wives of polygamous males bear fewer children (4.03) than do those of monogamous males (5.0); 10) male mortality higher than female mortality by 6% in the child population; 11)a clear link between consanguinity of parents (first cousin marriages) and mean number of children per family; 12)a low number of polygamous families (12.1%).

In the third chapter we discussed the complex of factors which influence the genetic makeup of the Bedouin population. We relied here on the existing historical, ethnographic and demographic information compiled in the previous chapter. We considered the subject of `effective population size' and the factors which affect it directly, such as differential fertility, sex ratio, polygamy, temporary changes in population size and consanguineous marriages. In addition, we discussed the various ways of computing `effective size' (Ne). We found that in a population like the Muzeina tribe, with approximately 3000 members, "effective size" would be only 846 individuals, and not an expected 1000. We reasoned that such an Ne size (800-1000), although diminishing the genetic variability in the tribe (Fixation index = 0.000591), cannot be the pivotal mechanism which accelerates this process.

A considerable portion of the third chapter was devoted to elucidation of the inter- and intratribal migratory processes in the Muzeina. It was shown that almost all of the population mobility (up to 97%), measured by comparing husband and wife origins in 300 families, took place up to the tribal level. Of all marriages within the tribes, in the Ghesenat subtribe, as an example, about 77% were marriages where both husband and wife were of the same sub-tribe, and of the remaining couples, more than 20.5% of the wives were from sub-tribes which genealogically were close to the sub-tribe of the husband (i.e., sub-tribes which share a common ancestor). Consequently, we concluded that the tribe or sub-tribe should be regarded not only as a social-organizational framework, but also as an `independent biological group'.

Extensive study of the various mating types helped to illuminate certain aspects of `internal migration' within the tribes. We defined six mating types and computed their frequency in the various subtribes of the Muzeina. These were: Hams or cousin matings (3.8-14.6%), extended family matings (18-22.4%), clan matings (33.7-45.7%), sub-tribal matings (8.5-12.9%), tribal matings (11-15.0%), and tribal affiliation mating (2-4%). For each of these we computed, with the aid of the Hams records and the genealogical structure of the tribe, the genealogical depth common to both mates, namely, two generations for Hams matings; 6 for extended family matings; 8 for clan matings; 10 for sub-tribal matings; and 12 or more generations for tribal matings. All this information pertaining to frequency of the various marital patterns on the one hand, and the common genealogical depth of the mates in each marital pattern on the other hand, enabled us to compute the relative contribution of the endogamous component (Fxe=0.0038615) to the coefficient of inbreeding - F. Thus we possessed most of the components for computing the general inbreeding coefficient F for the most recent generation of the Bedouin population, using the series of equations developed by Wright (1931).

The components at hand were: effective population size (Ne) = 846; migration into the tribe (M) = ca. 3%;; marital patterns (Fxe) = 0.0038615. We found that the F value for the last generation (the 16th since the Muzeina tribe was involved) equals Fxi_{16}=0.0044502. This value did not seem to us to adequately represent the true biological status of the tribe, mainly because it did not take into account the contribution of preceding generations (FA) to the F. Ignoring a continuing process of inbreeding, taking place over hundreds of years within a small group, could crucially affect the value of F. Therefore, by a careful reconstruction of the demographic history of the Muzeina tribe, based on two different models of the dynamics of intertribal social processes, we evaluated the contribution of preceding generations (FA) to the F. The FA component, we discovered, produced a critical change in the magnitude of the inbreeding coefficient value (F) and thus completely altered our thinking on the genetic structure of the Bedouin society. The new F value obtained for the Muzeina tribe was 0.09802, a very high value that has rarely been recorded for any other human population.

Since we had data on the gene frequencies in the different tribes for various biochemical systems (blood group P, haptoglobin, sensitivity to phenylthiocarbamide, ABO blood groups), we could determine whether it was justified to assume a high inbreeding coefficient for the population. The obtained results were almost identical with the calculations based on socio-demographic data (F=0.09802). In addition we tried to elucidate which of the two factors, genetic drift or selection, lead to the observed intertribal differences in gene frequencies. We examined the relationship between the observed and expected variance of the inbreeding coefficients (F_{ST}) and found that the observed variance ($S^2_{obs.}$) was significantly lower than the expected variance ($S^2_{exp.}$). Hence the difference in gene frequencies was attributed to random processes, such as genetic drift, rather than to selection.

In the third chapter we also considered the connection between a high inbreeding coefficient and biological variables. A review of the literature revealed that even if there was no complete consensus regarding the extent of influence of inbreeding on morphometric traits, the existence of such an influence is hardly debatable. The chapter concluded with a detailed review of the factors which were likely linked to the biological structure of the Bedouin society (with respect to history, ethnography and demography).

The fourth chapter considered growth and development processes in the Bedouin children examined, boys aged 5-13 years.

We opted to determine chronological age by three different criteria, namely, chronological age as reported (information provided by the child himself in conjunction with important events that took place in the South Sinai region, and/or by the school teacher or the local sheikh); dental age; and skeletal age. We showed that the reported chronologic age tended to be somewhat higher than the "biological" age, i.e., age based on stage of bone development or tooth eruption. Yet, considering the fact that the correlation coefficients between the biological and chronological ages were high ($0.89>r>0.81$), we decided to compare growth and development in Bedouin children with those in non-Bedouin children by their chronological age.

The main conclusions arrived at from comparing development in Bedouin and European boys were the following: The Bedouin children developed faster in weight and height at the early ages than did the European children. Since no data were available for Bedouin boys under 5 years, this conclusion derived mainly from comparison of theoretical regression lines of the two groups. Starting from age 7, however, the gap between the two groups closed, and subsequently the European children were found to develop faster than the Bedouin. In bodily breadth traits, within each age group, none of the Bedouin boys attained the mean values of the European boys. At age 13 the Bedouin boys resembled children of other Middle East groups but were shorter than their European counterparts. In body weight the Bedouin boys manifested the lowest mean values of all the compared groups, excepting low-caste Indian children. The Bedouin boys had a relatively narrower head and short face compared with like diameters in European children. As for the body extremities, up to about age 9 the Bedouin boys had on the average longer limbs than European boys but at subsequent ages the situation reversed. Amount of subcutaneous adipose tissue was comparatively low in Bedouin boys, and so also was their energy expenditure needed to perform a defined task.

By use of measures linking body to shape, we were able to summarize the morphologic differences between Bedouin boys and those from European countries as follows: Bedouin boys had a narrower body build relative to their stature; longer limbs relative to stature; a lower weight per unit of surface area; and a negligible amount of subcutaneous fat.

After examining the morphological differences between Bedouin boys and children of some other ethnic groups in the fifth chapter, we compared the body size and shape of Bedouin children from the different tribes in South Sinai. We concentrated mainly on the morphological differences between children of the Muzeina and Gebeliya tribes. The statistical processing of the data was by the two-way analysis of variance, with geographical origin, age and interaction. Our results showed that the Gebeliya children had, on average, a narrower head and longer face than Muzeina children. The latter possessed a broader body structure, e.g. broader shoulders, broader hips and greater chest circumference, both in absolute terms as well as relative to stature. Both Muzeina and Gebeliya boys had the same mean stature, but the former weighed more on average and had more subcutaneous adipose tissue and a lower ratio of body surface area to body weight.

The significant morphologic differences between the Muzeina and Gebeliya boys found expression in body surface area, the ratio of body surface area to body weight and the ratio of body surface area to stature, all invariably having lower values in the Muzeina group.

Concerned that the observed differences between the tribes might be due to the small samples in each age group, we combined all the age groups into a single sample for each tribe by converting the measurements into standard scores and constructing new distributions (a legitimate procedure considering that the MANOVA result did not show significant Age x Tribe interactionn effect). We then performed a one-way analysis of variance (ANOVA) since one factor, age, was now canceled out. To this analysis we added another, the statistical Scheffe method which enabled assessment of how the morphologic distances between individuals from the two tribes, Muzeina and Gebeliya, were affected by inclusion in the sample of individuals from other tribes. The obtained results were almost identical with those obtained by MANOVA on the small "age-tribal" samples. Yet, before ascertaining conclusively the reality of morphologic differences between the Bedouin children at the tribal level, we felt the need to rule out the possibility that the observed morphology in each tribe was actually a combined one, i.e., where each sub-tribe contributed to the overall morphology of the tribe although each had its unique morphological identity and differed largely from the other sub-tribes. Such a possibility seems likely if we take into consideration the fact that 77% of marriages are between members of the same sub-tribe. The genetic implications of such a possibility are discussed at some length.

We examined the morphological differences between boys of the sub-tribes in the Muzeina and the Gebeliya tribes. In the Muzeina tribe, all the sub-tribes have a common ancestor. Hence, what can lead to group differentiation here would be the fact that most of the brides (75%) originated from this framework; hence there was endogamy at the sub-tribal level. In the Gebeliya tribe, ancillary to the high percentage of marriages at the sub-tribal level, was the fact that one of the sub-tribes, the Awlad Gindi, was probably Egyptian in origin. The morphology of boys in the Gebeliya sub-tribes (Awlad Gindi vs. the Wehebat, Hamaida and Awlad Salim) was compared by a one-way analysis of variance based on standardized scores. The results showed that one-third of the traits studied manifested significant differences between the boys of the Awlad Gindi sub-tribe and the boys of the three other sub-tribes. We found the Awlad Gindi children taller in all body height measures; with a broader head and longer face; a broader girth; weighing more; and having longer limbs than the children of the other three sub-tribes, as well as manifesting greater body surface area and caloric expenditure per defined task.

In the Muzeina tribe three different groups were recognized, namely, Group 1 (Shadadine and Smehat subtribes, with Alwan as ancestor); Group 2 (Gsenat and Dararme subtribes, with Farag-Ali as ancestor); and Group 3 (Gawanme subtribe, with Faraj-G'hanen as ancestor). The obtained results indicated less marked morphologic differences than those between children of the sub-tribes of the Gebeliya. The discriminant traits which significantly differentiated between children of the Muzeina sub-tribes numbered only five or six, such as between Groups 1 and 2 in foot breadth and length, upper leg length; between Groups 2 and 3 in foot breadth, head length, chest circumference, trunk length, cephalic index, and chest circumference/ stature; between Groups 1 and 3 in sitting height, upper leg length, hand length, and chest circumference/stature. We concluded that the evidence showed little morphologic difference among the Muzeina sub-tribes. However, we did note a certain consistency in the direction of the differences, and therefore reasoned that the few significant results found in the Muzeina sub-tribes might be a forerunner, as it were, of future greater morphologic differentiation. And indeed when the morphology of children from each sub-tribe was examined separately, and not in groups of sub-tribes, the differences between the children became more pronounced and even correlated, surprisingly, with what we knew about the genealogical ties between the sub-tribes (see Chapter II), to wit: the morphological differences between children from subtribes, classified as genealogically remote from one another, are greater then between children from close subtribes.

It would seem, therefore, that morphologic differentiation between the children followed, to a considerable extent, socio-biological differentiations. Hence an important lesson was learned, that even in tribes regarded as a homogeneous group, i.e, having a common ancestor, there may arise, as a consequence of social processes, e.g. selective marriages, social frameworks such as sub-tribes which differ biologically from one another.

Once the morphologic differences between the tribes were established, we sought the reasons for such, as presented in the sixth chapter. We proceeded in four "directions" (altitude, nutrition, tribal origin, and marital patterns) as possible explanations.

1) Altitude. There is a marked disparity in altitude between the peripheral regions and the central region in the topography of South Sinai. At least two regions can be defined whose microclimates and vegetation differ considerably. One of these regions is that of the mountains, reaching an altitude of 1200-1400 meters, while the other is the coastal region or sea level. We chose the Muzeina tribe as our study model because it is the only tribe that has members scattered both in the mountain region as well as along the coast. To evaluate the effect of the topographic "altitude" variable (the first independent variable) on the "morphologic structure" variable (the dependent variable), while controlling the "origin-subtribe" variable (the second independent variable), we processed several runs of two-way analysis of variance. In each run we changed the components of the "origin" variable by running different sub-tribes. There was no significant influence of the altitude variable on the differential morphology in the Muzeina tribe.

2) Nutrition. Owing to the variegated nature of the South Sinai region, the economics in the different regions might have constituted a factor in the observed morphologic differences. Our extensive nutrition survey concentrated on four geographic regions, each of which presented a different economic picture. Thus the coastal region people subsisted largely on seafood as their major component in the diet; people in the the large water-rich oasis relied on

agriculture and orchards; the dune region depended on herding; and finally, the inhabited areas of the bare mountain region which offered no particular economic advantage. Our results showed that, barring the coastal region where, on the average, 30% of the children subsist once a day on seafood (summer only), the composition and content of the diet is rather uniform for the children of the various tribes in the different geographic regions in South Sinai. Therefore territorial localization of a tribe does not appear to afford any special economic advantage in terms of nutrition to its children.

The ancillary findings of our nutrition survey were also summarized in this chapter as follows: the available food is poor in variety; there were sharp fluctuations in the variety and quantity of the food from season to season; and the daily caloric supply was extremely low (computed as 1667 calories per day, with 70% derived from carbohydrates).

3) Tribal origin. A review of the history of the South Sinai tribes indicated that the origin of most of the tribes could be traced to the Arabian peninsula. However, oral historical accounts connect the Gebeliya tribe with geographic regions other than the peninsula (Egypt, Europe?). We assumed that if tribal origin played a role in defining intertribal morphologic differences, the differences between children of the Muzeina tribe and those of the Gebeliya tribe should be revealed by their relationship with other nearby Mediterranean groups. Hence, by means of cluster analyses, we estimated the morphological associations among boys of 7 groups, namely, the Muzeina and Gebeliya South Sinai Bedouin tribes; Kenous, Arab Nubian and Feddji from Egypt; and two Jewish Israeli groups, one with parents born in the Middle East, and the other with parents born in North Africa. We found that Gebeliya and Muzeina boys resembled each other morphologically more than they resembled any of the other boys. However, without exception, the morphological association of the Gebeliya boys with the Egyptian groups was greater than that manifested by the Muzeina boys, whereas the morphological resemblance of the Muzeina children to either of the Israeli groups was greater than that manifested by the Gebeliya children. These results partially confirm the accounts regarding an Egyptian element in the Gebeliya tribe, and repudiate the possibility of a European origin.

4) Marital patterns. Possibly marital patterns, that is, mode and extent of inbreeding among the tribes, could account for their morphological differences. In the introductory section we pointed out that the disagreement among investigators as to the influence of inbreeding on morphological and other variables is not on the actual existence of such an influence but rather on its

extent. We therefore assumed, knowing the social structure of the tribes, described in Chapter 2, that we could find evidence of inbreeding as a depressant influence in the growth and development of Bedouin children. As a first step, we discussed the possible decline in heterozygosity among the Bedouins with inbreeding, and the possible effects with time on the phenotype of the group due to intermarriage. In addition, our theoretical knowledge was broadened with respect to the association between the distribution of genotypes and quantitative (usually metric) traits. Our basic premise was that in a trait which distributes normally, the heterozygous individuals would concentrate around the average value, whereas the homozygous individuals would tend to occur at the extremes. We assumed that if in large populations with random matings most of the morphometric traits distribute normally or close thereto, then among the Bedouins (wherein the Ne, or effective size, is small and matings are not random), we should obtain for the studied morphometric traits deviations from the norm owing to changes in frequencies of the genotypes.

Since the measures were converted to standard scores, we could not employ the customary statistics for evaluating distributions, but had to rely on other measures, such as deviation from symmetry or skewness, and relative flatness of the curve or kurtosis. The criteria for obtaining significance for these two statistics were derived from tables especially constructed for small samples. The obtained results showed a relatively low frequency of traits that distribute with significant skewness and kurtosis. Thus, the Gebeliya showed two traits (upper leg length; hand strength left) with significant negative kurtosis and three with statistically significant negative skewness (bigonial breadth, biacromial breadth, biacromial breadth/stature) , whereas the Muzeina showed five traits with significant positive kurtosis (bigonial breadth, lower arm length, sitting height/stature, acromial height, upper body segment), one with negative kurtosis (chest circumference) and four with significant skewness (three positive; acromial height, bigonial breadth, cephalic index and one negative; upper body segment). In addition, we selected eight traits by Principal Component Analysis and reconstructed the observed frequency distributions at intervals of ±0.5 S.D. from the mean. We then compared them with the expected frequencies in normal distributions. Three major types of distributions were obtained, namely, 1)close to the normal distribution; 2)narrower and more high-peaked than the norm; and 3)bimodal. We concluded that the shape of the curve reflects primarily the action of two antagonistic forces: first, inbreeding, which leads to reduction in the number of heterozygotes in an endogamous population; and second, stabilizing selection, which acts against individuals at the edges of the distribution and leads to a rise in the number of heterozygotes. Through the inbreeding coefficient F (see Chapter 3), we calculated the expected drop in the heterozygote frequency as a result of inbreeding and compared it with that observed in the normal distribution where 38.3% of cases fall within ±0.5 standard deviations from the mean.

We assumed that in traits affected by inbreeding, there would be a decrease in the percentage of individuals concentrating around the mean, which would be proportional to the F. We showed that the inbreeding coefficient for the South Sinai Bedouins (F=0.09802) was expected to diminish on the 38.3% level (X±0.5 S.D.) by about 4% the frequency of heterozygotes in the population. Such a result was in line with the drop in the number of heterozygotes on the bimodal distributions, which reflected the influence of inbreeding. On statistical analysis we found that the drop in percentage of heterozygotes, as evident from the bimodal curves, was significant. The rise in the frequency of the heterozygotes, calculated from the narrow and tall curves to be 5% on the average, and attributed by us to the mechanism known as "stabilizing selection", was also found to be significant. It was concluded that in such traits where the forces of inbreeding and stabilizing selection met, they would cancel out each other's effects.

Finally, in the seventh chapter we attempted to ascertain tribal morphologic identity and the traits whereby this might be defined by means of discriminant analysis, by which we compared individual morphology with the mean morphology of the tribes. We computed the probability of successfully classifying children into their tribal group. In the first stage of our computation, we used a limited sample which included only the children of the Muzeina and Gebeliya tribes.

Our results showed that more than 78% of the children could be successfully related to their tribal group based on their morphology. When we enlarged the sample to encompass children from four Bedouin tribes, the success of classification diminished to 50.8%.

In summing up (eighth chapter) the subject of intertribal and intratribal morphologic differences, we defined main components, those single variables whereby one could define in the best way the Bedouin tribal morphology. Use of principle component analysis (PCA) revealed that by employing ten factors, we could explain 80% or more of the overall morphologic variance. Principal Component Analysis was based on standard scores of 41 morphological traits.

We also attempted to detect intertribal differences by the components of the morphologic variance (size and shape), defining a general characteristic common to each group of variables which represented a component of the variance as obtained from the PCA results. Our results showed that the morphological traits in which the tribes differed significantly are not necessarily concentrated in specific components.

Lastly, we assessed possible correlation between the historic-social evidence for the origin of and interrelations between the South Sinai Bedouin tribes, and the existing evidence on morphologic similarities and dissimilarities among them. It may be recalled that in earlier chapters we demonstrated fairly good correlations between the tribes with respect to various biochemical systems.

We attempted to "close the circle" between the first and last chapters by attempting to ascertain how the Bedouin tribes related from the standpoint of origin. For this purpose we resorted to cluster analysis, so as to join or dissociate the groups by the measurement of similarity or variance between the mean values for the traits. We found, both for the sub-tribes within the tribal framework, as well as for the tribes within the Towara, a greater morphologic similarity between tribes of similar origin.

As indicated, some of our conclusions are firmly founded; others, however, require further consideration and research.

Anthropological research is of critical importance for understanding past and present biological processes. And indeed we should remember that a human population displays close interrelations between its cultural history and its biological evolution. In the first chapter we stressed the fact that human populations still suitable for an anthropologic study such as ours were becoming scarce. The present study, which has dealt with the interactions between culture and biology within the Bedouin population has merely opened a small window on a limited subject, but constitutes, we hope, a gateway to a larger complex of universal biological problems which lend significance to the development of man as a sapient animal.