

(1961) believes that patients with chronic increase of plasma- γ -globulin are unusually sensitive to immune or allergic reactions. He describes a patient with hyperglobulinæmic purpura who developed "acute renal shutdown" after therapy with phenylbutazone and penicillin, and a further attack of renal decompensation after further therapy with phenylbutazone.

Waldenström (1961) is of the opinion that hyperglobulinæmic purpura is an "autoimmune" condition. This view is supported by our case where the purpura seemed to be dependent upon an abnormal globulin produced by a thymic tumour. Weiss et al. (1963) record that 2 patients with hyperglobulinæmic purpura were successfully treated with the cytotoxic drug, thioguanine. As in our patient, the plasma- γ -globulin was not reduced, despite a comparable clinical remission. Treatment with the cytotoxic drug was complicated by leucopenia and thrombocytopenia, whereas in our patient both the white blood-cell count and platelet count increased after thymectomy. Other varieties of "autoimmune" disease have been reported to respond both to thymectomy and to cytotoxic drugs. Schwartz and Dameshek (1962) report favourably on the use of cytotoxic agents in acquired hæmolytic anæmia. Richmond et al. (1963) report remission in a patient with severe acquired hæmolytic anæmia after treatment with azathioprene ('Imuran') and actinomycin, and Wilmers and Russell (1963) after thymectomy. Both forms of treatment have been tried in disseminated lupus erythematosus with some benefit (Dameshek and Schwartz 1960, Mackay and de Gail 1963). An important unanswered question is whether hyperglobulinæmic purpura would respond to thymectomy if no tumour were present. Thymectomy was undertaken for myasthenia gravis and primary erythroid hypoplasia at first because of their association with a thymic tumour. These diseases, however, are more serious than hyperglobulinæmic purpura, and it is questionable whether a trial of thymectomy for this disease is justifiable ethically, except in exceptional circumstances. Anterior mediastinography (Hare and Mackay 1963) to delineate the size of the gland would obviously be useful in deciding whether the thymus was implicated in the ætiology of the disease. In our patient the decision was never in doubt, since she had a large thymic tumour which had to be excised, even if there had been no associated signs and symptoms.

Summary

A benign thymic tumour, hyperglobulinæmic purpura, Sjögren's syndrome, Raynaud's phenomenon, hepatosplenomegaly, and low leucocyte and platelet counts were associated in a woman of 56. Thymectomy resulted in remission of the purpura and an improvement in the hæmatological abnormalities, but did not affect other aspects of the disease. The case suggests that hyperglobulinæmic purpura—a severe variant of Henoch-Schönlein purpura—is an "autoimmune" disease.

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INFLUENCE OF MIGRATION ON BLOOD-PRESSURE OF EASTER ISLANDERS

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ESSENTIAL hypertension has been attributed to the interaction of genetic and environmental factors (Pickering 1955). The epidemiology of blood-pressure can be studied by the analysis of two variables: the height or level of blood-pressure, and the rate of the rise of pressure with age. The rise of blood-pressure with increasing age in westernised populations has been thought to account for the high prevalence of essential hypertension (Pickering 1962). On the other hand, many surveys indicate that, in primitive populations, blood-pressure does not rise with age, and that hypertension is absent (Lowenstein 1961, Maddocks 1961). We have shown that in a rural Chilean community there is an age-dependent gradient ranging from 0.037 mm. per year in the poorest natives to 0.492 mm. per year in the richest foreigners (Cruz-Coke and Covarrubias 1962). The rise of blood-pressure in a population has therefore been attributed to a process of "acculturation" or "westernisation" (Maddocks 1961). Nevertheless, no confirmatory blood-pressure survey in a primitive population living in two different environments seems yet to have been reported.

To confirm the hypothesis that civilisation influences the relation of age to blood-pressure, we chose an isolated Polynesian population living in its own ecological niche and a group from among them who had been transplanted to the mainland.

Material and Methods

Easter Island, the highest peak of the East Pacific Rise (Menard 1960), consists of a national park, a national monument, and a sheep farm administered by the Chilean Navy. The ancestors of many of the native population of 1079 inhabitants were Europeans, Chileans, and Polynesians. Public-health conditions are satisfactory, and the population increases every year at the rate of 47 per thousand. The expectation of life at birth for both sexes is 51.4 years, a relatively high figure for a primitive population (Cruz-Coke 1963). Table I shows the age-distribution of the native population, and the proportion

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TABLE I—DISTRIBUTION OF EASTER ISLANDERS BY AGE, SEX AND MIGRATION ENROLMENT IN DECEMBER, 1962 (GOVERNOR'S REGISTER)

Total population (including emigrants)				Emigrants living on mainland during 1962
Age	Males	Females	Total	
0-9	191	219	410 (34.7%)	7 (1.7%)
10-19	125	163	288 (24.5%)	13 (4.5%)
20-29	98	90	188 (16.0%)	43 (22.7%)
30-39	60	71	131 (11.2%)	17 (12.9%)
40-49	43	45	88 (7.5%)	12 (13.6%)
50-59	19	23	42 (3.5%)	5 (11.9%)
60-69	7	16	23 (1.9%)	3 (13.0%)
70-79	7	2	9 (0.7%)	..
Total	550	629	1179 (100%)	100 (8.4%)

of the inhabitants who were living on the mainland in 1962. Each year some natives emigrate from the island and others return from the mainland; consequently there are two kinds of migratory natives: the "islanders" who remain in their ecological niche; and the "continentals", who migrate to continental Chile. The "islanders" live peacefully in social, political, and economic conditions absolutely dependent upon the continental garrison. The "continentals", on the other hand, reach the mainland to begin a struggle for life in widely different conditions.

In 1963, in the course of a medical survey of the native population of the island by a joint expedition from the University of Chile and the National Health Service, one observer took casual blood-pressure readings on a random

haptoglobins according to the method of Nagel and Etcheverry (1963).

Results

Table II shows a similar distribution of tribal ancestry in the two groups. Table III shows that the gene frequencies for the polymorphic alleles were also similar in both groups, and that the genotype distributions were in equilibrium according to the Hardy-Weinberg Law. Defective colour vision was present in 2 out of 65 islander males, but in none of the 30 continental males. This difference is not significant (χ^2 0.25, $P > 0.10$). We found only 5 "continentals" (10%) who could not taste P.T.C. and 7 (5%) "islanders" who could not. This difference, also, is

TABLE IV—REGRESSION-ANALYSIS OF DIASTOLIC BLOOD-PRESSURE (Y) AND AGE (X)

	"Islanders"	"Continentals"
No. of subjects	129	50
Mean age (yr. (X))	32.8	34.4
S.D.	17.08	14.44
Mean diastolic blood-pressure (mm. Hg) (yY)	84.2	86.8
S.D.	9.42	12.15
Regression coefficient	+0.09	+0.34
Test for linearity of regression	1.41 ($P > 0.05$ for 4 and 123 d.f.)	0.242 ($P > 0.05$ for 4 and 44 d.f.)
Test of independence of Y on X	1.87 ($P > 0.05$)	3.08 ($P < 0.001$)

TABLE II—DISTRIBUTION OF TRIBAL ANCESTRY OF TWO SUB-POPULATIONS OF EASTER ISLANDERS

Pre-existing tribe	No. among "islanders"	No. among "continentals"
Miru	17 (13.1%)	7 (15.3%)
Marama	29 (22.6%)	8 (17.3%)
Tupahotu	32 (24.3%)	15 (32.8%)
Ngaure	30 (23.3%)	9 (19.5%)
Raa	7 (5.4%)	5 (10.8%)
Ngatimo	2 (1.5%)	..
Non-tribal ancestry	12 (9.3%)	2 (4.3%)
Total	129 (100%)	46 (100%)

sample of subjects from the age of ten upwards, using conventional epidemiological techniques (Cruz-Coke and Covarrubias 1962).

The sample was classed according to the migration enrolment of 129 "islanders" and 50 "continentals". In each of them the following marker genes were determined: (1) alleles I_A , I_B , I_O , L_M , L_N , $cde(r)$, K , k , and Di^a according to the ABO, MN, Rh, Kell, and Diego blood-grouping; (2) alleles Hp_1 and Hp_2 for serum-haptoglobins, according to the method of Smithies (1955); (3) alleles T and t for phenylthiocarbamide (P.T.C.) taste-sensitivity (Harris and Kalmus 1951); and (4) alleles C and c for colour-blindness (Ishihara 1954, Hardy et al. 1957). A regression analysis of diastolic blood-pressure and age was performed in each group (Dixon and Massey 1957). Gene frequencies of blood-groups were determined according to the method of Race and Sanger (1962), and

not significant (χ^2 1.20, $P > 0.05$). Consequently all the marker genes used were similar in both sub-populations.

Table IV shows the regression-analysis of blood-pressure and age. The regression coefficients are different. The continental blood-pressure variable (Y) is highly significantly dependent on the age-variable (X). On the contrary, the islander Y-variable is independent of the X-variable. Fig. 1 shows two regression lines which are plotted significantly on a straight line. As the two sub-populations have the same mean diastolic blood-pressure and the same mean age, both lines are crossed exactly at middle age. Fig. 2

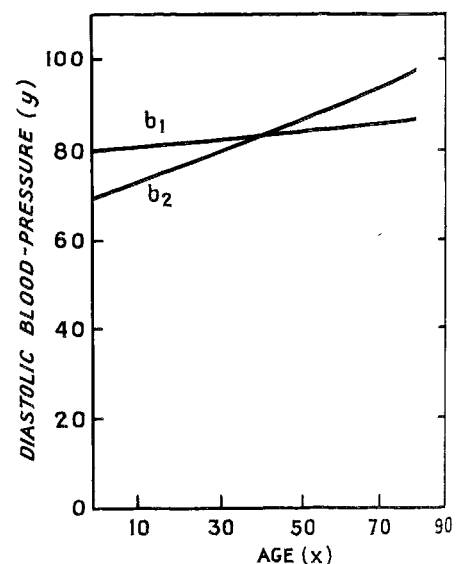


Fig. 1—Regression lines of diastolic blood-pressure (y) on age (x): b_1 (0.09 mm. per year) "islanders"; b_2 (0.34 mm. per year) "continentals".

shows that the continental group has a greater variance than the islander group in agreement with the strong age-dependence shown in fig. 1, and reaches hypertensive levels.

Discussion

The original tribal population of Easter Island was probably isogenic for most known polymorphic genes, with a typical blood-group pattern of the Polynesian race (Boyd 1963). In a sub-sample of 37 persons of "pure" ancestry, we found that phenotypes B, Rh (-), Kell (-), tt (non-tasters), and colour-blind males, which are rela-

TABLE III—GENE-FREQUENCIES FOR ALLELES OF THE ABO, MN, Rh, Kk, Di, AND Hp LOCUS IN TWO SUB-POPULATIONS OF EASTER ISLANDERS

Allele	"Islanders"			"Continentals"			P
	No.	Gene-frequency	χ^2	No.	Gene-frequency	χ^2	
I_A	118	0.46 + 0.047	0.42	46	0.45 + 0.074	0.03	> 0.10
I_B	118	0.02 + 0.010		46	0.02 + 0.017		> 0.10
I_O	118	0.51 + 0.047	0.94	46	0.52 + 0.056	0.05	> 0.10
L_M	113	0.42 + 0.031		44	0.52 + 0.056		> 0.05
$cde(r)$	113	0	2.41	44	0	3.80	> 0.10
K	113	0		44	0		> 0.10
Di^a	113	0	2.41	44	0	3.80	> 0.10
Hp_1	113	0.82 + 0.028		45	0.82 + 0.04		> 0.10

χ^2 = Hardy-Weinberg equilibrium for genotype distribution.
P = Level of significance of differences.

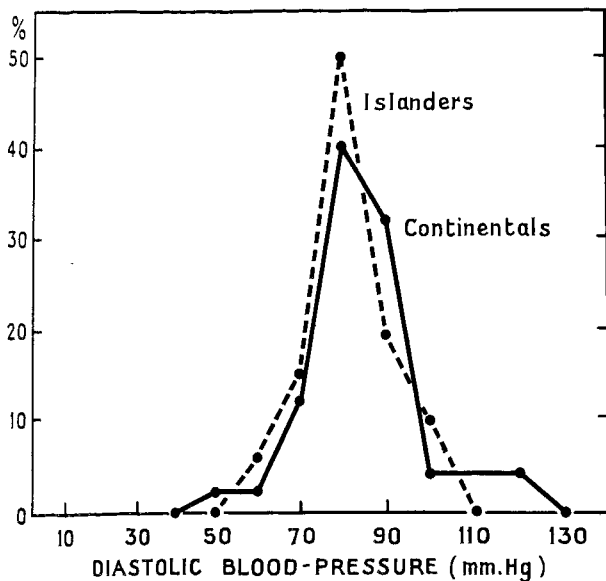


Fig. 2—Frequency distribution of diastolic blood-pressure: Continuous line, "continentals"; interrupted line, "islanders".

tively common in a Caucasian population, were completely absent. Our sample (table III) displays a low gene-frequency for I_B , H_p2 , and absence of cde , K , and D_i^a genes. The number of non-tasters (tt) and colour-blind males was small. Consequently the present population of Easter Islanders is mainly an admixture of Polynesian with Caucasians. This hybrid sample, divided according to an environmental variable (migration), shows in both groups a similar frequency-distribution of all the marker genes which we used. Moreover, the geographic distribution of our sample was random and members of all pre-existing tribes were represented in both groups (table II). These considerations suggest that the continental natives were not impelled to migrate to the mainland by the socio-economic circumstances of their foreign ancestors.

Massive migration is relatively recent, and the "continentals" have lived on an average for only three to five years on the mainland. Nevertheless, the rate and the speed of "westernisation" has been notable. It is difficult to convey briefly the great physical and sociological differences of environment which a native finds on reaching the mainland. He emigrates from isolated and peaceful surroundings to the stormy environment of a low-income group in a rising Latin American country. Notwithstanding that these continental natives are the first generation in a period of transition between primitive isolation and an urban civilisation, the regression-coefficient of blood-pressure and age differs significantly from that of the islander population. Apparently the new environment has significantly changed the age-dependence of blood-pressure, the genetic factors being completely excluded. This process increases the phenotypic variance and the tail of the gaussian curve of frequency-distribution reaches hypertensive levels. The continental sub-population displays a higher variance (147.7 mm. Hg) than the "islanders" (88.8 mm. Hg), in keeping with an "acculturated" population; hence there were hypertensive subjects (diastolic pressure over 105 mm. Hg). By contrast, hypertension is absent in the islander sub-population. This difference, despite the few subjects, is significant (χ^2 , 10.5, $P < 0.01$).

These results confirm our previous findings that, regardless of age, the increase in the variance of blood-pressure in a population is directly influenced by the duration and intensity of the environment (Cruz-Coke 1960). Hence a genotype uninfluenced by a stressful

environment shows no rise of blood-pressure with age. Dalh (1963) has suggested that when blood-pressure does not increase with age a genetic susceptibility is present, but that the appropriate environmental factors are lacking. The absence of essential hypertension in our peaceful "islanders" seems to confirm this interpretation. For instance, the mean diastolic blood-pressure of Easter Islanders is relatively high for the age (85 mm. at 35 years of age), and is comparable to similar figures in American Negroes (Comstock 1957). The Negro population of Georgia has a high frequency of hypertension, because its racial level of blood-pressure is significantly higher than that of white people in the same environment. Undoubtedly, Easter Islanders are predisposed to hypertension in the same way as the Negroes, but high blood-pressure appears only in relation to environment. Hence, hypertension is conditioned by two variables: a racial susceptibility determined by a relatively high "normal" level in a given population; and profound environmental changes operating on the genotype.

Summary

The rate of the rise of diastolic blood-pressure with age increases significantly in the inhabitants of Easter Island when they migrate to the South American continent. Consequently, essential hypertension (which is absent in those who remained on the island) is common among them.

The increase of the variance of blood-pressure is produced by the increase of the regression-coefficient of blood-pressure and age, and is directly influenced by migration, regardless of age.

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"... In time the principles of population control may be communicated to the primitive man within us and produce a lessening of the basic urge to procreate—but not yet! Furthermore, the complexities and anxieties of sophisticated communities, with their emphasis on satisfying relationships, or the miseries and frustrations of the underprivileged, place just those strains on the individual which call for the comfort, reassurance or distraction of physical union. Pressures from state and religion intended to stimulate or control that primary urge, have filtered down to the individual in unending variation and contradiction, begetting conflicts and determining actions, many of which, their origin obscured, pass into common and unquestioned usage. The greater the conflict, the less certain does the propriety of family planning appear."—ELIZABETH DRAPER, *The Times*, Feb. 26, 1964.