ANTHROPOLOGIE VI/2 1968

HETEROSIS EFFECT AS A CAUSATIVE FACTOR IN THE SECULAR TREND OF SOME CONTINUOUS TRAITS IN MAN[1)]

NAPOLEON WOLAŃSKI, EMILIA JAROSZ, MIRA PYŻUK

Among the factors influencing the development of certain quantitative characters in man during the postnatal period, those of in-breeding and cross in-breeding are the least known. As in the interpretation of the phenomenon called "secular trend" resides one of the causes given as cross in- breeding, and especially the effect of "vigorous growth of traits in half-breeds" called heterosis, we have performed this research task.

MATERIAL AND METHODS

The characters given beneath were measured according to the methods of Martin-Saller (Wolański, 1968). The observations were made in the morning hours of October and November 1966, in Szczecin, Poland. In his way we obtained data from about 850 boys and 950 girls aged 4, 8, 16 years (with an accuracy of ±1 1/2 months), all permanent inhabitants of Szczecin, and so from their approximately 2 900 fathers and mothers (in some cases, the parents of children of different age were the same, and that is why the number of parents is not exactly twice as much as the number of examined children).

We have chosen Szczecin as our research field because, already before, we had observed here quite a great growth of various indicators of the development of both children and juveniles (Miesowicz, 1964), and, also, because in this town during World War II there occurred a change in the population by 97 per cent. The people arriving the territory of Szczecin in 1945 and later, came from the territory of the whole of Poland within its frontiers of 1938. Therefore Szczecin, as a city with a newly forming population, was unusually well-suited for this kind of research.

RESULTS

The results obtained are presented in Tables 1 and 2, where a relationship between the distances of the birthplaces of father and mother can be noticed. We proceeded from the principle emphasized already several times in the relevant literature that the mean measure of the degree of relationship and, in every case, of the competency into two mutually differing gene pools in a population can be the distance between the birthplaces of father and mother. The division into cohorts (groups with firm limits of distance between the birthplaces of father and mother) was carried out

TABLE 1

The mean height of stature and size of Quetelet's index as well as the chest circumference measured at the level of the xiphoideale in 4, 8, 16-year-old children from Szczecin in dependence on the distance of the birthplaces of father and mother

Distance of birthplaces of father and mother in km	4 years		8 years		16 years	
	boys	girls	boys	girls	boys	girls
Body height in cm						
0—10	103,8	102,2	128,7	126,7	170,6	160,4
11—50	104,2	104,8	125,8	126,0	173,1	161,0
51—100	104,6	103,3	127,5	122,6	173,5	161,2
101—300	103,9	103,6	127,5	126,2	173,2	161,1
301—x	104,3	103,7	128,6	126,6	171,1	161,5
Quetelet's index						
0—10	165,29	162,39	201,09	194,99	347,39	332,39
11—50	164,49	164,49	198,19	198,19	354,49	345,99
51—100	166,19	158,39	202,39	185,69	371,19	342,09
101—300	166,09	163,09	203,59	200,39	351,79	346,49
301—x	169,09	163,29	205,49	197,58	361,49	343,59
Chest circumference (as against xi) in cm						
0—10	54,03	52,70	62,36	58,99	82,66	75,08
11—50	53,69	53,12	60,71	59,12	84,61	75,78
51—100	54,39	52,27	60,87	56,60	86,32	75,25
101—300	54,28	52,89	61,16	59 24	83,46	75,17
301—x	54,41	53,24	61,46	59,29	84,17	75,55

[1)] Supported by research grant No 467, 710 by U.S. Public Health Service, N. I. H., National Institute of Child Health and Human Development, Bethesda, Maryland, U.S.A.

on the basis of a demographic analysis of the degrees of contacts among people in the various regions of Poland.

The distance of 0 to 10 km corresponds to frequent contacts between the inhabitants of a village or a town who know one another. The distance of 11 to 50 km corresponds already to somewhat rarer contacts of inhabitants of one group, or of a larger town. The distance of 51 to 100 km refers to still rarer or even exceptional contacts within a district of a cultural region. The group of over 100 km already seems to be quite exceptional as regards frequency of mutual contacts, and that is why we divided it into two cohorts following the reason that in the territory of Szczecin up to a distance of about 300 km we found 60 per cent of marriages (i.e. 40 per cent of the two people were born within a distance exceeding 300 km from each other).

Thus the first cohort includes parents born within distances of 101 to 300 km, while the other one within a distance exceeding 300 km from each other. In the so formed cohorts we collected the mean data of the examined characters in children, separately for boys and girls, as well as for each age group. Thus we obtained 6 data, five cohorts to each of them. The data obtained express that, in relation to stature height and chest circumference (measured at the level of the xiphoideale), a strong association is observed in the type that simulaneously with increasing distance between the birthplaces of father and mother, both the stature height and the chest circumference of their children increases (Table 1).

A similar relation, even though somewhat more weakly expressed, was treated by means of Quetelet's index, informing us about the growing robusticity of the body of children along with increasing distance of the birthplaces of their father and mother (Table 1).

It is interesting to note that this rule is not to be observed as regards the circumference of the head (across the metopion and opisthocranion) or the cephalic index (eu—eu:g—op × 100) — (Table 2).

The check for correctness given in Table 3 confirms the hitherto drawn conclusions.

TABLE 2

The mean circumference of the head and the length = cephalic index of the head in 4,8, 16-year-old children from Szczecin in dependence on the distance of the birthplaces of father and mother

Distances of birthplaces of father and mother in km	4 years		8 years		16 years	
	boys	girls	boys	girls	boys	girls
Circumference of the head in cm						
0—10	51,08	50,32	53,10	52,06	56,77	55,41
11—50	51,83	50,29	53,26	52,06	56,97	55,61
51—100	51,26	49,95	53,18	51,94	56,66	55,47
101—300	51,50	50,55	53,11	52,17	56,37	54,78
301—x	51,62	50,56	53,17	52,33	56,99	55,26
Length — breadth index of the head						
0—10	86,49	87,32	86,33	85,83	86,23	85,51
11—50	86,68	87,27	87,32	84,45	84,43	85,56
51—100	86,99	87,32	85,52	85,43	83,70	84,61
101—300	86,67	86,43	86,84	86,13	84,41	85,05
301—x	88,88	85,40	86,61	86,26	84,70	85,00

TABLE 3

A test indicating the relationship between the linear increase of the absolute values in the children examined and the increase of the distance between the birthplaces of father and mother (values before the colon) or between the non-linear one (values after the colon).
The values on the right side of the Table indicate the numbers of relations showing a predominancy of the linear data over non-linear (high relationship), or showing a lack of predominance (low relationship).

Sign	4 years		8 years		16 years		Kind of the relationship		
	♂	♀	♂	♀	♂	♀	high	lack	opposite
Body height	3 : 1	3 : 1	3 : 1	2 : 2	2 : 2	3 : 1	4	2	0
Quetelet's index	2 : 2	3 : 1	3 : 1	2 : 2	3 : 1	2 : 2	3	3	0
Chest circumference	2 : 2	3 : 1	3 : 1	3 : 1	3 : 1	2 : 2	4	2	0
Head circumference	3 : 1	2 : 2	2 : 2	2 : 2	2 : 2	2 : 2	1	5	0
Lengt-breadth index of the head	3 : 1	1 : 3	2 : 2	3 : 1	2 : 2	2 : 2	2	3	1
High relationship	3	3	3	2	2	1			
Low relationship	2	2	2	3	3	4			

DISCUSSION

In the past few years (1960 to 1966) we observed a steady increase in the mean stature height of the children in Szczecin. Likewise over the years 1950 to 1962 (during which the children we studied were born) the number of marriages concluded in Szczecin climbed from 40 to 76 per cent, and at the same time an increase in the continuous biological integration of the number of people could be registered. We observed in this region a remarkable increase of marriages pertaining to cohorts with higher distances between the birthplaces of father and mother (e.g., from 24 to 37 per cent in the cohort of 101 to 300 km), while the percentage of marriages concluded in the cohorts comprising a small distance between the birthplaces of father and mother is diminishing (e.g., from about 15 to 7 per cent in the cohort covering an area of 0 to 10 km).

The connection of these processes with the observed phenomenon of heterosis shows that heterosis may be one of the mechanisms that are responsible for increasing the stature height within the region of research.

Thus apart from:

a) change in the frequency of genes (genetic flow), and
b) phenotype adaptation to altered ecological factors, we may consider as a third factor and mechanism
c) the effect of heterosis.

Further investigations are given over to the fixation of the genetic or physiological mechanism, or both together, as phenomena of heterosis.

REFERENCES

MIESOWICZ, I.: Porównanie rozwoju fizycznego dzieci i młodziezy z trzech róznych srodowisk miejskich, *Prace i Materiały Naukowe IMD, tom 2, str. 125—137, 1964.*

WOLAŃSKI, N.: „Tendencja przemian" u Homo sapiens, jej elementy i przyczyny, *Kosmos A, nr 4, str. 381—401, 1967.*

N. Wolański, Ph. D, Asoc. Prof.

Department of Developmental Morphophysiology, National Research Institute of Mother and Child, Warszawa, Poland