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Twin Studies in Sport and Physical Performance

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In his recent book* Dr. Roy J. Schepherd states that:

" Further information of genetic effects is likely to be derived from comparisons of identical (monozygotic) and fraternal (dizygotic) twins. Gedda (1961) has already shown that identical twins are more likely to have a similar interest in sports than are fraternal twins. It would be interesting to carry out comparisons of maximum oxygen intake and other objective measurements of endurance fitness on the two classes of twins, but this crucial experiment has yet to be completed ".

We are very glad to be able to announce here that Dr. Schepherd's wish is being fulfilled within the scope of a wider research project undertaken jointly by the Gregor Mendel Institute for Medical Genetics and Twin Research and the Italian Olympic Committee's Institute of Sports Medicine under the auspices of the Italian Sports Medicine Federation.

The studies we have undertaken aim to assess the respective roles of genetic and environmental factors as related to selection and training in sports and physical education.

The twin method affords, through a comparison of MZ and DZ within-pair concordances, an assessment of the degree of genetic conditioning in any individual trait.

It is quite obvious that the possible influence of training on any given trait is inversely proportional to the degree of genetic conditioning of the same trait.

If a given trait, required for a certain type of activity, is completely or almost completely conditioned by the genotype, we should seek those who have inherited it from their parents without wasting time and effort in useless training sessions.

As we can see, the scientific information we are seeking has great practical importance in the selection and training of athletes in every single field of sports and physical education.

The initial phase of our research project intends to assess the degree of genetic conditioning in many individual traits, while in the second phase the differential effect of training will be studied by submitting one twin per pair to general and specialized training programs.

Out of the Mendel Institute's Twin Register we selected 48 pairs of male twins; 12 MZ and 12 DZ aged 9 to 11 years, and 12 MZ and 12 DZ aged 15 to 17 years. Zygosity has been verified by means of blood groups, dermatoglyphics, equivocity tests and the comparison of five stable anthropological traits.

* Endurance Fitness. University of Toronto Press, 1969.

For each subject we recorded 10 anthropometric traits; the main static and dynamic ventilation parameters; the main cardiocirculatory parameters at rest and following exertion; dynamometric data for the flexors of the fingers, the flexors of the forearm on the arm, the adductors of the arm on the trunk, the extensors of the back, and the extensors of the legs.

Metabolic data (O_2 consumption, CO_2 emission, peripheral oximetry) were also recorded, along with the pulse rate, at rest and during exercise on the cycloergometer, with increasing loads to maximal O_2 consumption.

The results of all our tests are currently being analyzed. An informative sample on which we can already report today is represented by the analysis of the data concerning vital capacity as well as the dynamometry of either hand and of the extensors of the back. These results, shown in Tab. I, already lend themselves to some interesting considerations.

Tab. I. Mean values of within-pair differences and index of heredity (according to Holzinger) for four functional parameters in a sample of twins who do not practice sports

Parameter	Age (years)	Zygosity	X*		Ĥ**
Vital capacity	10	MZ	4.02	4.16	0.4741
	16	MZ	4.59		
	10	DZ	4.68	7.91	
	16	DZ	11.26		
Right hand dynamometry	10	MZ	11.12	9.12	0.3184
	16	MZ	7.45		
	10	DZ	12.79	13.38	
	16	DZ	14.02		
Left hand dynamometry	10	MZ	9.37	9.70	0.5037
	16	MZ	10.00		
	10		19.28	17.53	
	16	DZ	15.60		
		DZ			
Dynamometry of the extensors of the back	10	MZ	6.30	6.40	0.4949
	16	MZ	6.51		
	10	DZ	13.88	12.67	
	16	DZ	11.57		

* $X = \dfrac{A - B}{(A + B)\ 0.5}\ 100$, where A = MZ total value, and B = DZ total value.

** $\hat{H} = \dfrac{X_{DZ} - X_{MZ}}{X_{DZ}}$

It must be pointed out, in the first place, that our subjects had previously practiced no sport, and therefore the existing differences have not been heightened by a different response to systematic physical exercise.

For all four parameters the values of within-pair concordance are higher in MZ than DZ twins. Within-pair differences increase with age, especially in the DZ sample. The values of Holzinger's index of heredity (ĥ) vary between 0.3184 and 0.5037, indicating that these parameters can be widely modified by environmental factors such as training.

The experimental values may be variously interpreted for each parameter, providing the basis for further discussion, but we expect to do this on a further occasion, in conjunction with the presentation of more complete data.

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