(Childs, 1955). Whether this genetic inheritance is sufficient to provoke any inherited situs inversus as a genetic factor, or might influence the fertilized ovum as an acquired factor acting through its early environment, is a matter for speculation only. In support of the acquired theory of situs inversus is the fact that two environmentally acquired conditions—namely, agammaglobulinaemia and toxoplasmosis—have already been described in association with situs inversus (Collins and Dudley, 1955; Van Creveld *et al.*, 1948).

Since many cases of mucoviscidosis can have the latent type of disease and may pass unrecognized in the community except by the sweat-composition defect, it is possible that association between situs inversus and mucoviscidosis is more common than one at first imagines, and it might be the case that the Kartagener syndrome is a form of situs inversus associated with fibrocystic disease. The abnormality in the lungs and recurrent infection of the sinuses formerly led to the spontaneous belief that the lesions were almost certainly congenital in type, for the good reason that they occurred in the presence of such a pronounced congenital defect as situs inversus. If our case is not an exceptional one, an alternative view is now put forward—that the bronchiectasis and sinus infection may be occasionally associated with mucoviscidosis, and that, if searched for, concomitant defect such as faulty exocrine secretion of the pancreas and sweat will be found. It is supportive evidence for this theory that the defects in sweat composition were found in another member of the patient's family. Cases have been described in the literature which are capable of interpretation according to our hypothesis; for instance, Bergstrom *et al.* (1950) record two cases of the Kartagener triad, with two additional cases of bronchiectasis among six siblings. It is fairly well known that bronchiectasis arising in several members of the same family should arouse the suspicion that they have inherited some of the features of mucoviscidosis, and that examination of the sweat composition will usually not only confirm this but reveal other members of the family affected as latent cases.

Summary

A case of situs inversus viscerum is described requiring appendicectomy for acute obstructive appendicitis.

This patient with situs inversus also had had repeated attacks of pulmonary infection related to bronchiectasis and sinusitis, the syndrome described by Kartagener in 1933.

The patient had anomalies attributable to mucoviscidosis or fibrocystic disease—namely, abnormalities in sweat-gland secretion and in the content of the fat and nitrogen in the stool. He was aged 20 years—unusual in patients suffering from known mucoviscidosis. The anomaly of the salt content of the sweat was found in a sibling.

We thank Professor C. F. W. Illingworth, in whose wards the patient was treated, for helpful criticism and advice.

REFERENCES

- Adams, R., and Churchill, E. D. (1937). *J. thorac. Surg.*, **7**, 206.
 Bergstrom, W. H., Cook, C. D., Scannell, J., and Berenberg, W. (1950). *Pediatrics*, **6**, 573.
 Blegen, H. M. (1949). *Ann. Surg.*, **129**, 244.
 Brown, F. R. (1942). *Brit. med. J.*, **1**, 543.
 Childs, B. (1956). In Report of 18th Ross Pediatric Research Conference, Iowa City, Iowa, September, 1955.
 Cholt, M. R. (1947). *Amer. J. Surg.*, **73**, 104.
 Cockayne, E. A. (1937). *Quart. J. Med.*, **7**, 479.
 Collins, H. D., and Dudley, H. R. (1955). *New Engl. J. Med.*, **252**, 255.
 Darling, R. C., di Sant' Agnese, P. A., Perera, G. A., and Andersen, D. H. (1953). *Amer. J. med. Sci.*, **225**, 67.
 di Sant' Agnese, P. A. (1956). *Amer. J. Med.*, **21**, 406.
 Hershman, M. (1952). *Brit. med. J.*, **1**, 1357.
 Johnson, J. R. (1949). *Arch. Surg. (Chicago)*, **58**, 149.
 Kartagener, M. (1933). *Beitr. Klin. Tuberk.*, **83**, 489.
 Lineback, P. E. (1920). *J. Amer. med. Ass.*, **75**, 1775.
 Neher, R., and Wettstein, A. (1955). *Acta endocr. (Kbh.)*, **18**, 386.
 Sherck, H. H. (1922). *Surg. Gynec. Obstet.*, **35**, 53.
 Shwachman, H., and Gahm, N. (1956). *New Engl. J. Med.*, **255**, 999.
 Van Creveld, S., Arons, P., and de Bruyne, J. I. (1948). *Ann. Paediat.*, **171**, 177.
 Wollaege, E. E., Comfort, M. W., and Osterberg, A. E. (1947). *Gastroenterology*, **9**, 272.
 Wood, G. O., Blalock, A. (1940). *Arch. Surg.*, **40**, 885.

PHYSIQUE AND HAZARDOUS OCCUPATIONS

A COMPARISON OF THE PHYSIQUE OF 160 ROYAL MARINES

BY

F. de S. DONNAN, M.B., B.S., D.I.H.
Late Surgeon Lieutenant, R.N.

The physique and choice of occupation of three groups of men serving in the Royal Marines have been studied. The initial object was to compare the physique of a particular branch known as swimmer-canoeists with that of branches not engaged in such severe training, but comparison of other trades also showed differences of interest.

1. *Swimmer-Canoeists* receive special training in canoeing in rivers and tidal waters, and underwater swimming for such purposes as underwater demolition and beach reconnaissance. Training is arduous and is unlikely to be survived by those who are not mentally and physically robust. Training is largely carried out at night. Underwater swimming in these conditions is a sufficiently trying experience in itself; it is the more so when it forms only one item amongst overland night marches, parachute drops, and heavy physical labour and exposure involved in canoeing. The group here presented represents the entire training staff of an establishment where swimmer-canoeists are trained; no trainees are included.

2. *General Duty Marines*.—This group consisted of a cruiser detachment of Royal Marines to whom I had access. As such they were engaged in the normal peacetime training of the Royal Marines, not so severe or exacting as that undertaken by group 1, but more arduous than that of many occupations. All were questioned about their intentions regarding volunteering in the future for more arduous training. Any having such intentions were excluded.

3. *Other Special Branches*.—A third group of men belonging to miscellaneous trades, not involving major hazard, were also studied. They comprised clerks, drivers, vehicle mechanics, and cooks. All those available to me at one given time were measured, with the exception of those relegated to their particular trade for medical reasons.

These three occupational groups might be expected to embrace gradually diminishing degrees of "somatotonia," the component of temperament described by Sheldon as correlating most closely with mesomorphy or muscularity. Somatotonia includes

such traits as liking for physical exercise, resistance to physical discomfort, and the ability to withstand physical danger and undertake hazardous activities. Thus, if the qualitative relationship between physique and temperament reported by Sheldon and Stevens (1942) is to be confirmed, it would be reasonable to expect to find a higher proportion of more muscular or mesomorphic builds among swimmer-canoeists than among other branches. This appeared to be the case.

Assessment of Physique

The method employed is that devised by Parnell (1957) and modified from his standard deviation method (Parnell, 1954).

The assessed physique is called the "phenotype" by Parnell to draw attention to the fact that it does differ importantly from Sheldon's somatotype (Sheldon and Tucker, 1940). Both are estimates of the fundamental and theoretical morphogenotype. The somatotype is a broad concept and represents the nearest approximation to it, and is based on all available evidence, including, if time permits, lifelong study. The phenotype does not claim such a fundamental nature, and is affected to some extent by the variations produced by exercise, nutrition, and disease in muscle girth and skinfold measurements, though measurements of bone are more stable.

The ages of men under study are relevant, as the muscularity "4" chart is applicable only to the age group 18-25, from which the measurements on which it is based are drawn. The ages of the groups studied are shown in Table I.

TABLE I

Group	No.	Mean	Range
1	41	24.5	21-34
2	62	21.5	18-28
3	57	22.2	18-32

Men whose ages were over 25 were questioned on their weight history, and any marked changes taken into account. This was also done where muscular hypertrophy had resulted from special exercise, such as weight-lifting. The possibility that the special training of group 1 might produce muscular hypertrophy is relevant, and is discussed later.

Results

The average measurements for the three groups are listed in Table II. The differences between the group averages are calculated and a test of significance is applied (Bradford Hill, 1955). The differences and their significance are shown in Table III.

To correct for height variation between the groups, the differences have been scaled down in the appropriate ratio and compared with the original standard error of the difference. This tends to diminish the significance of any difference. The corrected

TABLE II

	Group 1 Canoeists	Group 2 Cruiser Detachment	Group 3 Other Branches
Number	41	62	57
Age	24.5	21.5	22.2
Height (in.) .. .	70.26	69.1	69.5
Weight (lb.) .. .	165.6	155	152
Ponderal index ..	12.79	12.95	13.02
Biceps (in.) .. .	12.45	11.80	11.65
Calf (in.) .. .	14.25	13.80	13.65
Humerus (cm.) ..	7.24	6.93	7.02
Femur (cm.) .. .	9.78	9.65	9.6
Fat (mm.) .. .	29	30.5	30

TABLE III

Measurement	Difference	S.E. of Difference	C.R. *	Significant	Level of Significance
<i>Comparison of Groups 1 and 2</i>					
Height	1.16	0.4	2.9	Yes	1%
Ponderal index ..	0.2	0.08	2.5	"	2%
Biceps	0.65	0.16	4.1	"	0.1%
Calf	0.45	0.17	2.6	"	1%
Humerus	0.31	0.06	5.2	"	0.1%
Femur	0.13	0.12	1.08	No	
Fat	1.5	1.7	0.9	"	
<i>Comparison of Groups 1 and 3</i>					
Height	0.76	0.22	3.5	Yes	0.1%
Ponderal index ..	0.22	0.07	3.1	"	1%
Biceps	0.8	0.07	12.3	"	0.1%
Calf	0.6	0.04	15.0	"	0.1%
Humerus	0.22	0.06	3.7	"	0.1%
Femur	0.18	0.08	2.2	"	5%
Fat	1	1	1.0	No	

* C.R. = Critical ratio = $\frac{\text{Difference}}{\text{S.E. difference}}$

TABLE IV

Measurement	Difference	S.E. of Difference	C.R.	Significant	Level of Significance
<i>Comparison of Groups 1 and 2</i>					
Biceps	0.64	0.16	4.0	Yes	0.1%
Calf	0.44	0.17	2.6	"	1%
Humerus	0.31	0.06	5.1	"	0.1%
Femur	0.13	0.12	1.1	No	
<i>Comparison of Groups 1 and 3</i>					
Biceps	0.79	0.07	12.2	Yes	0.1%
Calf	0.59	0.04	14.8	"	0.1%
Humerus	0.22	0.06	3.6	"	0.1%
Femur	0.18	0.08	2.2	"	5%

figures are given in Table IV; their significance remains unchanged.

Swimmer-canoeists are found to be significantly taller and heavier than the men from the cruiser detachment and those in other branches. Their ponderal index—height (in inches) divided by cube root of weight (lb.)—is significantly lower. Their biceps, calf, and bone measurements are greater in all cases, and significantly so with only one exception—the difference in femur measurements of groups 1 and 2.

Phenotypes

The number and percentage proportions of each sample are given in Table V according to the six sectors

TABLE V

Sector	Numbers			Percentages		
	Central	Peripheral	Total	Central	Peripheral	Total
<i>Group 1</i>						
543-443	2	1	3	4.9	2.5	7.4
453-343	2	16	18	4.9	39	43.9
354-344	9	5	14	21.9	12.2	34.1
345-334	3	3	6	7.3	7.3	14.6
435-434	—	—	—	—	—	—
534-433	—	—	—	—	—	—
Total	16	25	41	39	61	100
<i>Group 2</i>						
543-443	2	6	8	3.2	9.7	12.9
453-343	13	14	27	20.9	22.5	43.5
354-344	6	1	7	9.7	1.6	11.3
345-334	3	8	11	4.8	12.9	17.7
435-434	2	3	5	3.2	4.8	8
534-433	1	3	4	1.6	4.8	6.4
Total	27	35	62	43.4	56.3	99.8
<i>Group 3</i>						
543-443	8	2	10	14	3.5	17.5
453-343	7	6	13	12.25	10.5	22.75
354-344	3	3	6	5.25	5.25	10.5
345-334	6	10	16	10.5	17.5	28
435-434	1	7	8	1.75	12.25	14
534-433	2	2	4	3.5	3.5	7
Total	27	30	57	47.25	52.5	99.75

of primary and secondary component dominance, with a further division into central and peripheral types. The percentage of mesomorphs in each group is shown in Table VI.

TABLE VI

Group 1: 78% " 2: 54.8% " 3: 33.5%	Test of Significance		Mesomorphs v. Rest Level of Significance
	Group	C.R.	
	1 v. 2	2.65	1%
	1 v. 3	4.95	0.1%
	2 v. 3	2.30	5%

Phenotype distributions are also plotted on the conventional two-dimensional somatochart (see Figs. 1-3). This conveys an excellent visual impression of the difference in distribution of the three groups, which may be summarized as follows:

(a) Swimmer-canoeists (Fig. 1) are confined to the areas in which mesomorphy is either dominant or strongly

FIG. 1

represented. Nowhere is it present in less than 4 strength.* Two main groupings appear. One of peripheral endomorphic mesomorphs, and a second of central ectomorphic mesomorphs.

(b) General duty marines appear (Fig. 2) to be rather more evenly distributed. Endomorphic mesomorphy remains predominant as in group 1, but ectomorphic mesomorphy is less strongly represented. Endomorphs and ectomorphs, which were absent in group 1, appear in this distribution.

(c) The men engaged in less hazardous trades show a still more scattered distribution, with mesomorphy less often dominant.

The main differences are that group 1 shows no individuals south of the 117-551 gradient, and no individual higher than 5 in ectomorphy or 4 in endomorphy, or lower than 4 in mesomorphy.*

Groups 2 and 3 show individuals up to 6 in ectomorphy and endomorphy and numerous 3s and occasional 2s in mesomorphy.

Individuals less than 4 in mesomorphy or more than 4 in endomorphy and 5 in ectomorphy are unlikely, it seems, to be suitable for swimmer-canoeist training.

*With one exception, a 334.

Conclusions

The graphical and statistical expression of results reveal significant differences in physique between the groups. Less significance may attach to the muscular measurements than the bone in view of the well-known capacity of skeletal muscles to undergo work hypertrophy, but it may be noted that, with the exception of the difference between intercondylar femur measurements in groups 1 and 2, the differences in bone measurements are of equal and in some cases of greater significance than the muscular measurements. As anticipated in terms of Sheldon's thesis, swimmer-canoeists show a higher percentage of mesomorphs than the other two groups.

As a method of selection of suitable trainees, physique estimation has some use in so far as negative conclusions may be drawn regarding their suitability. Thus

FIG. 2

FIG. 3

the demonstration that a candidate is a 452 does not add any useful information regarding his abilities. But if his physique is outside the demonstrated distribution of swimmer-canoeists, it seems unlikely that he will be suitable for training. Experienced instructors probably use this knowledge intuitively, but a prospective study of trainees with progress reports might, it is suggested, prove a useful next step.

Summary

A study has been made of the physique of 160 men serving in the Royal Marines. Those in the more hazardous branches are shown to have a more muscular physique. This is considered to be in keeping with Sheldon's thesis that a relation exists between muscularity and somatogenic traits of temperament.

I wish to acknowledge my thanks to the Medical Director-General of the Royal Navy for permission to publish the above paper and to Dr. R. W. Parnell for his help and criticisms during its preparation.

REFERENCES

- Hill, A. Bradford (1955). *Principles of Medical Statistics*, 6th ed. Lancet Ltd., London.
Parnell, R. W. (1954). *Amer. J. phys. Anthropol.*, **12**, 209.
— (1957). *Brit. med. J.*, **1**, 1485.
Sheldon, W. H., and Stevens, S. S. (1942). *The Varieties of Temperament*. Harper, New York.
— and Tucker, W. B. (1940). *The Varieties of Human Physique*. Harper, New York.

REMISSION IN DIABETES

BY

ARNOLD BLOOM, M.D., M.R.C.P.

Physician, Whittington Hospital, London

The tendency to develop diabetes appears to be inherited as a mendelian recessive trait (Joslin, Root, White, and Marble, 1952), but the time of onset and the severity of symptoms vary considerably. In some diabetics, and particularly in the young, there appears to be an absolute failure of insulin production. Plasma studies in these cases show an absence of circulating insulin (Bornstein and Lawrence, 1951), while post-mortem studies on the pancreas fail to demonstrate an insulin content (Wrenshall, Hartroft, and Best, 1954). In diabetics of this type tolbutamide is ineffective, and permanent insulin is necessary to sustain life.

On the other hand, in other diabetics, particularly in obese patients, the circulating insulin appears to be normal, and at post-mortem examination the pancreas can be shown to yield insulin. In such cases the inherited defect may be no more than a functional disability of the pancreas to deal with abnormal stress situations. In potential diabetics this stress is often provided by overeating, but can also be brought about by emotional disturbances, by trauma, by infection, or by pregnancy, for example. Mild diabetes will often remit to an apparently normal state when the stress situation has been removed, as is common experience in obese diabetics following a restricted diet or when an infection has been overcome.

However, some cases of diabetes are neither so severe as to need immediate insulin nor so mild as to respond to simple dietary restriction, and these patients to-day are commonly treated with tolbutamide or similar hypoglycaemic agents. Nevertheless, the decision to put these moderate cases on insulin or tolbutamide is

necessarily an arbitrary one, depending on the severity of the diet and the length of observation. As a rule, weight and symptomatology are the deciding factors. The more overweight the patient is compared with normal for his height and age, the more restricted will the diet be and the longer the period of observation before recourse to adjuvant therapy. On the other hand, where the patient is not overweight, where symptoms are troublesome, and particularly when there is intercurrent infection, the sooner will insulin or tolbutamide be prescribed. The decision to put diabetics on insulin or tolbutamide is not irrevocable. Some patients placed on insulin show a decreasing need for it, so that eventually control is by diet alone. In recent trials of oral hypoglycaemic agents (Crowley, Wolff, and Bloom, 1957) it was found that many newly diagnosed diabetics, not responding to diet alone but responsive when tolbutamide was added, remained normoglycaemic and free from urinary sugar after a six-weeks course of this hypoglycaemic agent. Since then all new diabetics not controlled by diet but responsive to tolbutamide have been given a six-weeks course of these tablets, and the tablets were reintroduced only if relapse of the diabetic state occurred.

The purpose of this communication is to define the proportion of new diabetics (1) who have been controlled by dietary restriction alone from the start, (2) in whom dietary restriction was augmented initially by temporary insulin or tolbutamide, and (3) who need permanent insulin or tolbutamide as well as diet. The dangers of unnecessary prolongation of insulin therapy are stressed.

The patients under survey were those referred to the diabetic unit at Whittington Hospital largely during the period of 1952 to 1957, and all have been under observation for at least six months. In all, 1,125 patients with diabetes were referred during this period, but those who were under treatment when first seen are not included, which leaves 550 newly diagnosed cases for review. There were 344 females and 206 males; 287 (52%) were aged 40 to 65, 82 (15%) were younger than 40, and 181 (33%) were older than 65 at onset. The diagnosis was confirmed by a glucose-tolerance curve in all except severe and acidotic cases where the diagnosis needed no confirmation. 100 g. of glucose was administered to the patient in a fasting state, and venous blood sugars were estimated by Hagedorn and Jensen's method in the fasting state, half an hour, one hour, and two and a half hours after ingestion of glucose.

Initial Treatment

Initial treatment varied according to the type of diabetes present (see Diagram).

1. *Diet Alone*.—Mild and overweight diabetics were instructed concerning a 1,200- or 1,500-calorie diet according to the degree of obesity, and were instructed as out-patients to test the urine for sugar, initially three times daily. Control was regarded as satisfactory when the urine became sugar-free and blood sugars were at a normal or near normal range. As a rule the diet was increased up to 2,000 calories when weight had been lost. Diet alone was also tried in more severe diabetics, usually in the ward, except where insulin was indicated as stated below.

2. *Diet and Tolbutamide*.—Where diet alone failed to relieve symptoms and to control glycosuria and