homosexuals were significantly lower than those of a control group. A group of heterosexual neurotics, however, showed a similar deviation from the control group. The androgyny score, however, did not differentiate the homosexuals from the controls any better than did the biacromial diameter, which is less in these patients. It was concluded that homosexuals have a body-build similar to that found in patients with other psychiatric disorders and that it could not be specifically related to their sexual abnormality.

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DISTRIBUTION OF ANDROGYN IN MENTAL PATIENTS

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The purpose of the present study is to investigate the physique of mental patients by using a measure of the relative maleness and femaleness of body build—the discriminant androgyny score (Tanner, 1951, 1955). Abnormalities in the psychosexual development of mental patients have been postulated and reported by many, and it is of interest to see if such abnormalities are reflected in the development of the corresponding physical endowment of these patients.

The androgyny score is a discriminant function from measurements of the bi-acromial and bi-iliac diameters of groups of normal men and women. The relative proportions of these two diameters have for many years been known to differ in males from those in females. The androgyny score enables the most effective differentiation to be made between the sexes using these measurements; the score is obtained as follows:

$$3 \times \text{bi-acromial} - 1 \times \text{bi-iliac diameter (cm.)}$$

Tanner found this score to have a normal distribution, with a mean and standard deviation of 90.1 and 4.7 for men and 78.9 and 4.6 for women. He found this score misclassified only 12% of the 409 men and women he examined.

The Investigation

Four groups of subjects of each sex were investigated. These were a control group, a group of schizophrenics, and a group with affective disorders; the last group was further divided into a group of patients suffering from a depressive illness and into a group suffering from various neurotic reactions. The male control group consisted of members of a large business organization. The female control group was obtained from an

FIG. 1.—Androgyny scores and bi-acromial diameters in female patients.

FIG. 2.—Androgyny scores and bi-acromial diameters in male patients.

antenatal clinic. None of the measurements used except weight are affected by pregnancy, and in each case the patient's earliest antenatal weight, recorded within the first months of pregnancy, was ascertained. The diagnostic criteria used followed those described by Mayer-Gross *et al.* (1954), with the exception that, for statistical purposes, depressive and neurotic patients were grouped together under the term "affective disorders."

The following measurements were made on each patient: weight, height, bi-acromial diameter, and

bi-iliac diameter. The last three measurements were all made by the same observer (A. J. C.), who used a Martin anthropometer. Patients were measured standing upright, shoulders relaxed.

Results

Tables I and II show the results and the statistical significance of the various measurements, and Figs. 1 and 2 show how the various groups are distributed with regard to the androgyny score and the bi-acromial diameter. A group of homosexuals in the males and a group suffering from toxæmia of pregnancy in the females are included as they have been compared with the same controls (Coppen, 1958, 1959). Except for the neurotic groups, there is little difference between the capacity of the androgyny score and that of the bi-acromial diameter to distinguish between various diagnostic groups. The androgyny score and the bi-acromial diameter are smaller in all the psychiatric groups (both sexes) than in the control groups. The female patients differ less from the controls than do the males, but the parallelism of the results in the two sexes is striking. Schizophrenics show a greater divergence from the controls than the affective (neurotic and depressive patients) group. The neurotics of both sexes differ from the controls, the schizophrenics, and the depressives because of their narrow bi-iliac diameter.

Discussion

The main difference between the groups is in the bi-acromial diameter, the bi-iliac differing only in the

neurotics. Since the bi-iliac diameter is not significantly narrower from the controls in the other diagnostic groups, it follows that the bi-acromial differences are unlikely to be solely due to a general factor of narrowness, though such a general factor could play a part in the neurotics. Similar findings have been reported by other workers—for example. Rees and Eysenck (1945).

It has been shown that certain factors, such as height, age, and social class, may affect the bi-acromial and bi-iliac measurements, and data published by the Board of Trade (1957) give an indication of the extent of this interrelationship. Height varies slightly with age and social class. The bi-acromial diameter does not vary with age, but is slightly larger in subjects of the professional class. If the differences between the controls and patients were due to social-class factors one would expect to see this reflected in differences in stature between the groups; whereas the height of the groups does not show significant differences. Indeed, Clements and Pickett (1954) have shown that differences in chest girth between social classes disappear when standardized for a constant stature.

There is some evidence that the androgyny score or its most important component, the bi-acromial diameter, may be connected with certain other sexual and psychosexual characteristics. Thus Ferriman *et al.* (1957) found a significantly wider bi-acromial diameter in women with hirsuties and oligomenorrhoea than in controls. Lindegård (1956) reported a significant correlation between androgyny and size of penis.

TABLE I.—Results in Control, Total Psychiatric, Schizophrenic, and Affective (Depressive and Neurotic) Groups. Comparison by "t" Test with Control Group

	Controls		Total Psychiatric Group				Schizophrenic Group				Affective Group (Depression and Neurosis)			
	Mean	S.D.	Mean	S.D.	t	P	Mean	S.D.	t	P	Mean	S.D.	t	P
Males:	N=53		N=93				N=40				N=53			
Androgyny ..	90.3	4.1	86.8	5.8	3.9	0.001	85.9	6.1	4.1	0.001	87.8	5.6	2.5	0.02
B.A.D. (cm.) ..	39.8	1.6	38.5	2.0	4.3	0.001	38.2	1.8	4.3	0.001	38.8	2.4	2.5	0.02
B.I.D. (cm.) ..	29.3	1.3	28.9	1.4	2.0	0.05	29.0	1.6	1.9	0.1-0.05	28.8	1.3	2.5	0.02
Weight (kg.) ..	71.9	7.6	68.3	10.3	2.1	0.05	68.5	11.4	1.9	0.1-0.05	68.3	9.6	2.13	0.05
Height (cm.) ..	172.6	6.1	172.0	7.6	0.4	N.S.	170.8	6.8	1.3	N.S.	172.9	8.1	0.21	N.S.
Age (yr.) ..	41.5	10.5	37.1	11.6	1.3	..	38.6	11.6	1.2	..	39.5	11.7	0.92	..
Females:	N=50		N=138				N=46				N=92			
Androgyny ..	78.9	3.3	77.1	4.5	2.6	0.01	76.4	4.5	3.2	0.01	77.5	4.5	1.9	0.1-0.05
B.A.D. (cm.) ..	35.9	1.2	35.3	1.4	2.7	0.01	35.2	1.6	2.4	0.02	35.3	1.3	2.7	0.01
B.I.D. (cm.) ..	28.9	1.6	28.5	1.5	1.5	N.S.	28.9	1.6	0	N.S.	28.2	1.5	2.5	0.02
Weight (kg.) ..	56.6	8.0	56.6	8.9	0	..	62.2	10.3	3.1	0.01	53.8	8.2	1.97	N.S.
Height (cm.) ..	160.0	4.8	159.7	6.4	0.2	..	159.2	7.0	0.6	N.S.	160.0	6.2	0	..
Age (yr.) ..	24.1	4.1	38.6	11.5	8.7	0.001	36.1	11.0	7.3	0.001	39.8	11.8	9.29	0.001

B.A.D. = Bi-acromial diameter. B.I.D. = Bi-iliac diameter.

TABLE II.—Affective Group Split into Depressive and Neurotic Groups. Comparison by "t" Test with Control Group

	Depression				Neurosis			
	Mean	S.D.	t	P	Mean	S.D.	t	P
Males:	N=31				N=22			
Androgyny ..	87.4	6.1	2.48	0.02	88.4	4.8	1.74	0.1-0.05
B.A.D. (cm.) ..	38.7	2.5	2.37	0.05	38.9	1.9	2.26	0.05
B.I.D. (cm.) ..	28.9	1.6	1.22	N.S.	28.3	0.9	3.17	0.01
Weight (kg.) ..	69.1	10.1	1.43	..	66.7	9.8	2.50	0.02
Height (cm.) ..	172.4	8.5	0.07	..	173.6	6.7	0.70	N.S.
Age (yr.) ..	42.6	11.9	0.44	..	35.1	11.8	2.37	0.05
Females:	N=63				N=29			
Androgyny ..	77.5	4.4	1.86	0.1-0.05	77.4	4.9	1.71	N.S.
B.A.D. (cm.) ..	35.4	0.4	1.67	0.1-0.05	35.1	1.2	2.93	0.01
B.I.D. (cm.) ..	28.6	1.6	1.00	N.S.	27.5	1.3	4.24	0.001
Weight (kg.) ..	54.2	7.5	1.71	0.1-0.05	52.9	9.8	1.90	0.1-0.05
Height (cm.) ..	159.8	6.0	1.06	N.S.	160.4	6.6	0.48	N.S.
Age (yr.) ..	43.9	12.7	12.40	0.001	31.0	9.8	4.37	0.001

B.A.D. = Bi-acromial diameter. B.I.D. = Bi-iliac diameter.

Raboch (1957) found that hypogonadal men, some with female sex chromatin, had a smaller bi-acromial diameter than normal controls. Coppen (1958) found a more masculine androgyny score in women with toxæmia of pregnancy. There is also some indication that the androgyny score or the bi-acromial diameter is related to psychosexual development. Raboch found in his group that libido was greatly reduced. Coppen found in his toxæmic group that not only was the female function of bearing children disturbed but that psychosexual difficulties were also often present in these women. Homosexuals have also been found to differ, with regard to androgyny and the bi-acromial diameter, from a control group (Coppen, 1959).

In order to offer a possible interpretation of our results a brief review of factors believed to play a part in sexual differentiation is necessary. Firstly, there is the genetic inheritance. Secondly, there is the differentiation of the internal and external organs of the sexual apparatus. Recent work (Jost, 1947, 1953; Segal and Nelson, 1957; Witschi *et al.*, 1957) has thrown a good deal of light on the subject. It takes place in two phases in mammals, at first *in utero* and later when development is completed at puberty. It is now known that in mammals the female type is the basic, neutral, non-hormonal type. In males masculinization takes place under the influence of foetal hormones. The absence of stimulation by the appropriate hormones at the exact time in the foetus leads to the female type of development. However, excessive androgenic stimulation at critical stages may lead to masculinization in the female. This state of affairs is the opposite of what is found in birds, where the "basic" type is male. The third aspect relates to the sensitivity of various parts of the body or receptors to differentiating hormones. This is greatest in the sexual and reproductive organs, but it appears that other parts of the body share this capacity to a greater or lesser extent. Vague (1956) has drawn attention to this factor.

Thus there are certain general somatic differences between the sexes, and two such body measurements—the bi-acromial and the bi-iliac diameter—have been found to offer a suitable index of such a general somatic sexual differentiation, though there are many others (see review by Tanner, 1955). This somatic difference between the sexes is present to some extent before puberty, but becomes very much more pronounced during and after puberty. The bi-acromial diameter shows the most marked sex difference; the bi-iliac diameter shows a moderate sex difference before puberty, but this difference decreases after this period.

Both male and female psychiatric patients have a narrower bi-acromial diameter, and it may be hypothesized that this is a result of a lack of development from the neutral type, which is basically female. This would account for the greatest abnormality appearing in male patients, for it is the male that travels furthest from the basic type, and thus abnormalities in this process of differentiation would show most in the male.

The point at which this abnormality appears is not known; it may be genetically determined or produced by environmental disturbances during the period of the child's growth. Ferriman *et al.* have shown the probability of a genetic inheritance in their group of women with hirsuties and an increased bi-acromial diameter.

However, the psychologically disturbed parent will possibly affect the child's development both genetically and by providing a psychologically disturbing environment for the child to grow up in. Animal experiments with gentling—that is, stroking and petting—are of interest in this connexion. For example, Weininger (1954) showed that gentled rats grew larger and survived prolonged stress better than non-gentled rats.

Thus there may be several theoretically possible interpretations of these data, and further investigations of body build and its association with mental illness before and during puberty, together with genetic studies, are needed to clarify the problem.

Summary

The androgyny score, a measure of the relative maleness and femaleness of body build, was applied to the study of the physique of mental patients (schizophrenia, depression, and neurosis). Patients of both sexes had a significantly lower (more feminine) androgyny score and a narrower bi-acromial diameter than their control groups.

We are grateful to Dr. H. J. Friend for arranging the examination of the controls at Unilever House.

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The annual report of the Director of the World Health Organization Regional Office for Europe has recently been issued. This Regional Office, situated at Copenhagen, serves all the countries of Europe, with the exception of Hungary, Byelorussian S.S.R., and Ukrainian S.S.R., who do not at the moment actively participate in the work of W.H.O. The region also provisionally includes Turkey and Morocco at the request of their respective governments. The report describes the various health activities made available to member states at their request with the aim of improving health conditions in Europe. Besides traditional activities, such as the control of communicable diseases, important work has been undertaken to solve health problems particular to our times: air pollution, water pollution, the growing need to utilize surface waters in addition to the already well-exploited underground water resources of Europe, investigations into cardiovascular diseases, cancer control, and epidemiological research into various chronic and degenerative diseases. (*W.H.O. Report of the Regional Director*, July, 1958–June, 1959).