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PHYSIQUE AND MENTAL BREAKDOWN IN YOUNG ADULTS

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A method is described of estimating body type by means of physical anthropometry in the form of a three-numeral index, similar to the somatotype index introduced by Sheldon (Sheldon, Stevens and Tucker, 1940). This index is related largely, though certainly not wholly, to genetic influence. In the second part of this report, disposition to breakdown in early adult life is shown by comparing the frequency of somatotypes among patients and among healthy controls.

Estimating Body Type by Physical Anthropometry

The method of estimating body type presented here is similar to that described previously (Parnell, 1954a, 1954b). The same measurements are taken, but interpretation has been simplified. The method is basically the same as that used for 11-year-old children (Parnell *et al.*, 1955), but a different style chart is used. This contains all the necessary information, so that no extra tables are required.

Although the aim has been to correspond as closely as possible with Sheldon's estimates of somatotype, the components are here termed Fat (F), Muscularity (M), and Linearity (L) in place of his usual endomorphy, mesomorphy, and ectomorphy. (Bone development is included in the estimate of muscularity.) In using F, M, L ratings, primary dominance is indicated by capital letters, secondary dominance by small letters—for example, Fm, Fl, Mf, Ml, Lm, Ll. F, M, L nomenclature is used to emphasize that the scores are physical measurements and to avoid the assumption that the scores describe exactly the same entities as those rated photoscopically by Sheldon. The emphasis, therefore, is in the first place on phenotype, that which can be measured at a given time, rather than on Sheldon's somatotype.¹

A copy of the new chart, which is called the "Muscularity 4" or M.4 chart, is shown in Fig. 1. The basic measurements are those of young men aged 16–24 years. The ratings in the first and third components of the index can be determined directly from the chart.

¹ There are important distinctions here. A morphogenotype is presumed to exist because of the persistence of individual structure through life, just as genotypes are presumed to exist because human beings give birth to human beings, not to other species. It is impossible, however, to deal directly with the genotype, which is an abstract concept; only the phenotype can be measured. Sheldon's somatotype is defined as the best estimate of morphogenotype possible on the available evidence of phenotype or successive phenotypes. The term "somatotype" was introduced to indicate the path an individual may be expected to follow through life in relation to other people, assuming normal conditions of nutrition, exercise, and health.

The Fat scale is a logarithmic one, to correct for skewness in the male distribution of the sum of the three skinfold measurements, and is based, as previously, on the measurements of Oxford University students. Their mean "total fat" measurement is given a rating of 3½ to correspond roughly with the mean in endomorphy among students of 3.2 (Sheldon *et al.*, 1940) and of average man of 3.34 (Sheldon, 1954). The third component, Linearity, is given directly from the ponderal index, height in inches divided by the cube root of weight in pounds. It corresponds closely to the median of the range for each component given in Sheldon's tables (1954).

Instead of height, bone, and muscle measurements each at half standard deviation intervals, as in the earlier Deviation Chart (Parnell, 1954b), the new M.4 chart gives height at 1½-inch (3.8-cm.) intervals, and for each height a column of right-sided bone and muscle measurements appropriate to a rating of 4 in "Muscularity." These are calculated from the Oxford University student's average measurements (in the Height 70 in.—1.75 m.—column) making the assumption that for a given rating in Muscularity, bone and muscle measurements are proportionate to height; for example, a man of 67 inches (1.67 m.) with 4 in Muscularity has bone and muscle measurements 67/70, those of a man of 70 inches (1.75 m.) and the same Muscularity.

To determine the individual's score in this component, his bone and muscle measurements are ringed (Fig. 1) and the mean of their positions is found in relation to his height column. A provisional estimate for Muscularity is allotted according to the number of columns the mean score lies to the right or left of the appropriate height, counting each column passed as half a unit more or less respectively than 4. (The spacing of the height columns at 1½ inches (3.8 cm.) was chosen to make this possible.) A correction has then to be made for fat, since it is impossible to exclude this from muscle-girth measurements, and subcutaneous fat inevitably contributes something, though only a small amount, to "bone" measurements, resulting in an overestimate of muscularity where more than average fat is present. In this case allowance must be made by subtracting from the provisional estimate. Similarly, where there is less than average fat, the correction takes the form of adding. The amounts to be subtracted or added are proportional to the difference between an actual fat rating and the mean total fat, and are shown in Fig. 1. Phenotype 53½3—see Fig. 1, is an example.

From the Universities of Oxford and Birmingham 2,063 men students were typed by this method, their distribution being shown in Fig. 2.²

Extremes in Muscularity

Anyone unfamiliar with the data might be excused for thinking that this distribution underestimates the muscularity of this population. Fig. 3, however, illustrates the distribution of candidates at a "Mr. Universe" physique competition. The median Mr. Universe has a phenotype, by this method, of 271, and even if the second component estimate is based on bone alone, to exclude the obvious muscle hypertrophy from weight-lifting and other progressive resistance exercises, his median type is 26½. There can be no doubt that extremes in the second component exist, though not in the university population reviewed.

Comparison with Deviation Chart Typing

Comparison of the Deviation Chart and Table Typing method, previously reported (Parnell, 1954b), with the M.4 method of typing the student population is provided in Table I. It may be seen that the differences between the results, using these two methods, are slight. The differences between Table Typing and photoscopic interpretation have also already been reported (Parnell, 1954b); the differences between the present method and photoscopic interpretation are rather larger, not particularly in the first and third components, but in the second component discrepancies exceeding half a unit occurred in about one-third. The second component, however, is the most difficult to assess photo-

² Occasional plotting difficulties were encountered and dealt with by ½ point reductions of secondary components while maintaining primary dominance—for example, phenotypes 633 and 336 were plotted as 62½ and 2½½ respectively.

TABLE I.—Differences Between M.4 Chart Ratings and Table Type Ratings on 2,063 Healthy Young Men Aged 17-24 Years. (Difference Equals M.4 Minus T.T.)

Difference:	Percentage Distribution								
	-2	-1½	-1	-½	0	+½	+1	+1½	+2
Component:									
I. F (endomorph)	0.0	0.1	1.5	20.9	57.0	18.2	2.1	0.2	0.0
II. M (mesomorph)	0.0	0.5	6.7	27.4	42.9	19.1	3.2	0.2	0.0
III. L (ectomorph)	0.0	0.2	1.9	10.4	41.9	38.1	7.5	0.1	0.0

Discrepancies exceeding a half were found in 3.9% of F ratings, 10.6% of M ratings, and 9.7% of L ratings.

scopically, and discrepancies exceeding half a unit occurred in 17% of mesomorphic estimates reported by expert photoscopic somatotypists (Tanner, 1954). Nor is there any guarantee that this amount of agreement among experts with similar training could be obtained by observers with less training; indeed, experience seems to show it not infrequently worse.

Principal Advantages

It is therefore for reasons of consistency and objectivity that the M.4 method is recommended. It is less subject than photoscopic typing to variable interpretation by different observers, or by one observer on different occasions—a variability permitted by the range of choice in Sheldon's ponderal index tables. Inter-observer error with the M.4 chart depends only on the accuracy with which the measurements are taken, and probably inter-observer error in measuring approaches the column interval on the chart only in the case of bone measurements: even here it should seldom exceed 1 mm. with trained observers.³

³ In fat subjects, outside curved callipers with rounded points are preferable to the straight-arm type, because they dip more closely to the bone.

ADULT DEVIATION CHART OF PHYSIQUE (Male Standards)			NAME.....		AGE..... 18		DATE		
			OCCUPATION.....		Married/Single.		Ch.: M.....F.....		
					REF. No.				
Fat : (Skinfold)			Age		Total 3 Skinfold Measurements				
(mms.) Over triceps ...	18		16-24	12 15 18 22 27 33 40 48	57	68	83	100 120	
Subscapular ...	22		25-34	15 18 22 27 33 42 50 59	70	84	101 120	142	
Suprailiac ...	17		35-44	17 21 25 30 37 46 55 66	78	95	116 138	162	
Total fat ...	57		45-54	18 22 27 32 40 49 59 71	84	102	124 147	172	
ENDOMORPHY Estimate ...				1 1½ 2 2½ 3 3½ 4 4½	5	5½ 6 6½ 7			
Height (ins.) ...	67.0		55.0 56.5 58.0 59.5 61.0 62.5 64.0 65.5	67.0	68.5 70.0 71.5 73.0 74.5 76.0 77.5 79.0 80.5				
Bone : Humerus ...	6.8		5.34 5.49 5.64 5.78 5.93 6.07 6.22 6.37 6.51	6.65	6.80 6.95 7.09 7.24 7.38 7.53 7.67 7.82				
(cms.) Femur ...	9.5		7.62 7.83 8.04 8.24 8.45 8.66 8.87 9.08 9.28	9.49	9.70 9.91 10.12 10.33 10.53 10.74 10.95 11.16				
Muscle : Biceps ...	31.6		24.4 25.0 25.7 26.3 27.0 27.7 28.3 29.0 29.7 30.3	31.0	31.6 32.2 33.0 33.6 34.3 35.0 35.6				
(cms.) Calf ...	36.3		28.5 29.3 30.1 30.8 31.6 32.4 33.2 33.9 34.7 35.5	36.3	37.1 37.8 38.6 39.4 40.2 41.0 41.8				
First estimate of mesomorphy ...			1 1½ 2 2½ 3 3½ 4 4½	5	5½ 6 6½ 7				
Correction for fat (T.F. mms.) ...			12 15 18 22 27 33 40 48	57	68 83 100 120 140				
Age : 16-24 ...			+½ +½ +½ +½ 0 -½ -½ -1	-1½	-2 -2½ -3 -4				
25-34 ...			(+½) (+½) +½ +½ 0 -½ -½ -1	-1½	-2 -2½ -3 -4				
35+ ...			(+½) (+½) +½ +½ 0 -½ -½ -1	-1½	-2 -2½ -3 -4				
MESOMORPHY (corrected estimate)			1 1½ 2 2½ 3 3½ 4 4½	5	5½ 6 6½ 7				
Weight Wt. lb. H.W.R.			Age						
Present			18	12.1 12.3 12.5 12.7 12.9 13.1 13.3 13.5 13.7 13.8 14.0 14.2 14.4					
H.K.W.			23	11.7 12.0 12.2 12.5 12.8 13.0 13.2 13.4 13.6 13.8 14.0 14.2 14.4					
Usual			28	11.5 11.8 12.1 12.4 12.6 12.8 13.0 13.3 13.5 13.7 13.9 14.2 14.4					
At 18 years			33	11.3 11.7 12.0 12.3 12.5 12.7 12.9 13.2 13.4 13.6 13.9 14.1 14.4					
At 23 years			38	11.2 11.5 11.8 12.1 12.4 12.6 12.8 13.1 13.3 13.6 13.9 14.1 14.4					
Recent change			43+	11.1 11.4 11.7 12.0 12.3 12.6 12.8 13.1 13.3 13.6 13.9 14.1 14.4					
ECTOMORPHY			1 1½ 2 2½ 3 3½ 4 4½	5	5½ 6 6½ 7				
Biacromial (cms.) ...	38.0	30.7 31.6 32.4 33.3 34.2 35.1	36.0 36.9 37.7	38.6	39.5 40.4 41.3 42.2 43.0 43.9 44.8				
Bi-iliac (cms.) ...	30.0	23.0 23.8 24.6 25.4 26.2 27.0	27.8	28.6 29.4 30.2 31.0 31.8 32.6 33.4					
Androgyny 3 × Biac-Bi-iliac	84.0	66.4 68.8 71.2 73.5 75.9	78.3 80.6 83.0 85.4 87.8	90.1	92.5 94.8 97.2 99.6 102.0 104.3				
Strength : R. Hand L. Hand Lumbar pull									

FIG. 1.—Adult deviation chart for physique—M.4 style. Phenotype 53½3 at age 18. Androgyny score (Tanner, 1951) 84.0 lies about halfway between mean values for men and those for women (in boxes).

The principal advantages of the M.4 chart over the Deviation Chart lie in speed and simplicity. Ringing measurements on the M.4 chart and estimating phenotype are now one operation, while, before, two tables had to be consulted and a calculation worked out for each individual.

It must be mentioned, however, that the increased objectivity is in some respects a drawback; clearly the M.4 chart

preliminary estimates of dominance when somatotyping with the help of Sheldon's tables. For this purpose, to discard the photograph altogether would be to rob oneself of a valuable permanent record and an additional source of instruction in such matters as dysplasia. The physical anthropometric estimates, however, undoubtedly sharpen the definition of typing, both by adding greater precision and by improving agreement between observers. In practice, one comes to rely greatly on this objective check to photoscopic impressions.

Weight Variation at a Given Age

Variation in the weight of Oxford students from one year to the next has been reported elsewhere (Parnell, 1954c). Among men, 83%, and among women, 91%, changed less than 10 lb. (4.5 kg.) in a year, roughly two-thirds gaining and one-third losing. Only 6% of students gained more than a stone (6.35 kg.); only about 1% lost more than this amount. Considerable variation occurs, therefore, though not very often in health. There is room on the Deviation Chart to enter differing weight or fat measurements recorded at one age or subsequent ages.

Extreme Weight Variation in Mental Illness

Extreme variation of phenotype estimates may be met in patients with anorexia nervosa who, when most emaciated, may have subcutaneous fat and ponderal index scores corresponding to phenotype 217. After insulin-coma treatment and recovery, these measurements may change so that they correspond with phenotype 524, and two months later settle close to 424, the only constant finding being a "dip" type of index with lowest rating in the middle component. Without knowledge of the history it would be impossible to grasp from the M.4 chart alone at the worst stage of illness that the somatotype probably lies within an orbit of $\pm \frac{1}{2}$ to 1 point from type 424. The photograph, however, may help directly, for it shows body width and length proportions, clearly indicating ectomorphy $4 \pm \frac{1}{2}$ to the trained eye. Obvious loss of weight, clinically or photoscopically, prevents undue importance being attached to the excessively high ponderal index found at the height of this illness.

Women's Phenotypes

Women may be measured in the same way, their measurements plotted on the M.4 chart, and a phenotype estimate derived. Such estimates have been plotted for 671 women students entering Oxford and Birmingham Universities between 1950 and 1954 (Fig. 4). Their distribution differs to some extent from the distribution of women's somatotypes

FIG. 2.—Phenotype distribution of 2,063 men students from the universities of Oxford and Birmingham.

FIG. 3.—Phenotype distribution of 24 competitors at the 1955 "Mr. Universe" physique contest.

works best with healthy persons; exact allowances for changes in weight and subcutaneous fat brought about by underfeeding or illness may be difficult to assess, whereas evidence of the true rating in, say, ectomorphy is normally detectable in the photograph. It is not claimed that the M.4 method by itself is as suitable for Sheldon somatotyping as photoscopy. It is, however, an accurate and consistent way of phenotyping, and there is considerable scope in socio-medical surveys for a method of phenotyping healthy people by physical anthropometry alone, especially where photography is impracticable for lack of accommodation, equipment, or time, or again on grounds of expense or unwillingness to be photographed on the part of any of the subjects. But, in addition to phenotyping without photography, these phenotype estimates are here used and are recommended as

FIG. 4.—Phenotype distribution of 671 women students from the universities of Oxford and Birmingham.

published by Sheldon (1954, p. 13). Unfortunately, his photoscopic standards for women have not so far been published, and, although it will be a comparatively simple matter, when the time comes, to prepare conversion tables based on the percentile distribution in each component, the percentile distributions for this sample are not yet available either (Sheldon, 1956, personal communication). It is recognized that the adoption of an independent distribution for women might lead to some confusion, but if the differences in technique and nomenclature describing M.4 phenotypes are kept in mind, such confusion should be avoided. The M.4 scales are more precise in themselves and more easily grasped than photoscopic interpretation: these are distinct advantages.

Disposition to Breakdown

Disposition to breakdown in mental health is measured for individual somatotypes or groups of somatotypes by comparing the frequency of each type in a series of patients and a series of controls. The first series of patients here consists of 208 consecutive Oxford University students advised by their general practitioners to attend the Warneford and Park Hospitals during the last four years for consultant psychiatric opinion. The first 100 were mentioned in an earlier report (Davidson *et al.*, 1955). The control series consists of 405 Oxford students attending a pilot health service between

1947 and 1950, for which the volunteer rate was 70%. M.4 phenotype and independent photoscopic estimates were compared before settling the final somatotype to be used. Fig. 5 shows those somatotypes ringed which appeared more often in the patient series; Fig. 6 those somatotypes which appeared more often among the healthier controls. The actual frequencies may be compared in Table II. There is a highly significant difference between the distribution of the 208 patients and the 405 healthy controls ($\chi^2=24.25$, $P<0.001$). A comparative ratio in the third column of

the table—Comparative ratio = $\frac{\% \text{ Patients}}{\% \text{ Controls}} \times 100$ —indicates by higher figures which physiques show greatest disposition to breakdown.

These are the linear or ectomorphic physiques, especially those in whom fat is more prominent than muscle (Lf), but high rates were also found in Fl types: briefly, muscular builds were least disposed to upset.

Similar conclusions concerning the significant association of comparative mental and muscular weakness in young men are reached if the student patients are compared with Sheldon's figures for somatotype frequency in a large American population ($n=46,000$) from 16 years of age upwards. Comparison of non-student patients under 30 years with student controls also yields the same general trend. The Oxford student population appears rather more

FIG. 5.—Somatotypes which appeared more often among Oxford men students under psychiatric care than among healthy students.

FIG. 6.—Somatotypes which appeared more often among healthy men students at Oxford than among patients.

TABLE II.—Percentage Distribution of Male Patients by Dominance of Physique

Dominance	Oxford Students			Other Patients		U.S.A. Sample ($n=46,000$)
	Patients ($n=208$)	Controls ($n=405$)	% Patients % Controls $\times 100$	Under 30 Years ($n=195$)	% Patients % Controls $\times 100$	
FAT:						
Fl Central	5.8	2.5	232	3.6	104	1.9
Fl Peripheral	9.2	3.7	248	5.6	151	5.1
Fm Central	7.2	5.4	133	4.1	76	7.7
Fm Peripheral	13.0	16.6	78	9.7	59	17.7
MUSCULAR:						
Mf Central	5.8	12.1	48	4.6	38	7.8
Mf Peripheral	8.2	21.5	38	13.8	64	26.9
Ml Central	6.3	11.2	56	10.2	91	9.4
Ml Peripheral	9.2	15.6	59	16.9	108	22.0
LINEAR:						
Lm Central	4.8	13.8	25	10.2	74	5.9
Lm Peripheral	22.1	29.4	75	26.1	89	17.8
Lf Central	14.9	5.7	262	9.2	161	3.6
Lf Peripheral	36.1	12.4	291	27.1	218	6.3
444	3.4	1.0	340	1.0	100	4.2
Total	100.2	100.2	100	100.2	100	100.0

Oxford student patients *v.* controls, $\chi^2=24.25$, $P<0.001$. Non-student patients *v.* controls, $\chi^2=27.66$, $P<0.001$. (Type 444 excluded.)

linear than the general population in the States, and this tends to lessen the contrast between non-student patients and student controls.

Individual phenotypes show striking contrast in disposition—for example, type 452 was five times more common in the healthy sample, type 325 six times more common among the patients.

The question may reasonably be asked whether this general trend could be due to mental patients losing weight. The answer is that careful weight histories were taken and allowance made for any weight loss recorded; secondly, the photographic check was used and a further independent check was provided by the ratio of height to chest width. Neither height nor chest width changes appreciably with weight loss, and although the mean ratio for samples of patients showed them to be more linear as a group than healthy persons, there was no excess of patients with ratios either more or less linear than the average for healthy persons of their own particular phenotype.

Disposition to Mental Illness in Young Women

So far 227 women patients under the age of 30 years have been phenotyped by combined M.4 chart estimates and photoscopy. Of these, 75 were attending at the Park Hospital for functional nervous disorders, the remaining 152 had been admitted consecutively to four mental hospitals. The distribution of their phenotypes by dominance is given in Table III, and may be compared with the figures for 671

TABLE III.—Percentage Distribution of Women Patients by Phenotype Dominance

Phenotype Dominance	Women Patients Under 30 Years (n=227)	Birmingham and Oxford Students (n=671)	Ratio % Patients % Controls × 100
FAT:			
Ff Central ..	11.5	7.3	157
Ff Peripheral ..	26.4	33.1	80
Fm Central ..	4.4	3.3	(133)
Fm Peripheral ..	15.4	37.7	41
MUSCULAR:			
Mf Central ..	0.0	0.5	(0.0)
Mf Peripheral ..	0.0	0.3	(0.0)
Ml Central ..	0.0	0.5	(0.0)
Ml Peripheral ..	0.0	0.0	(0.0)
LINEAR:			
Lm Central ..	0.9	0.1	(-)
Lm Peripheral ..	0.4	0.1	(-)
Lf Central ..	7.5	3.1	242
Lf Peripheral ..	32.7	13.5	242
444 ..	0.9	0.5	(-)
Total ..	100.0	100.0	100

Women patients under 30 years v. healthy students, $\chi^2=62.73$, $P<0.001$. (The three poorly populated sectors and type 444 were excluded.)

healthy women students at Oxford and Birmingham Universities. Once again the difference in distribution is highly significant ($\chi^2=62.73$, $P<0.001$), with the same Lf phenotypes showing the highest disposition to breakdown. Among fat but more muscular women belonging to the Fm sector there is a great excess of healthy students. Figs. 7 and 8 illustrate the contrast between phenotypes which are commoner in the patient and healthy samples respectively. There are too few women in sectors Mf, Ml, and Lm to justify comparison.

Somatotype and Psychiatric Diagnosis

No significant difference has been found so far in the physical distribution of patients admitted to mental hospitals and those attending the neurosis centre. An account of the relationship between physique and mental illness will not, however, be complete until the results are related to psychiatric diagnosis. For this purpose, psychiatric records are being collected, using certain well-defined clinical criteria for up to 200 patients of each sex in progressive age groups. This study is now well advanced, and in due course will form the topic of a combined report with Dr. Ian Skottowe, the psychiatrist concerned.

Summary and Conclusions

A method is described of estimating body type by means of physical anthropometry in the form of a three-numeral phenotype index, similar to the somatotype index introduced by W. H. Sheldon. The index is derived during the clinical interview by entering the measurements direct on to an M.4-style Deviation Chart. The F, M, L, phenotype index of Fat, Muscularity, and Linearity may be read from the chart without further tables, except that tables are most convenient for calculating the ponderal index of Linearity.

Comparison with the results of Deviation Chart and Table typing previously reported (Parnell, 1954b) shows that the differences between component ratings determined in this way and by the M.4 type chart are small. The M.4-style chart has notable advantages.

FIG. 7.—Phenotypes which appeared more often among women mental hospital patients under 30 years of age than among healthy students.

FIG. 8.—Phenotypes which appeared more often among healthy students than among women patients under 30 years of age.

Women's phenotypes may be derived from the M.4 chart, using the same absolute scales. Their phenotype distribution is reported. The possibility of subsequent correction of this distribution is discussed.

Weight variation at a given age is discussed in relation to phenotyping both healthy persons and mental hospital patients.

Disposition to mental breakdown is measured in terms of phenotype frequency in patient and control series. (The phrase "somatotype frequency" is reserved for the young men who were photographed and typed by Sheldon's criteria.) There was a highly significant tendency for mental disturbances to occur more often in Sheldon's endomorphic ectomorphs—that is, a linear build with proportionately more fat than muscle—type Lf. More muscular young men, especially endomorphic mesomorphs (type Mf), were much commoner in the healthy sample. For example, phenotype 452 was five times more common among healthy young men, phenotype 325 six times more common among patients.

The somatotype distribution of other young men patients, excluding students, showed similar significant trends.

Among women under 30, disposition to breakdown was once again significantly much greater in Lf phenotypes. In sector Fl there was about average expectation of breakdown. Lastly, in sector Fm there was a significantly higher proportion of healthy students.

APPENDIX : NOTE ON SUBCUTANEOUS TISSUE CALLIPERS

The subcutaneous tissue callipers ("Q") used throughout this work are no longer in production. Their specification, and that of the Harpenden callipers now available, are given by Tanner and Whitehouse (1955). Unfortunately, the equation they gave for transforming "Q" measurements to Harpenden equivalents is unworkable owing to an error. A set of Harpenden Total Skinfold measurements in millimetres is therefore provided in the table below for each age group to replace the "Q" figures given in Fig. 1 if Harpenden callipers are used.

Equivalent Skinfold Measurements Using Harpenden Callipers

Age	Total of Three Skinfold Measurements													
16-24	10	12	14	17	20	24	29	36	45	57	73	93	114	
25-34	12	14	17	20	24	30	38	48	60	74	94	114	+	
35-44	13	16	19	22	27	35	44	55	68	87	109	+	+	
45-54	14	17	20	23	29	37	47	61	74	95	118	+	+	
Estimate F	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	

Based on 180 duplicated measurements partially selected to cover the scale

The Harpenden callipers have two advantages—the spring loading varies relatively little as the jaw opens, and, secondly, the dial is capable of more accurate measurement. They have one serious disadvantage: the needle takes time to settle. Repeated studies with serial photographs of calliper dial and stopwatch show that even in the lower part of the scale the needle settles by variable amounts up to 1 mm. in the first 10 seconds after the callipers are applied, and continues to move for 30-45 seconds or so afterwards. In the upper part of the scale, it moves as much as 2-4 mm. in the first 10 seconds. The accuracy of the procedure should not be overrated.

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THE CONCEPT OF MEDIASTINAL PAIN

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The usual patterns of pain occurring in ischaemic heart disease, hiatus hernia, and pericarditis are well recognized. Many clinicians, however, will remember having seen patients with a history of sudden or severe chest pain somewhat similar to, or even identical with, that occurring in myocardial infarction, but in whom a subsequent diagnosis of carcinoma of the lung or other condition involving the mediastinum was ultimately proved. There is no doubt that chest pain can arise from the involvement of several different pain-sensitive structures in the mediastinum by various pathological processes, and the following case reports illustrate the fact that the patterns of pain resulting may cause considerable difficulty in diagnosis. Interesting variations in the sites of pain reference have also been noted.

Bronchial Neoplasm with Mediastinal Involvement

It is not rare for new growth of the bronchus to present with a sudden excruciating central chest pain which may be mistaken for the pain of myocardial infarction. It is similar in character, radiating up into the neck and jaw and down into the arms, but with the significant addition of a component of pain which radiates up into the head, scalp, face, and ears. Furthermore, the pain is repeated at longer or shorter intervals. In the first instance such a pain may be regarded as due to myocardial infarction, but with recovery and then repeated attacks without confirmatory electrocardiographic evidence, the diagnosis of myocardial infarction becomes untenable. Most physicians will have seen such patients who were regarded as having cardiac pain, and subsequently a neoplasm of the bronchus with mediastinal involvement has been found.

Interestingly, in one case of carcinoma of the left upper lobe bronchus referral of pain to the left side of the head occurred.

Case 1.—A man of 49 years was awakened from sleep one night with severe retrosternal pain followed in several minutes by left hemiparesis of considerable severity. He vomited. The pain then radiated to the left elbow and lasted about one hour. This recurred twice subsequently, and none of the attacks was induced by exertion or change of posture. An unproductive cough developed at about this time. Examination revealed a sthenic man with a dry cough. There was moderate hypertension. The percussion note was slightly impaired over the left lung apex anteriorly. An E.C.G. tracing was normal. A chest x-ray film revealed a mass in the region of the aortic knuckle (Figs. 1 and