

A FIRST STUDY OF THE WEIGHT, VARIABILITY, AND CORRELATION OF THE HUMAN VISCERA, WITH SPECIAL REFERENCE TO THE HEALTHY AND DISEASED HEART.

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1. DURING the last few years, thanks to many improvements in our methods of analysis, several of the biometric constants of the human body have been investigated. The coefficients of correlation of almost all the separate bones have been ascertained with some accuracy, and the suspected relationship between intellectual and physical characters has been closely scrutinised. Under these circumstances it is strange that so little work has been done on the weights and correlations of the viscera. Even such a simple measurement as the weight of the heart does not appear to have been calculated from any adequate series of observations. English text-books of anatomy give this weight on the authority of Reid and Peacock or on that of Clendinning. These two sets of observations are based upon very few cases. Peacock and Reid's results are drawn from 181 males and 110 females, and Clendinning's from 90 and 71 respectively*. It will be evident, therefore, that no great importance can be attached to them, even if we leave on one side the fact that they afford no materials for the study of correlation.

Clearly, the only way to obtain data for the solution of problems concerning the absolute and relative weights of the viscera is to extract as large a series of observations as possible from the *post-mortem* department records of a large general hospital. The present memoir contains the preliminary analysis of such a series from the pathological data of the London Hospital.

It might be supposed that *post-mortem* records would contain a very large number of available cases, and that the weights of the various organs would be found recorded with considerable accuracy. As a matter of fact, however, simple

* Clendinning's results are quoted in the English text-books, and also in Grisolle's *Traité de Pathologie Interne* (9th Ed. p. 200, Vol. II.). See also, K. Pearson: "Variation in Man and Woman" (*Chances of Death and other Studies in Evolution*, Vol. I. p. 816); Peacock and Reid: *London and Edinburgh Monthly Journal of Medical Science*, 1848-6, 1854.

measurements of this kind appear to be rather despised by *post-mortem* clerks, and the records are, from the quantitative point of view, very disappointing. Weights are frequently omitted altogether; sometimes we read "Spleen *about* 3 or 4 ozs."; at others, the ingenious writer appears to have given free play to his imagination, and we read of a man of forty-six years of age having a heart weighing *one ounce!**

It is much to be desired that, in future, more accurate methods of recording these simple observations should be adopted, so that large numbers of valuable facts may be rendered available for statistical inquiry. In my own research, after excluding the large majority of the examinations, there yet remained a considerable number of fairly trustworthy data suitable for tabulation, and this paper contains some of the results deduced therefrom, which it is hoped will not be without interest. I propose to divide my subject into four parts:

First. I shall discuss the average sizes, variabilities, and correlations of the heart, liver, spleen, and kidneys in the general population, diseased and normal, to be found within a London general hospital.

Secondly. I shall consider only cases in which the organs were found healthy on *post-mortem* examination. We shall thus to some extent be able to appreciate the influence of disease in modifying the biometric constants of the organs in question.

Thirdly. I propose to deal with the influence of age on the biometric constants for the viscera in man.

And, lastly. I shall consider the influence of certain special diseases from the same standpoint. All the data dealt with in this memoir are for males, the number of females in my collection being very much smaller. As far as I am aware, no investigation of this kind on the viscera has yet been undertaken, and mine does not profess in any respect to be more than a preliminary study. Its object is to draw attention to the need of better *post-mortem* records, and to indicate the wide field of valuable research which they open up, not only to the biometrician but to the physician†.

2. *The General Hospital Population.*

In my first series of tables I have dealt, subject to certain limitations, with a random sample of a general hospital population. To avoid the extreme changes due to youthful growth or senile decay I have tabulated only cases between the

* L. H. *Path. Reports*, 1899, No. 661.

† "Il ne faut jamais négliger de peser les organes, surtout ceux qui sont atteints de lésions pathologiques; le poids fournit souvent en effet des renseignements précieux sur le degré et sur l'importance des lésions; on n'oubliera pas cependant qu'il existe sur ce point des variations individuelles considérables..... Le poids total du sujet, la taille, l'âge, le sexe sont tout autant de conditions qui font varier le poids des organes eux-mêmes." (Bard: *Précis d'Anat. Path.* p. 786.)

ages of 25 and 55. Such a "random sample" is, of course, also a selection in that it consists solely of those patients who died in hospital, and upon whom a *post-mortem* examination was held. Thus it is far from being a random sample of the "general population" of the country, many classes of which are never found in the wards of a general hospital at all.

Evidently the population of a general hospital will chiefly consist of, (i) persons acutely ill, (ii) those suffering from surgical injuries or diseases, (iii) sufferers from medical affections requiring special treatment. Chronic maladies of old age, such as bronchitis, indeed, any highly chronic disease, will be under-represented in comparison with the general death-rate. Similarly the number of cases of valvular heart disease and rarer disorders, such as *Diabetes Mellitus* or *Insular Sclerosis* and other nervous lesions, will be above the general average.

Now, as pneumonia and bronchitis, particularly the latter, form a considerable number of the so-called "terminal affections" responsible for a large majority of all adult deaths, a random thousand necropsies will not give us the information we require as to the quantitative relations of average viscera, *post-mortem*. The error resulting from too few cases of senile bronchitis will be lessened, if not minimised, by the fact that we have confined our attention to cases of less than 55 years of age. But even thus we have too many cases of valvular cardiac disease, and as this affection tends to produce hypertrophy of the heart, the average weight in the first three tables is probably a good deal higher than that of the ordinary population at death.

It is, of course, to be remembered that this "general hospital population" does not mean the "normal" or healthy one. The above remarks are merely intended to show that a thousand deaths in hospital will not be due to exactly the same causes as a thousand deaths taken at random outside, and that therefore when we proceed to select sub-groups, such as "Normal Hearts," "Hearts in Pneumonia," etc., the material we have to select from is not what it would have been had we been able to start with 1000 random deaths in the population at large. And so, if we find that the average weight or variability of an organ is diminished when we proceed to special classes, we must bear in mind that possibly the change might not have been so striking if we had had a more representative sample to start from.

General Hospital Population.

TABLE I. *Hearts with Livers.* Number 1382.

Mean Heart	13.53 oza.	Standard Deviation	4.680 oza.
Mean Liver	63.01 oza.	Standard Deviation	13.314 oza.
Correlation of Heart and Liver			
.1931 ± .0175.			

TABLE II. *Hearts with Spleens.* Number 1303.

Mean Heart	13.07 oza.	Standard Deviation	4.067 oza.
Mean Spleen	6.61 oza.	Standard Deviation	3.345 oza.
Correlation of Heart and Spleen			
.1827 ± .0181.			

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TABLE III. *Hearts with Kidneys.* Number 1293.

Mean Heart 13.14 oza. Standard Deviation 4.134 oza.
 Mean Kidneys 12.68 oza. Standard Deviation 3.125 oza.
 Correlation of Heart with Kidneys $\pm 0.577 \pm 0.175$.

In this table the weight is that of the two kidneys taken together. To these results I add a table of the coefficients of variation*, so as to obtain some appreciation of the relative variability of the organs in question.

TABLE A.
Relative Variability in Weights.

Organ	Coefficient of Variation
Hearts with Livers ...	34.59
Hearts with Spleens ...	31.12
Hearts with Kidneys ...	31.47
Livers	21.12
Spleens	50.58
Kidneys	24.63

} mean 32.39

The substantial difference between the weights of the heart in the cases when livers were measured with hearts and the cases when either spleens or kidneys were measured is due to the fact that the 1382 cases of the former only in part cover the 1292 to 1303 cases of the latter, the additional cases, amounting to three or four hundred, are due to entries in which only two or three weights were given. It seemed desirable to include all possible cases in order to utilize as much material as possible. But there has clearly been some special reason for measuring livers in the case of very large hearts which has not arisen in the case of spleens or kidneys. Thus with livers we have hearts up to 36 oza., but with either spleens or kidneys only up to 28 oza.

On the whole with respect to both mean and variability, we may consider the hearts with spleens or kidneys to give a more reasonable approach to the biometric constants of the general hospital population than arises in the case of hearts with livers, where there is evidence of much more selection.

We notice at once :

(a) That the spleen is relatively much more variable than the heart, and the heart than the liver or kidneys.

(b) That the heart mean is considerably higher than that usually given in anatomical text-books †.

* The coefficient of variation = $100 \times \text{Standard Deviation} \div \text{Mean}$.

† Peacock and Reid's result on 181 male hearts is a mean of 10.699 oza. The coefficient of variation calculated from their figures by Pearson is 19.825. For the liver, the mean (from 84 cases) is 58.48 and the coefficient of variation 14.32 (Pearson: *op. cit.* Vol. 1. p. 816). It might, however, be better to compare these numbers with the results given later for the "healthy organs." Pearson says that we may probably conclude from Peacock's own statements that he "has cut off a considerable tail of really healthy hearts weighing over 12 oza." (*op. cit.* p. 817).

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(c) That there are quite sensible correlations between the weight of the heart and that of the other organs.

3. The "Normal" Heart.

Let us now consider the "normal" heart. Evidently the ideal normal heart is hardly at present capable of measurement with respect to any character other than those related to its manner of performing its functions. Such an organ ought really to be measured during the life of its owner, and we cannot do this, as we are unacquainted with the exact relation subsisting between body weight and heart weight in the living subject. The following is, perhaps, the best approximation to the truth that we are in a position to make. Correlation tables have been constructed for pairs of organs found to be healthy *post-mortem*. In any case in which I had the least reason to suspect the existence of disease, the measurements have been excluded.

The following results were reached :

Healthy Organs.

TABLE IV. *Hearts with Livers.* Number 358.

Mean Heart 11.04 ozs. Standard Deviation 1.923 ozs.
 Mean Liver 60.44 ozs. Standard Deviation 8.948 ozs.
 Correlation of Heart and Liver $\cdot 2780 \pm \cdot 0329$.

TABLE V. *Hearts with Spleens.* Number 517.

Mean Heart 11.25 ozs. Standard Deviation 2.073 ozs.
 Mean Spleen 5.22 ozs. Standard Deviation 1.996 ozs.
 Correlation of Heart and Spleen $\cdot 2654 \pm \cdot 0276$.

TABLE VI. *Hearts with Kidneys.* Number 413.

Mean Heart 11.24 ozs. Standard Deviation 1.946 ozs.
 Mean Kidney* 12.01 ozs. Standard Deviation 2.016 ozs.
 Correlation of Heart and Kidneys $\cdot 4004 \pm \cdot 0279$.

Drawing up a table of coefficients of variation as before we have :

TABLE B.

Relative Variability of Healthy Organs.

Organ	Coefficient of Variation
Hearts with Livers ...	17.42
Hearts with Spleens ...	18.42
Hearts with Kidneys ...	17.30
Livers 14.80
Spleens 38.21
Kidneys 16.80

* The mean value of the right kidney of 100 males 20 to 65 years of age, as deduced by Pearson from Reid and Peacock's values, is 5.57 ozs.

From these results we infer,

(a) That the average "healthy" organs are all lighter than those of the average general hospital population, and probably lighter than those of the general population as a whole. The weights are still, however, higher than those given by Peacock and Reid or by Clendinning.

(b) In passing from the mixed hospital population to the class of healthy organs, we find in every case the absolute variability is reduced, and by very large amounts indeed, the variability of the heart by over 50 p.c., and the other organs by amounts even 30 to 40 p.c. of their value.

(c) Relatively, the healthy spleen is still the most variable organ, and the heart comes second, but the kidneys are now close to the heart and the liver not very far behind. Disease appears to affect the weights of heart and spleen most, of livers and kidneys least.

We notice that our value for the coefficient of variation of the healthy heart is now 17.7 as against the result deduced from Peacock and Reid's measurement of 19.8 and for the liver 14.8 as against their 14.3*. We could hardly have anticipated such good agreement, and it certainly tends to confirm the value of the coefficient of variation as a fairly "steady" biometric constant.

4. *Influence of Age on the Weights of the Viscera.*

I have first considered the change in the absolute weight of the adult male heart with age, and I have then investigated the influence of age upon one set of correlations and variabilities, i.e. those of heart and spleen.

Table VII. gives the correlation between age and weight of heart in the case of health. We deduce the following values of the constants:

TABLE VII. *Relationship of Weight of Healthy Heart to Age.* Number 699.

Mean Heart	11.13 ozs.	Standard Deviation	2.015 ozs.
Mean Age	40.23 years.	Standard Deviation	8.500 years.
Correlation of Weight of Heart with Age = $.1363 \pm .0250$.			

There is thus a distinctly sensible increase of heart weight in health with age, the coefficient of correlation is more than five times its probable error. Still the correlation is smaller than what we might possibly have anticipated. Calculating the regression line we have, if H_p be the probable weight of heart in ozs., and A the age in years:

$$H_p = 9.8322 + .0323 A.$$

Thus the average healthy heart gains about $\frac{1}{3}$ oz. per ten years. For example we have:

* Pearson (*The Chances of Death*, Vol. 1. p. 318) gives 20.49 for the coefficient of variation of the right kidney as deduced from Peacock and Reid's measurements, as against my values of 16.80 for healthy and 24.68 for general hospital weights of both kidneys.

Average weight of Heart at 20 years is 10.48 ozs.				
"	"	"	30	" " 10.80 "
"	"	"	40	" " 11.12 "
"	"	"	50	" " 11.45 "
"	"	"	60	" " 11.77 " *

As far as I am aware, the correlation between age and weight of body in adult males is unknown. We should *a priori* expect it to be greater than the above, but it is always dangerous to judge without actual data. The correlation between stature and age is known, and is actually *negative*; the stature of the adult male diminishing by about $\frac{1}{2}$ inch for ten years after his prime at 28 years†. We thus conclude that while the stature decreases by $\frac{1}{2}$ unit, the heart increases by $\frac{1}{2}$ unit per ten years.

When we remember that the healthy heart is on the average much smaller than the heart in disease, and that sickness on the average increases continuously with age‡, we shall probably lay less emphasis on the general *a priori* idea that the weight of the adult heart increases very sensibly with age alone.

For my second inquiry I had unfortunately not sufficient material to divide my healthy hearts into three age groups and thus determine the influence of age on variability and correlation. I should have got less than 180 cases for each table. I was thus reluctantly compelled to deal with hearts in the general hospital population.

I divided them into three groups, ages 25—35, 35—45, and 45—55. The following results were reached:

Age Influence on Hearts and Spleens of General Hospital Population.

TABLE VIII. *Hearts and Spleens.* Ages 25—35. Number 358.

Mean Heart 11.91 ozs.	Standard Deviation 3.997 ozs.
Mean Spleen 7.45 ozs.	Standard Deviation 3.768 ozs.
Correlation of Heart and Spleen = $\cdot 0785 \pm \cdot 0384$.	

TABLE IX. *Hearts and Spleens.* Ages 35—45. Number 536.

Mean Heart 13.16 ozs.	Standard Deviation 4.018 ozs.
Mean Spleen 6.60 ozs.	Standard Deviation 3.428 ozs.
Correlation of Heart and Spleen = $\cdot 1817 \pm \cdot 0282$.	

TABLE X. *Hearts and Spleens.* Ages 45—55. Number 403.

Mean Heart 13.65 ozs.	Standard Deviation 4.425 ozs.
Mean Spleen 6.21 ozs.	Standard Deviation 3.120 ozs.
Correlation of Heart and Spleen = $\cdot 2518 \pm \cdot 0315$.	

* Clendinning gives, Ages 15—29, 8 $\frac{1}{2}$ ozs.; 30—50, 9 $\frac{1}{4}$ ozs.; 50—60, 10 $\frac{1}{4}$ ozs. *Med. Chirurg. Trans.* 1838. See also Peacock and Reid, *op. cit.*

† *Biometrika*, Vol. i. pp. 46—9.

‡ *Biometrika*, Vol. ii. pp. 260 *et seq.*

Forming as before a table of coefficients of variation, we have :

TABLE C.

Relative Variabilities of General Hospital Population of Hearts and Spleens at different Ages.

Organ	Coefficient of Variation	Organ	Coefficient of Variation
Heart, 25—35	32.79	Spleen, 25—35	50.42
Heart, 35—45	30.53	Spleen, 35—45	51.97
Heart, 45—55	32.42	Spleen, 45—55	50.24

We can draw some important results from the above constants.

(a) The heart in the general hospital population of adults increases far more rapidly with age than it does in the class of healthy hearts. On the other hand the weight of the spleen sensibly decreases.

(b) The absolute variability of the heart increases 10 per cent., and the absolute variability of the spleen decreases 17 per cent. during the period considered. These are quite sensible changes. Thus, while the heart tends to grow larger and more variable, the spleen tends to grow smaller and less variable.

(c) If we deal with relative variation as judged by the coefficient of variation, we see that the changes referred to under (a) and (b) almost balance each other. Or, the relative variabilities of both heart and spleen remain sensible constants with age and equal to the values found for the general hospital population of adults of all ages in Table A, p. 66. This is further evidence of the real value of the coefficient of variation as a biometric measure of variability.

(d) The correlation between heart and spleen steadily increases with age. In the first period it is comparatively small, in the second period it has much the same value as in the general hospital population of adults (see p. 65), and in the third period it approaches the value found for healthy adults.

These results are quite reasonable. As death below the age of 35 is generally abnormal*, we should expect to find that the coefficient of correlation was low. Over the age of 45 years there is a slow deterioration of all organs. There is no evidence to show that this degeneration is much more acute in any one of the organs we are considering than in any other. Therefore, although the absolute weights will differ from the normal, the correlation may be the same, and this we see that it actually is.

* By "abnormal" is meant here a death due to disease; the result of an accident would be from this point of view a normal death, as probably leaving the viscera "healthy" under *post-mortem* record.

5. *Influence of Special Diseases on the Cardiac Biometric Constants.*

We are now in a position to consider the effect of some special diseases on the weight and correlations of the heart. Unfortunately, scantiness of material and pressure on my time hindered my developing this most interesting branch of my subject very fully in the present paper. I shall hope to give it further consideration in another communication. I have confined my attention here to the heart and spleen weights, variabilities, and correlations in the case of two disease groups. First, Pneumonia (excluding tubercular disease); secondly, Valvular Disease of the Heart and Aortic Aneurism. I regret that the total number of cases available is small.

TABLE XI. *Hearts and Spleens. Cases of Pneumonia. Number 177.*

Mean Heart 12.50 oza. Standard Deviation 2.768 oza.
 Mean Spleen 6.59 oza. Standard Deviation 2.842 oza.
 Correlation of Heart and Spleen = .1065 ± .0501.

TABLE XII. *Hearts and Spleens. Cases of Valvular Disease and Aortic Aneurism. Number 166.*

Mean Heart 19.08 oza. Standard Deviation 5.950 oza.
 Mean Spleen 8.57 oza. Standard Deviation 5.158 oza.
 Correlation = .0552 ± .0522.

Forming as before a table for relative variabilities :

TABLE D.

Relative Variabilities of Heart and Spleen under Special Diseases.

Disease	Organ	Coefficient of Variation
Pneumonia	Heart	22.15
Valvular Disease and Aortic Aneurism	Heart	31.18
Pneumonia	Spleen	43.12
Valvular Disease and Aortic Aneurism	Spleen	60.16

From these values of the constants we may draw the following conclusions :

(a) In cases of pneumonia the mean weight of the heart is above that of the healthy heart (p. 67), but slightly below that of the general hospital population heart (p. 65). The weight of the spleen is somewhat above that of the healthy spleen (p. 67), and only about equal to that of the general hospital population spleen (p. 65). The absolute variabilities of both heart and spleen in pneumonia are far lower than the values in the general hospital population, and only slightly higher than their values in the case of healthy organs. The same remark applies to relative variabilities, which are in the case of this disease somewhat higher than the healthy values, but considerably below those of the general hospital population. We must therefore conclude that pneumonia does not influence in a *marked* degree the average values or the variabilities of either heart or spleen weights. As it

does raise the variability somewhat, i.e. introduces disturbances in the relationship, we are not surprised to find that it weakens, although again not in a very marked degree, the correlation between weights of heart and spleen.

(b) On the other hand, Valvular Disease and Aortic Aneurism send up the weights of *both* heart and spleen not only vastly above their healthy values, but markedly above the values for the general hospital population. Further, their absolute variabilities are increased considerably above the general hospital population values, and *à fortiori* above the healthy values. The coefficients of variation of both are also far above the values in health, and that for the spleen above the general hospital values. In the case of the heart, the mean has been sent up so high that although the absolute variability is considerably greater, the relative variability remains much the same. The general effect of these heart diseases is to render the correlation between heart and spleen hardly sensible.

If we may judge by these two cases the general effect of disease is to increase the variability of affected organs and reduce their correlation. This is absolutely in keeping with the sensible, but of course less marked, changes we find when we pass from a population with healthy organs to the general hospital population, which of course contains much disease.

6. *General Conclusions.*

The present paper is chiefly intended as an illustration of how effective biometric methods might be from the standpoint of medical science if only there were a systematic collection on a large scale of normal and pathological data. Some definite conclusions, however, may yet be drawn, and some suggestions made on the basis of our numbers. We see sensible, if moderate, correlations between the weights of heart, liver, spleen, and kidneys.

It may be somewhat difficult to understand why the heart-kidney correlation is higher than that of the heart with any of the other organs. That the kidney should be more closely associated with the heart than the liver is possibly owing to its more subordinate functions. The liver is the seat of so many important processes that its immediate connection with the heart is not so great as that of the heart with the kidney. The excretion of fluids is so closely bound up with physical changes in the vascular system, and conversely changes in renal structure react so markedly upon the heart and blood vessels that a very close physical relationship appears probable. No doubt the liver is greatly affected in many forms of cardiac disease, but on the other hand serious functional disturbances or even acute inflammation of the liver do not produce heart changes with the same precision as analogous mischief in the kidney does. If this partially and imperfectly accounts for the higher heart-kidney correlation as compared with the heart-liver coefficient, it may perhaps serve as an argument in the case of the spleen. Heart mischief nearly always reacts on the spleen, but splenic trouble does not always affect the heart.

If we consider in broad lines the general results of our investigation, we should say that they may be summed up in the statement that both special diseases and the general want of health to be found in a hospital population tend in the same directions, namely, to increase the variability of the organs dealt with and to reduce their correlation. As we pass from the general hospital population to a healthy population we find that variability sinks and correlation rises. To what extent this is an antecedent or concomitant of the diseased state it might not be always possible to assert.

In taking any population, low variabilities and high correlations are the two factors which measure closeness to type. As a general rule, under a given environment closeness to type is a condition of stability, we may almost say, of low selective death-rate. Hence we may look upon disease as less stringent approach to type, and high variability and low correlation as a sign of instability*.

Of course the capacity to vary absolutely and to alter the relationship of organs must exist, or a race will not be able to effect a change in type with a changing environment. Still, if we trust the theory of correlation by natural selection at all, death before senility as far as it is selective is the destruction of the less fit, i.e. of those not approaching within certain limits the type suitable to the environment. Thus it comes about that we shall expect on the Darwinian theory to find the individuals who die of disease in adult life to be more variable and less highly correlated in their organs than the "healthy." This is precisely what we do find, and the *post-mortem* room provides direct evidence in favour of the action of natural selection in the case of man. Indeed, in a not very conscious way the medical world has been expressing these very truths of evolution in other words. The figures we have considered showing lowered correlation in the diseased state are a biometric illustration of the truth of Dr Sutton's aphorism, "Disease is absence of rhythm †." In the normal or healthy group we see a population possessing the characteristic marks of stability, small variability, and high correlation. In the two special and the general diseased groups we have conditions tending in the opposite sense. In the healthy class we get a closer quantitative relationship between the weights of the viscera, in the diseased there is greater variety of proportions. Indeed, to adopt a well-worn definition, "Among the diseased each organ has a life and growth of its own, irrespective of the needs of the organism as a whole." Our biometric investigation shows us this independent life and growth leading to increased variability and to lessened correlation, shortly, to those deviations from type which beyond certain limits are incompatible with survival under a given environment ‡.

* In the evolution of subspecies it seems probable that the hardest and most prolific groups have the least coefficients of variation. Thus in an investigation recently made by Mr A. Bacot and the author on the variability of *Spilosoma Urticae*, it was found that in several series of broods the groups with the largest coefficients of variation had the least net fertility.

† *Medical Pathology*, 1888, p. 95 *et seq.*

‡ I desire to take this opportunity of expressing my gratitude to Prof. Karl Pearson, to whose staff, among other acts of kindness, I owe the correction of many arithmetical slips in the above results. Anything of interest in this essay is due, either directly or indirectly, to him.

TABLE IV.

Healthy Hearts and Livers. Males.

Hearts in ozs.

Livers in ozs.	Hearts in ozs.									Totals
	7-125—8-125	8-125—9-125	9-125—10-125	10-125—11-125	11-125—12-125	12-125—13-125	13-125—14-125	14-125—15-125	15-125—16-125	
44-125—48-125	3	5	3	5	3	2	1	—	—	22
48-125—52-125	2	12	13	10	7	3	3	2	2	54
52-125—56-125	3	8	15	6	10	9	1	1	—	53
56-125—60-125	6	8	11	13	7	6	4	3	3	61
60-125—64-125	2	3	12	9	10	2	7	2	1	48
64-125—68-125	1	3	3	13	13	6	5	1	—	45
68-125—72-125	1	1	4	4	7	4	2	1	2	28
72-125—76-125	—	1	1	4	5	6	7	1	2	27
76-125—80-125	—	1	3	6	3	3	5	1	—	22
Totals ...	18	42	65	70	65	41	35	12	10	358

TABLE V.

Healthy Hearts and Spleens. Males.

Hearts in ozs.

Spleens in ozs.	Hearts in ozs.									Totals	
	7-125—8-125	8-125—9-125	9-125—10-125	10-125—11-125	11-125—12-125	12-125—13-125	13-125—14-125	14-125—15-125	15-125—16-125		16-125—17-125
1-125—2-125	4	3	3	2	2	1	2	1	—	—	18
2-125—3-125	6	7	12	9	6	5	1	—	—	—	46
3-125—4-125	6	15	21	16	14	10	6	11	2	—	101
4-125—5-125	1	12	25	18	16	11	13	3	5	1	104
5-125—6-125	5	8	16	27	24	13	13	—	5	—	111
6-125—7-125	1	5	9	4	10	9	2	2	2	—	44
7-125—8-125	—	2	7	8	6	11	6	4	6	1	53
8-125—9-125	—	1	2	7	1	3	1	1	—	1	17
9-125—10-125	—	—	—	1	5	—	2	2	3	—	13
10-125—11-125	—	2	1	1	—	—	—	—	—	—	4
11-125—12-125	—	—	—	—	2	1	1	1	—	1	6
Totals ...	23	55	96	93	85	64	49	25	23	4	517

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TABLE VI.

Healthy Hearts and Kidneys. Males.

Hearts in ozs.

Kidneys in ozs.	Hearts in ozs.								Totals	
	7:125—8:125	8:125—9:125	9:125—10:125	10:125—11:125	11:125—12:125	12:125—13:125	13:125—14:125	14:125—15:125		15:125—16:125
7:125—8:125	1	3	—	2	2	1	—	—	—	9
8:125—9:125	1	6	5	1	3	1	—	—	—	17
9:125—10:125	7	7	6	14	6	4	3	1	1	49
10:125—11:125	2	8	23	17	11	4	2	2	1	70
11:125—12:125	1	5	11	22	19	12	7	3	1	81
12:125—13:125	1	4	17	12	11	13	8	1	1	68
13:125—14:125	3	2	8	7	12	9	7	2	2	54
14:125—15:125	1	—	4	3	5	5	8	5	2	33
15:125—16:125	1	1	1	1	4	2	7	—	3	24
16:125—17:125	—	—	—	1	2	1	—	—	1	7
17:125—18:125	—	—	—	—	1	—	—	—	—	1
Totals ...	18	36	75	80	76	52	42	15	15	413

TABLE VII.

Correlation of Age and Heart Weight. Healthy Males.

Hearts in ozs.

Ages.	Hearts in ozs.										Totals
	7:125—8:125	8:125—9:125	9:125—10:125	10:125—11:125	11:125—12:125	12:125—13:125	13:125—14:125	14:125—15:125	15:125—16:125	16:125—17:125	
25th and 26th	3	4	7	6	3	2	5	1	—	—	31
27th and 28th	3	9	10	9	8	3	1	2	—	—	45
29th and 30th	3	6	10	9	12	7	2	1	1	—	51
31st and 32nd	4	7	9	9	6	4	6	—	—	—	45
33rd and 34th	5	4	9	14	7	7	2	3	3	—	54
35th and 36th	2	6	4	11	10	8	1	1	3	—	46
37th and 38th	3	7	10	6	10	5	2	3	4	1	49
39th and 40th	—	5	13	13	16	10	4	1	3	—	65
41st and 42nd	—	3	11	4	7	8	4	3	3	—	43
43rd and 44th	—	3	8	4	8	3	6	—	2	—	34
45th and 46th	4	4	13	7	10	6	8	3	3	—	57
47th and 48th	1	3	7	4	5	7	4	1	—	—	32
49th and 50th	1	7	13	5	5	7	5	6	—	1	50
51st and 52nd	3	4	7	7	6	2	6	4	3	—	42
53rd and 54th	—	4	8	13	7	7	4	—	3	1	47
55th and 56th	1	1	1	—	2	1	1	1	—	—	8
Totals ...	33	77	140	121	122	86	61	28	28	3	699

TABLE X.
Hearts and Spleens. General Hospital Population. Males. Middle Age (45—55 years).

Hearts in oza.

	5-125-6-125	6-125-7-125	7-125-8-125	8-125-9-125	9-125-10-125	10-125-11-125	11-125-12-125	12-125-13-125	13-125-14-125	14-125-15-125	15-125-16-125	16-125-17-125	17-125-18-125	18-125-19-125	19-125-20-125	20-125-21-125	21-125-22-125	22-125-23-125	23-125-24-125	24-125-25-125	25-125-26-125	26-125-27-125	27-125-28-125	28-125-29-125	Totals
1-125-2-125	1	1	3	2	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
2-125-3-125	1	1	3	3	6	5	4	7	4	7	3	1	3	1	1	1	1	1	1	1	1	1	1	1	28
3-125-4-125	1	1	1	9	10	7	4	10	4	4	8	4	1	1	1	1	1	1	1	1	1	1	1	1	60
4-125-5-125	1	1	1	4	15	9	5	16	2	4	7	2	3	3	3	1	1	1	1	1	1	1	1	1	70
5-125-6-125	1	2	2	2	6	10	12	10	2	4	4	2	3	3	4	1	1	1	1	1	1	1	1	1	74
6-125-7-125	1	1	1	2	3	8	6	3	1	1	4	1	3	2	4	1	1	1	1	1	1	1	1	1	36
7-125-8-125	1	1	2	1	2	3	6	10	2	1	5	2	3	1	2	1	1	1	1	1	1	1	1	1	43
8-125-9-125	1	1	1	1	2	4	1	1	1	2	1	1	4	1	1	1	1	1	1	1	1	1	1	1	19
9-125-10-125	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
10-125-11-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
11-125-12-125	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
12-125-13-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
13-125-14-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
14-125-15-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
15-125-16-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7
16-125-17-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17-125-18-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18-125-19-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19-125-20-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20-125-21-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Totals ...	1	6	11	21	40	43	49	39	37	25	32	13	18	13	12	3	5	2	11	9	2	6	2	1	403

Spleens in oza.

