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OBSERVATIONS
ON THE
SHAPE OF THE CHEST
IN CASES OF
HYPERTROPHY OF THE HEART.

A THESIS FOR AN ACT FOR THE DEGREE OF M.B.
IN THE UNIVERSITY OF CAMBRIDGE.

BY

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OBSERVATIONS
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THE shape of the chest in its general relation to the strength of the man has probably been observed since the earliest contests of athletes, since the siege of Troy and the games of Taillten. Physicians too, from early times, have noticed the effect of certain morbid internal conditions upon the chest wall. Hippocrates describes the winged appearance of persons inclined to phthisis. So does Aretæus. The barrel-shaped chest of emphysema has long been mentioned by medical writers, and the pigeon breast is so plain to every eye that it has a vernacular name. The shape of the chest has been used to help diagnosis and prognosis, but the nature of the changes it undergoes has often been misunderstood and their cause misinterpreted. I have heard that one of the oldest fellows of the College of Physicians used to tell how, when he was a clinical clerk at Saint Bartholomew's Hospital, the physicians described cases of emphysema as cases of water on the chest. They must have attributed the rounded walls and bowed breast bone to the extend,

ing pressure of the water. At the present day many think pigeon breast as much a mere deformity as a snub-nose or a low forehead. Well-informed men, when they see a patient with a deep hollow in the front of his chest, attribute it to some blow or fall in childhood; to which, indeed, the patient himself thinks he can trace it. When the physical forces acting on the chest walls are considered, it is hard to imagine how blows in early life can ever cause permanent cup-shaped depressions in the chest. If such cases occur at all they must be as rare as falls in childhood are common. Besides, erring in conclusions, observers have been mistaken in some of their facts. Their method has been at fault. For example: measurements with tape have been used to demonstrate the difference between the sides in cases of pleural effusion and the diminution of capacity following paracentesis. More accurate observation shows that the shape of both sides of the chest is altered by an effusion on one. In estimating the enlargement it is therefore necessary to remember that the side without effusion has not its normal proportions.

An accurate knowledge of the shape of a chest and a comparison of its sides can only be attained by making a tracing of its circumferential outline. Andry and Bouillaud invented an instrument for this purpose, and their idea was improved on by Woillez. These cyrtometers, as they were called, were complex and expensive. Dr. Gee has devised a simpler. His cyrtometer costs sixpence. It is made of two pieces of fine pewter pipe, joined at one end by two inches of caoutchouc tubing. All the outlines referred to in this thesis have been made with this homely instrument. I have to thank Dr. Gee for

instructing me in its use. For purposes of comparison it is necessary to use one level of measurement. I have taken all my outlines at that of the sterno-xiphoid joint. This line has several advantages. It avoids the shoulder blades, the pectoral muscles, and the breasts. It passes over the tract in which the heart is not covered by lung.

Each outline has been taken as follows:—The patient puts his hands on his crown. I measure with a callipers the antero-posterior diameter of his chest at the sterno-xiphoid level, and mark the measurement on a sheet of paper. I then put the caoutchouc hinge over his backbone and bend the metal pipe on each side round the chest, fitting it accurately at every point. At the sterno-xiphoid joint I make a pencil mark on each piece of piping. The tubes are then turned outwards on the hinge, and are laid at once and without alteration of their curve on the paper. The centre of the hinge is made to coincide with one of the calliper marks, the front pencil-mark with the other. The outline is then traced by running a pencil round the inner side of the bent tube. The object of the calliper measurement is to prevent any error which the trifling elasticity of the hinge might cause. The piping has no perceptible resiliency.

Two axes give the general proportions of the outline; the antero-posterior diameter and the transverse diameter. The former is drawn from the middle point of the back to the middle point in front: the latter is drawn through the middle point of the antero-posterior diameter and at right angles to it.

By the method of rectangular co-ordinates the curve of any outline may be written down in numbers, and from

them it can be accurately reproduced upon paper. I have given examples from which the outlines can be drawn with no greater error at any point than one-twentieth of an inch.

The co-ordinate sheet should be of tissue paper. Two long lines crossing at right angles are ruled upon it. It will make the measurement simpler if the line which is to correspond with the antero-posterior diameter be ruled in black ink ; the other in red. Each line is divided into half inches, and through the marks parallels are drawn. Each point is numbered and each half-inch divided into tenths. The ruled sheet is then laid on the outline to be described. The ordinate and abscissa, or the red distance and the black distance from the intersection of the diameters, of every point at which the curve crosses one of the ruled lines, are read off. Signs may be avoided by calling the quarters severally right anterior, right posterior, left anterior, left posterior, and giving each a column. Conversely an outline may be drawn from the numbers by ruling a sheet in the same way and joining the points, of which the ordinates and abscissæ are given. Bulgings and depressions in the outline may be indicated in a tabular form by a modification of this plan.

The outline of the well-formed chest approaches an ellipse. In the suckling the axes are most nearly equal. The chest is almost circular. In the chest of *Alice Maud Hope Gorridge* a healthy child of 23 days, the diameters were: antero-posterior, 32 ; transverse, 36.*

* The measurements are throughout expressed in eighths of an inch. Where the measurement included a less fraction, the nearest eighth is taken. I have chosen the eighth because I think the cyrtometer is accurate to about this fraction.

In the healthy adult, and even in the young child, the transverse diameter exceeds the antero-posterior in a greater degree than in the new-born babe.

The right half is usually a little the larger, but sometimes the left is in excess.

The following table gives the measurements of ten healthy chests. The results of auscultation and percussion were in each case normal, nor was there any history of lung disease.

HEALTHY CHESTS.

NAME.	Age.	Occupation.	A. P.	T.
—	50—60	Physician	76	102
—	30—40	Surgeon	77	101
—	25	Clinical Clerk	69	88
Cox, Thomas . .	47		73	105
Dillon, Samuel . .	31	Potman	71	96
Grange, Charles . .	19	Knave	64	85
Heslop, Philip . .	32	Beadle	79	112
Jones, Thomas . .	28	Drover	62	90
Luxton, Alfred . .	18	Porter	62	88
Miles, Henry . .	20	Druggist	66	92

The few female chests I have taken seem to show a somewhat rounder outline.

FEMALE HEALTHY CHESTS.

NAME.	Age.	A. P.	T.
Fox, Emma	8	54	60
Gorringe, Mary Anne . .	45	61	81
Hall, Mary Anne	25	72	84
Webb, Jane	12	51	65

The table shows that in the well-formed male chest the transverse exceeds the antero-posterior diameter by rather more than one-third of the latter. In the female chest the excess is one-fifth.

There are deviations from the normal ratio which may be called subtypical. They indicate defective lung development, but are not morbid conditions.

In chests otherwise normal, as also in the subtypical, a slight transverse depression may often be noticed. Dr. Gee has shown that it is a result of some impediment to inflation at the bases of the lungs. The impediment prevents the entrance of air. The external therefore exceeds the internal pressure, and the chest wall is pressed in. This change in shape affects but little an outline taken at the sterno-xiphoid level.

The subtypical varieties of chest are :—

The shallow chest.

The pigeon breast.

The shallow chest may be flattened in front, or it may merely present a broad arch. It is often accompanied by projection of the scapulæ, and has hence been termed pterygoid, alar. As Aretæus says: *ὠμοπλάται ἐκφανέες ὅλαι ὅκως πτέρυγες ὀρνίθων*. The shallow chest and the pigeon breast both point to likelihood of disease. The pigeon breast is, further, a relic of disease in the past. The disease which causes it occurs in early life while the chest is growing. Hence this variety may be counted a defective, or subtypical development, and may be considered apart from the special morbid changes to be discussed farther on. The pigeon breast is wedge shaped, the breast-bone being the thin end of the wedge. The edge presents several de-

grees of sharpness. In rickety persons it is usually rounded. The cause of pigeon breast is catarrh in childhood. I have watched its formation from day to day in a protracted case of whooping cough. As catarrh is a frequent accompaniment of rickets, so the chest of the rickety is often a pigeon breast. The catarrh causes diminution of internal pressure by impeding inspiration, and the chest wall gives under the external pressure. The softness of the ribs facilitates the change of shape, and the rickety chest is usually, as Dr. Gee shows, transversely constricted as well as pigeon-breasted. The following tables show the proportions, in ten examples each, of shallow chest and of pigeon breast. Two supplementary tables illustrate respectively the frequency of lung affection in shallow chests, and the common concurrence of rickets and pigeon breast.

The subtypical varieties of chest are to the typical as a common-place is to a well-bred horse,—of equal use for ordinary purposes, but of less potential capacity.

SHALLOW CHEST.

NAME.	Age.	Occupation.	A. P.	T.
Boyden, Abraham .	23	Conductor	64	99
Branch, John . .	21	Marine	63	98
Dance, William .	33	Engine-fitter	64	103
Matthews, William .	36	Clerk	60	92
Sewell, Joseph . .	24	Fireman	66	98
Solomons, Abraham.	26	Tailor	61	95
Walker, Reuben .	30	Foot soldier	66	105
Williams, George .	20		60	99
Young, Charles J. .	22	Shoemaker	60	88
Yuill, William . .	30		56	92

PIGEON BREAST.

NAME.	Age.	Occupation.	A. P.	T.
Beck, Albrecht . .	4	Hot-presser	50	52
Doyle, William . .	24		63	76
Dungate, Arthur . .	15		51	64
Hawes, George . .	8		45	53
Hill, Edwin . .	17	Butcher	64	84
Jeffrey, Thomas . .	6		50	55
Luxford, Thomas . .	22	Brass-moulder	74	80
Morris, John . .	21	Printer	72	89
O'Donnchada, James	15	Calenderer	54	67
Webb, George . .	26	Harness-maker	72	85

SHALLOW CHEST.

NAME.	Age.	Occupation.	A. P.	T.	Signs of disease.
Allonby, David . . .	23	Cane-mounter	61	91	Hæmoptysis.
Bales, Alice . . .	19		54	82	Phthisis.
Beech, George . . .	27	Carpenter	61	93	None.
Bill, Ellen . . .	11	Nursemaid	46	64	None.
Blackborough, Ellen	14		44	66	None.
Cass, William . . .	23	Printer	56	86	None.
Evans, Jane . . .	11		48	66	Chronic cough, clubbed fingers.
Griffin, Richard . .	8	Schoolboy	41	60	None.
Griffiths, Charles . .	18		59	91	None.
Johnson, George . .	19	Labourer	66	101	None.
Kelly, Patrick . . .	49	Foot soldier	66	102	None.
Murray, Thomas . .	40	Stableman	61	92	Cough : five months.
Nash, Cornelius . .	16				Chronic cough.
Potter, John . . .	35		67	101	None.
Racket, George . . .	16		64	92	Cough : one month.
Swiney, John . . .	26	Pawnbroker	56	84	None.
Whitman, Jabez . .	19	Shoe-cutter	56	88	Abscess and enlarged cervical glands.
Wilcock, Harriet . .	24		54	84	None.
Wilson, James . . .	42		59	96	Hæmoptysis.
Wilson, William . .	19		64	101	Hæmoptysis.
Young, Charles . .	22	Shoemaker	58	87	None.

PIGEON BREAST.

NAME.	Age.	Occupation.	A. P.	T.	Indication of Rickets.
Atkinson, Annie .	5		48	54	None.
Bartholemew, Florence. . .	2		43	47	Ribs beaded, clubbed limb bones.
Galton, William .	4		54	58	Ribs beaded, bones of forearm distorted.
Hillman, Henry . .	4		51	58	None.
MacCall, James .	12	Schoolboy	52	67	Ribs beaded.
Skeuse, Charles . .	14	Cabinetmaker	57	74	Ribs beaded, lateral curvature.
Swinden, William .	6		46	54	Ribs beaded.
Utens, Albert . .	37	Cigar-maker	80	78	Lateral curvature.
Wade, Richard .	28	Cooper	78	92	Old rickets.
Watts, Charlotte. .	5		44	52	None.

In the following case I observed the gradual formation of a pigeon breast.

Annie Ni-Dubhlain, aged five years, was admitted into Hope Ward, S. B. H., on April 23, 1872. Moist rales were audible over both lungs, but there was no dulness on percussion. She coughed frequently with a marked whoop. The cough began in February, 1872. On June 15 she went home almost free from cough, but rather short-winded. On August 3 she was again a patient in Hope Ward. She had much dyspnœa and considerable hæmoptysis. The latter ceased, but there were abundant rales over both lungs when she left, at her own request, at the end of a month. On May 2 the dimensions of her chest were A. P. 50, T. 64; and on August 13, A.P. 50,

T. 57. Thus, in May, her chest was of normal shape, and at Lammas was a pigeon-breast.

The tables show that in the normal chest the transverse exceeds the antero-posterior diameter by about one-third of the latter; in the shallow chest by one-half; and in the pigeon breast by one-fifth.

The proportions are the most important considerations in studying a chest. The absolute size depends upon the height of the individual. It is desirable to ascertain the proportions accurately by means of a cyrtometrical outline, as the eye cannot otherwise take in the whole circumference from one point of view.

The shape of the chest in health having been explained, I proceed to the general proposition :

That certain morbid conditions of its viscera cause alteration in the shape of the chest.

The chief diseases of its viscera, excluding for the present the heart, which cause change in the outline of the chest, are :—Catarrh, Pneumonia, Phthisis, Emphysema, Pleurisy, Aneurysm.

The chest wall has constantly two forces bearing upon it, pressure of inhaled air from within outwards, and pressure of the atmosphere from without inwards. The external pressure is continuous and almost constant : the internal may be diminished. If it be diminished continuously or repeatedly, external pressure causes a permanent depression of the chest wall. Catarrh, by cutting off a portion of lung from the entrance of air, thus causes depression. When the obstruction, though not continuous, is often repeated, the external pressure acts at the most yielding part of the chest and forms a pigeon breast. Catarrh may cause prolonged or permanent collapse of a small portion

of lung. A permanent local depression in the chest wall follows. The transverse constriction, before-mentioned, is an example. Curious cup-shaped hollows may occur.

The following table shows five such cases. The measurement of the depression is obtained by drawing a perpendicular from the most protuberant point on each side to the transverse diameter. The width of the hollow is the length of the transverse diameter included between these perpendiculars. Its depth is the excess of the perpendicular over the antero-posterior half diameter. As the hollow is not always symmetrical the depth and width on each side are given.

This method is adopted for the convenience of the table. The full measurements of one of these chests, on the method of rectangular co-ordinates, are appended. From them the outline may be accurately drawn.

CUP-SHAPED DEPRESSIONS.

NAME.	Age.	Occupation.	A.P.	T.	Width R.	Width L.	Depth R.	Depth L.
Talbot, Harry .	20	Clerk	43	84	28	24	8	11
Fontaine, Henry	40	Foot soldier	49	96	21	22	8	8
Macklin, James.	45	Glasscutter	69	94	16	12	2	3
Buck, Charles .	21		60	101	20	23	4	6
*Heslop, James .	33	Footsoldier	66	102	16	21	4	6

Harry Talbot was subject to constant coughs when a child, but he had suffered no other illness. Auscultation and percussion of his extraordinary chest gave normal results.

* Measurements for drawing given in Appendix.

Henry Fontaine's chest, in July 1872, gave the following physical signs :

Left side : Percussion note } normal.
 Breathing sounds }

Right side : Percussion : high pitch note at apex.

Auscultation : Breathing sounds almost inaudible in front, and very feeble behind.

Occasional mucous rales audible over the upper half of the lung behind.

In August 1871, his cough began. He has since gradually lost his voice and is now extremely hoarse. With the laryngoscope I saw a small ulcer on the posterior wall of the larynx. He had served his full time in the 90th Regiment of the Line, and was with a Militia Regiment in the Autumn Manœuvres of 1871. I have detailed the symptoms and history of this case in order to confirm the patient's own assertion that the depression in his chest had existed long before his illness. Phthisis had attacked his right lung, the left was healthy, but the depression was nearly symmetrical. The conclusion is that it had followed some catarrh of childhood.

In *James Macklin's* chest the depression was deeper at a higher level. In neither his case, nor in the two others, was there any history of lung disease, but that of catarrh in youth.

After pneumonia there is usually some depression of the chest wall on the affected side. It is probably due to imperfect expansion of the lung. The drawings were made after the acute stage had passed. They therefore

indicate the result of the disease, not the shape of the chest wall during it.

The flattening is in each case estimated by laying the unaffected on the affected curve. The line joining their points of section gives the length of the flattening. The greatest distance between the two curves, measured perpendicular to the length line, gives the depth of the flattening.

PNEUMONIA.

NAME.	Age.	Lung affected.	A. P.	T.	Length of Fl.	Depth of Fl.
Bailey, William .	22	Right	70	100	50	2
Gorringe, Mary Ann .	45	Left	61	81	37	2
Parrot, John .	29	Right	63	92	44	2
Thompson, Mary Ann	24	Right	54	79	50	5
Thorne, Charles .	28	Left	84	64	64	4

In phthisis the formation of cavities is followed by extensive shrinking of parts of the chest wall. Lesser shrinkings are also found. No one attributes these to mechanical injuries. Nor can they be asserted to be congenital malformations, for their progress may be observed. Their dependence upon physical conditions of pressure alone remains. The changes which take place in phthisis are sufficient to demonstrate that the chief cause of alteration in the outline of the chest is disturbance of the balance of pressure. This fact has a practical value in diagnosis. In hæmoptysis, for instance, the discovery of a marked shrinking lessens the probability of the hæmoptysis being due to mere bronchial hyperæmia.

The following table shows the changes on the affected

side in ten cases of phthisis. The shrinkings have been estimated as in the pneumonia table.

PHTHISIS.

NAME.	Age.	Occupation.	Lung affected.	A. P.	T.	Length of Fl.	Width of Fl.
Gill, George .	24	Carpenter	Left	62	94	62	5
Holland, William .	30	Engineer	Right	62	89	32	1
Hopkins, John .	21	Ivory-cutter	Both	57	86	49	4
Keresy, James .	15	Painter	Left	55	79	52	3
Moss, Abdiel .	27	Carpenter	Left	61	88	48	3
Ni Cuinlain, Anne .	15	Nursemaid	Left	47	74	28	2
O'Donnabhain, John .	33	Shoemaker	Right	54	88	56	4
Paul, George .	36	Billiard-marker	Left	67	80	40	3
Porter, Edward .	38	Porter	Left	68	94	64	5
Schofield, Aaron .	44	Carman	Left	64	95	56	5

In catarrh and phthisis, and after pneumonia, there is a diminution of internal pressure on the chest wall, and the depressions in outline are due to the external pressure of the atmosphere.

I will not venture to debate the causes of emphysema—

Grammatici certant et adhuc sub judice lis est.

But the cause of the alteration in the shape of the chest is plain: it is an increase of the internal pressure. The sternum is arched, the antero-posterior diameter of the chest is positively increased, and the section approaches the circle. The short windedness of the patient, his purple face, his raised position, the hypertrophy of his breathing muscles, point to a condition in which extreme inspiration seems the necessity of his life.

The following table gives the dimensions of twenty emphysematous chests. In all except *Patrick O'Riadhain's*

cardiac dulness was abolished. An asterisk indicates that the patient had bronchitis. *John Boland* had for years been short of breath. Inspection showed that *Daniel O'Caimh* and *Peter Tallboy* probably had pigeon-breasts before they became emphysematous, and that the chests of *William Knox* and *Patrick O'Cualabhain* were shallow to begin with.

EMPHYSEMA.

NAME.	Age.	Occupation.	A. P.	Tr.
*Andrews, Robert . .	34	Vitriol-maker	70	91
*Blair, William . .	40	Wood-carver	71	86
Boland, John . .	24	Dock labourer	82	96
Dixon, David . .	44		75	93
*Greenfield, Thomas .	41		73	103
*Hurcombe, Peter . .	49	Sailor	74	92
*Johns, Matthew . .	45	Policeman	84	103
*Knox, William . .	41	Lighterman	82	108
Martin, Joseph . .	41	Labourer	96	100
Morris, George . .	35	Miller	72	90
*O'Caimh, Daniel . .	17	Printer	71	80
*O'Cathasaigh, John .	43	Labourer	82	95
*O'Cualabhain, Patrick	39	Shoemaker	64	92
*O'Faelain, Patrick . .	45	Pavior	76	94
*O'Heghra, Patrick . .	62	Coachman	74	95
O'Mathuna, Cornelius	60	Labourer	79	107
*O'Riadhain, Patrick .	51	Tailor	75	91
*Sumpter, Alfred . .	40	Waterman.	74	99
Tallboy, Peter . .	45		69	89
*Westover, Joseph . .	30	Ropemaker	74	92

The table shows that the proportion in emphysema, including slight cases, is A. P. 1, T. $1\frac{1}{4}$. If advanced cases are taken it is A. P. 1, T. $1\frac{1}{5}$. Where there is a pigeon-breast to begin with, the proportion may be A. P. 1, T. $1\frac{1}{8}$.

Old writers noticed the expansion of the chest in emphysema and misinterpreted it. In pleurisy the cause was too obvious to leave room for error. The effusion dis-

tends one side of the chest. The shape of the other side is also changed, though to a less degree. The result of paracentesis demonstrates that the bulging is no accidental condition, but is directly dependent on the internal change. The side without effusion is increased in capacity by a slight approach to the semicircle. The side with effusion shows most distension in its anterior two-thirds. I have, in the following table, estimated the bulging on the plan pursued to show the shrinking in phthisis. Since the side without effusion is somewhat distended, this method represents rather less bulging than there really is. A pleural effusion may sometimes be disproved by cyrtometry. *Eliza Moulder*, aged six, was admitted into Hope Ward, S. B. H., for a pointing empyema. The cyrtometer showed that the sides of her chest were of the same size. This would be impossible in empyema. The supposed effusion was an abscess in the tissues outside the ribs.

PLEURISY.

NAME.	Age.	Side affected.	A. P.	T.	Width of bulging.	Depth of bulging.
Clothier, John .	5	Right	49	58	58	2
Davis, Annie .	6	Right	52	59	52	5
Hands, William .	21	Left	63	80	52	3
Hopps, Daniel .		Right	64	91	64	6
Wilkins, John .	33	Left	66	107	52	6

The following cases show how rapidly change in shape follows paracentesis, and demonstrate the bulging to be caused by the effusion.

Lavinia King, aged six, was a patient in the Evelina

Hospital. On September 15, 1872, physical examination of her chest gave the following results :—

Percussion : right side ; note normal.

left side ; absolutely dull back and front, except above the clavicle, where the resonance is impaired, but dulness is not absolute.

Auscultation : right side ; breathing sounds exaggerated.

left side ; no vesicular breathing audible.

Heart : apparent apex beat in the fourth right intercostal space half an inch within, and one inch below the right nipple.

The dimensions were—

A. P.	T.	Width of bulging.	Depth of bulging.
51	60	48	4

On September 19, paracentesis having meantime been done, dulness had given place to resonance on the left side, and the heart's impulse was to left of the sternum. The dimensions were—

A. P.	T.	Width of bulging.	Depth of bulging.
48	59	0	0

Daniel Deverell, a butcher, aged 20, was a patient in John Ward, S. B. H. The physical signs were (on August 21, 1872) :

Percussion : left side absolutely dull, back and front.

Auscultation : left side ; no breathing sound audible.

right side ; breathing exaggerated.

Heart : sounds best heard in the mid line over the xiphoid cartilage.

Paracentesis was done on August 22, and seventy ounces of straw-coloured serum were let out. The day after I

took a second drawing of his chest. The side filled again and paracentesis was again done. He left the hospital with both lungs in good order, at the end of October.

The table shows the three conditions of his chest—

DATE.	A. P.	T.	Width of bulging.	Depth.
August 21 .	72	104	The whole side.	7
August 23 .	70	99	50	3
October 25 .	66	93	0	0

Whether the shrinkings which follow pleural adhesions are due to the traction force of the new tissue, or to the fact that adhesion prevents perfect expansion of part of the lung, I have been unable to determine.

The bulgings produced by aneurysm are sometimes considerable, but they mostly affect the upper part of the chest. In two cases which I examined there were large aneurysms of the arch of the aorta. The measurements showed that at the sterno-xiphoid level the shape of the chest was unaffected.

The alteration of the outline of the chest in six several conditions of its organs sufficiently establishes the general proposition laid down.

It is to be observed that the outline alone will not diagnose the particular disease. In the first group of changes, those caused by external pressure, percussion may fail to clear the matter, and I know no way of universally distinguishing the shrinkings caused severally by catarrh, pneumonia, phthisis. Percussion and palpation serve to separate the changes of emphysema, pleurisy,

aneurysm. An aneurysmal bulging pulsates. An effusional bulging might theoretically pass for a unilateral emphysema, but it is dull on percussion.

I now proceed to the particular proposition that hypertrophy of the heart causes a definite alteration in the shape of the chest.

If the four quarters into which the extremities of the diameters divide the outline of the chest be taken as regional divisions, the part of the chest wall covering the heart will lie in the left anterior quarter. Hypertrophy of the heart causes a bulging in this part of the line. The bulging is generally a small segment of a circle of which the middle point of the antero-posterior diameter is the centre, but its position is its most marked character. Its most prominent point is nearer the sternum than the end of a line meeting the circumference and drawn at right angles to the chord of the left anterior segment of the chest. The eye readily perceives a very slight deviation from a curve. A bulging which is obvious in a drawing when reduced to numerical comparison with the right side is sometimes found no deeper than $\frac{1}{8}$ in. That it is none the less definite an alteration, I think the notes of the following cases show.

The table gives the chest measurements and dimensions of the bulging in ten cases of hypertrophy of the heart. The physical signs establishing the diagnosis in each case follow. In one case only was there a post-mortem examination.

HYPERTROPHY OF THE HEART.

NAME.	A. P.	T.	Length of bulging.	Depth of bulging.
Barnardier, Thomas . .	52	58	22	2
*Dale, Stephen . . .	57	72	35	2
Holland, Henry . . .	71	102	63	3
Howard, John . . .	65	81	13	2
Ismay, Emma . . .	55	62	15	1½
Nixon, Henry . . .	86	103	19	1
Ni Helidhe, Ellen . .	68	72	32	3
Reius, Charles . . .	64	79	44	4
Stephens, John . . .	73	88	58	3
*Wilton, William . .	65	90	55	6

Thomas Barnardier, aged eight years, an out-patient at S. B. H.

April 3, 1872. Results of examination :

Heart : Percussion, area of cardiac dulness increased.

Auscultation ; a systolic murmur loudest at the apex beat.

He had acute rheumatism some time ago.

Stephen Dale, aged 9 years, a patient in Mark Ward, S. B. H.

June 20, 1872. Results of examination :

Heart.—Inspection : apex beat half an inch to left of the left nipple and two inches below it.

Palpation : impulse heaving.

Percussion : area of cardiac dulness increased.

It extends upwards to the second rib on the left side ; to the right as far as the right edge of the sternum, and leftwards to a point in the sixth intercostal space.

* Measurements for drawing given in Appendix.

Heart.—Auscultation : two systolic murmurs. They are synchronous. One is musical. It is audible in both axillæ, all over the front of the chest, and behind. The other is audible at the apex beat, along the left edge of the sternum, in the left axilla and at the angle of the left scapula.

At Christmas, 1871, he had acute rheumatism.
He has since had scarlet fever.

Henry Holland, a sailor, aged 30 years, a patient in Matthew Ward, S. B. H.

June, 1872. Post-mortem examination :

Heart : Generally hypertrophied ; the left side most so.

Weight, 40 ounces.

Aortic valves diseased.

Aorta and arteries generally, highly atheromatous.

John Howard, an oilman, aged 18 years, an out-patient at S. B. H.

October 2, 1872. Results of examination :

Heart.—Inspection : apex beat two inches directly below the left nipple.

Palpation ; a systolic thrill may be felt at the apex beat.

Percussion : area of cardiac dulness increased.

Auscultation : a diastolic murmur, best heard at the second right intercostal space beside the sternum.

Emma Ismay, aged 10 years, an out-patient at S. B. H.
May 1, 1872. Results of examination :

Heart.—Inspection : apex beat to left of left nipple.

Palpation : a systolic thrill at the apex beat.

Percussion : area of cardiac dulness increased.

Auscultation : a loud systolic murmur audible all over the front of the chest, and at the angle of the left scapula.

Henry Nixon, a policeman, aged 47 years, a patient in Matthew Ward, S. B. H.

Aug. 8, 1872. Results of examination :

Heart.—Palpation : impulse heaving.

Percussion : area of dulness increased. It extends to left of the left nipple.

Auscultation : a systolic murmur, best heard at the second right intercostal space, beside the sternum. It is audible at the apex beat and at the angle of the left scapula. Also a diastolic murmur loudest at the base of the heart.

Ellen Ni Helidhe, aged 16, a patient in Hope Ward, S. B. H.

August 20, 1872. Results of examination :

Heart.—Inspection : apex beat in the sixth left intercostal space, on the anterior axillary line.

Palpation : impulse heaving.

A systolic thrill at the apex beat.

Percussion : area of cardiac dulness largely increased. It extends on the right side to within half an inch of the

right nipple, thence upwards to a point one inch to right of the sternal joint of the third right rib; thence to a point on the lower edge of the fourth left rib at its sternal joint, thence in a curved line downwards and leftwards to the apex beat.

Auscultation: a loud harsh systolic murmur audible at the apex beat, all over the front of the chest, in the left axilla and at the angle of the left scapula. At the apex beat the murmur replaces the first sound of the heart and almost obliterates the second.

Charles Reius, a printer, aged 18 years, an out-patient at S. B. H.

April 24, 1872. Results of examination:

Heart.—Percussion: area of cardiac dulness largely increased. Its boundaries are the left border of the sternum, the lower edge of the fourth left rib and the seventh rib, three inches to left of the left nipple.

Auscultation: a loud systolic murmur audible at the apex beat, in the left axilla and at the angle of the left scapula. Also a diastolic murmur, best heard on the fourth left costo-sternal joint.

He had acute rheumatism in November 1870.

John Stephens, a clerk, aged 22 years. A patient in Luke Ward, S. B. H.

May 21, 1872. Results of examination :

Heart.—Inspection : apex beat in the sixth left intercostal space, two inches to left of the left nipple.

Percussion : area of cardiac dulness increased.

Auscultation : a systolic murmur audible all over the cardiac area loudest at the heart's base, but loud at the apex beat, not distinctly audible behind.

He has suffered from palpitation since the age of fourteen.

William Wilton, a telegraph messenger, aged 14 years, a patient in Matthew Ward, S. B. H.

April 17, 1872. Results of examination :

Heart.—Percussion : area of cardiac dulness increased.

It extends from the right border of the sternum to about half an inch to left of the left nipple. The lower edge of the third left rib is its limit upwards.

Auscultation : on the sternum a friction sound is audible. The heart sounds are quite distinct along the same line. Two inches below the left nipple a systolic murmur is audible. It is to be heard in the left axilla and at the angle of the left scapula.

The patient's liver was much enlarged, and his legs were swollen. He was very short of breath, but did not feel very ill, and insisted on leaving the hospital early in May.

As far as physical signs can establish a diagnosis, the signs in the above cases prove the existence in each of hypertrophy of the heart. In each the table of measurements shows a distinct bulging of the chest-wall. The cyrtometrical drawings demonstrate the bulging more clearly than numbers, and at the same time establish its peculiar character. The conclusion is that hypertrophy of the heart causes such bulging. Probably it does so by the force of its impulse against the chest-wall. Various circumstances may occasionally prevent the formation of such a bulging, but where it exists I believe it to be a distinct physical sign of hypertrophy of the heart.

There are three cases in which confusion may arise.

1st. Where there is a præcordial bulging in a healthy chest.

2nd. Where a pericardial effusion bulges the chest.

3rd. In some cases of enlarged liver.

If a præcordial bulging in a healthy chest extend beyond the normal area of cardiac dulness, percussion will eliminate it. Such enlargement may sometimes be seen where the left side instead of the right has a slight normal excess. Supposing the bulging to be strictly in the heart's part of the circumference, I know no way of distinguishing it without examining the heart. But, practically, I believe this objection to have little weight, for out of two hundred and fifty chests which I measured and drew myself, and scrutinized for the purpose, only two had any bulging which could be confused with that of the above cases.

In a case in Luke Ward, S. B. H., in which Dr. Southey made the diagnosis—"pericardial effusion, broncho-pneumonia (both lungs), effusion at base of left lung,"—there was a conspicuous bulging in the cardiac region. There

were no signs of hypertrophy. I could not have distinguished the bulging.

In a case in Matthew Ward a liver containing several carcinomatous masses of potato size pressed out the chest so as to simulate the bulging of hypertrophy of the heart.

But these are rare cases, and are unlikely from their other circumstances to lead to erroneous diagnosis.

On the other hand, I believe that the observation by cyrtometry of the specific bulging I have described is an aid to the diagnosis of hypertrophy of the heart.

APPENDIX.

JAMES HESLOP (Cup-shaped depression).

Right Anterior.		Left Anterior.		Right Posterior.		Left Posterior.	
R.	B.	R.	B.	R.	B.	R.	B.
0	8.3	1	8.4	12.7	1	12.8	1
1	8.4	2	8.9	12.7	2	12.6	2
2	8.8	3	9.2	12.4	3	12.4	3
3	9	4	9.4	12.1	4	12	3.7
4	9.2	5	9.6	11.5	5	11.9	4
5	9.1	6	9.5	11	5.7	11.2	5
6	8.9	7	9.2	10.7	6	11	5.3
7	8.4	7.2	9	10	6.6	10.1	6
8	7.9	8	8.6	9.5	7	10	6.1
9	7	8.8	8	9	7.4	9	6.8
10	6	9	7.8	7.9	8	8.5	7
11	4.8	9.9	7	7	8.2	7	7.6
12	2.9	10	6.8	6	8.5	6	8
12.2	2	10.6	6	5	8.6	5	8.1
12.4	1	11.0	5.4	4	8.6	4	8.2
12.6	0	11.3	5	3	8.5	3	8.3
		11.8	4	2	8.4	2	8.3
		12	3.5	1	8.3	1	8.2
		12.2	3	0	8.2		
		12.5	2				
		12.7	1				
		12.8	0				

STEPHEN DALE (Hypertrophy of Heart).

Right Anterior.		Left Anterior.		Right Posterior.		Left Posterior.	
R.	B.	R.	B.	R.	B.	R.	B.
0	7.2	1	7.3	9.1	1	8.8	1
1	7.1	2	7.4	9	2	8.5	2
2	7	3	7.3	8.6	3	8	3
3	6.9	4	7	8	4	7.3	4
4	6.5	5	6.3	7	5	7	4.4
5	5.9	5.4	6	6	6.6	6.5	5
6	5	6	5.6	5.4	6	6	5.4
7	4.2	6.6	5	5	6.1	5	6
7.2	4	7	4.6	4	6.4	4	6.4
8	3	7.5	4	3	6.6	3	6.6
8.5	2	8	3.1	2	6.8	2	6.8
8.9	1	8.1	3	1	6.9	1	7
9	0	8.7	2	0	7		
		8.9	1				
		8.9	0				

WILLIAM WILTON (Hypertrophy of Heart).

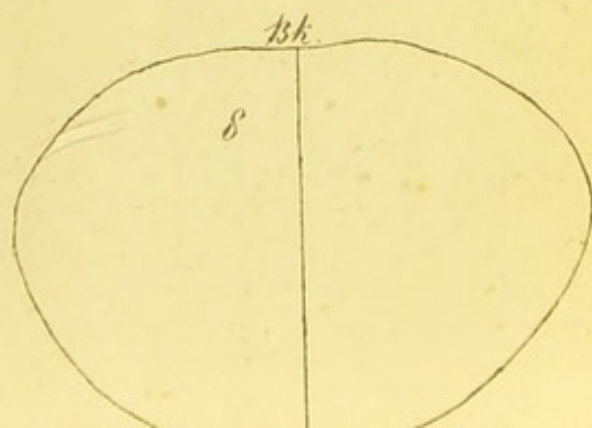
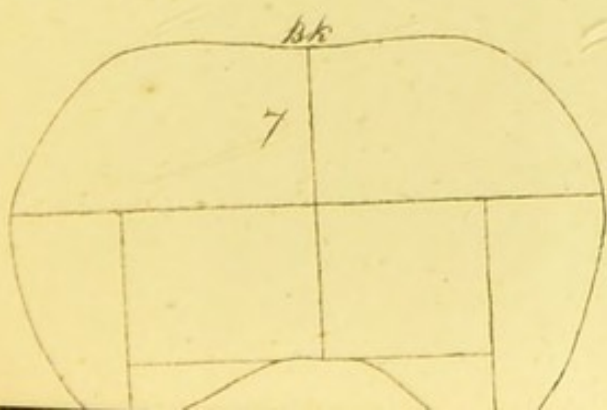
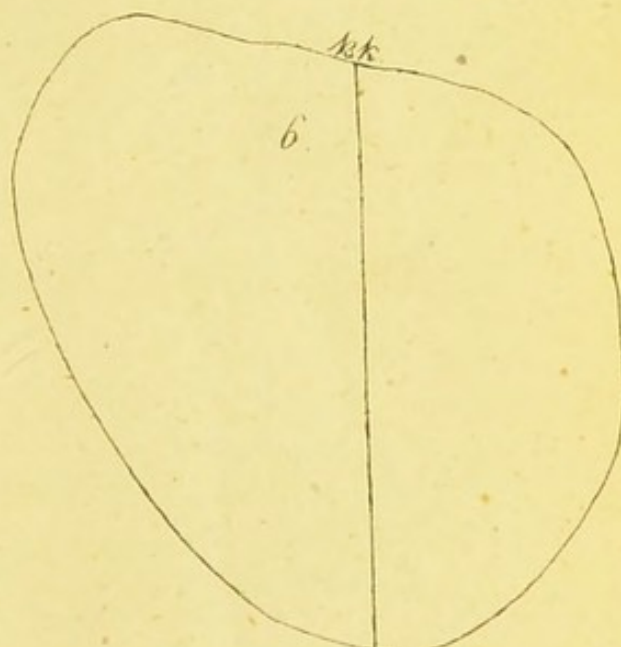
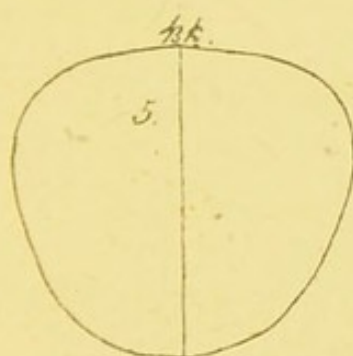
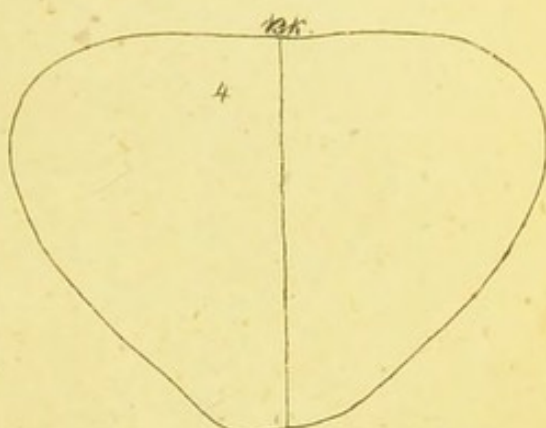
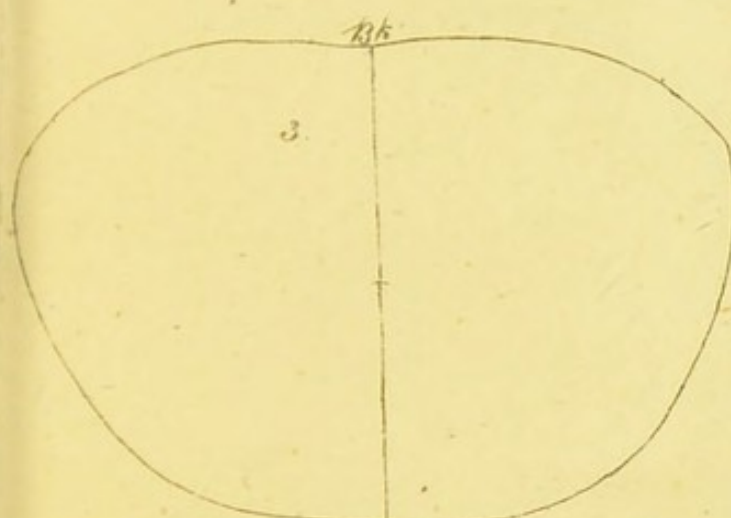
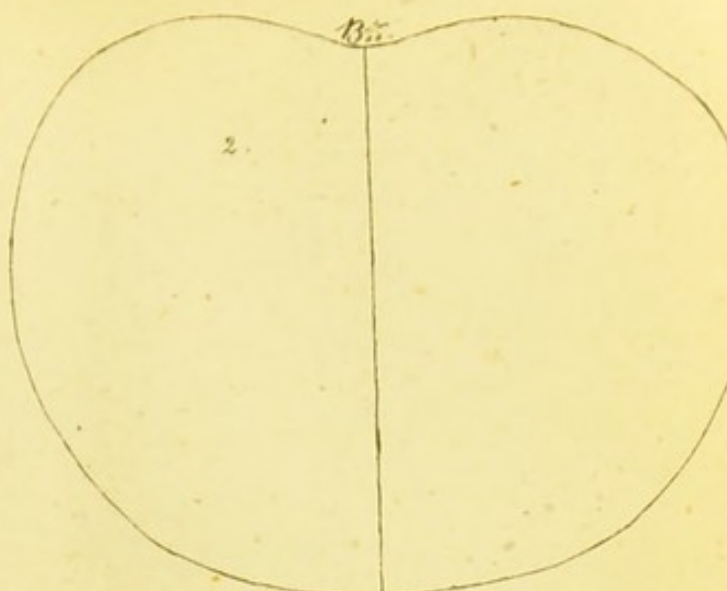
Right Anterior.		Left Anterior.		Right Posterior.		Left Posterior.	
R.	B.	R.	B.	R.	B.	R.	B.
0	8.5	1	8.7	11	1	11.3	1
1	8.3	2	8.8	11	1	11.1	2
2	8.2	3	8.8	10.4	3	11	2.2
3	8.1	4	8.8	10	3.7	10.8	3
3.6	8	5	8.6	9.8	4	10.1	4
4	7.9	6	8.2	9	5	10	4.1
5	7.4	6.8	8	8	6	9.3	5
5.9	7	7	7.9	7	6.6	9	5.3
6	6.9	8	7.2	6	7	8.1	6
7	6.0	8.7	7	5	7.3	8	6.1
8	5.3	9	6.2	4	7.5	7	6.8
8.3	5	9	6	3	7.7	6.7	7
9	4	10	5	2	7.8	6	7.2
10	2.8	10.6	4	1	7.9	5	7.3
10.4	2	11	3	0	8	4	7.5
10.8	1	11.2	2			3	7.5
11	0	11.4	1			2	7.6
		11.4	0			1	7.7
						0	8

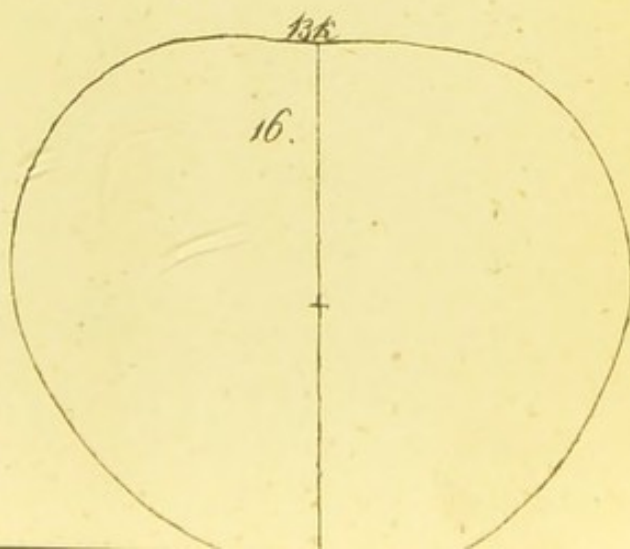
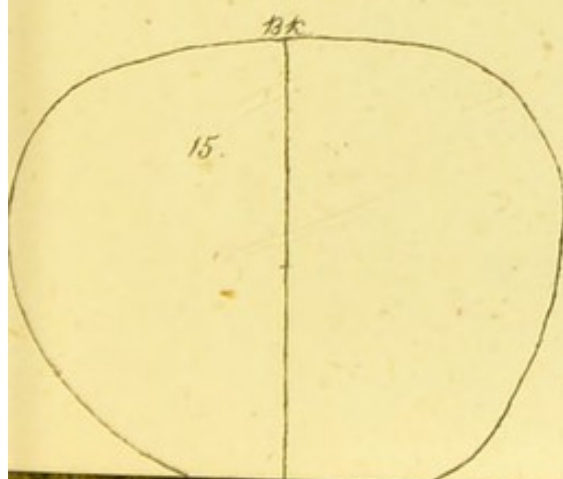
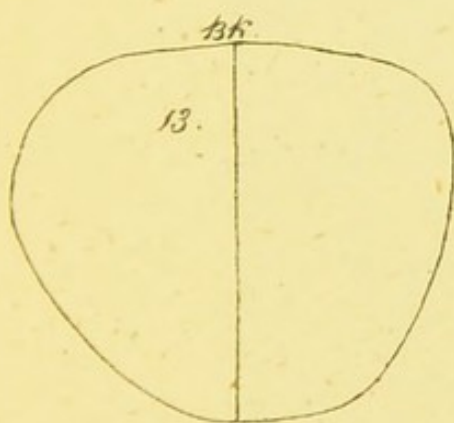
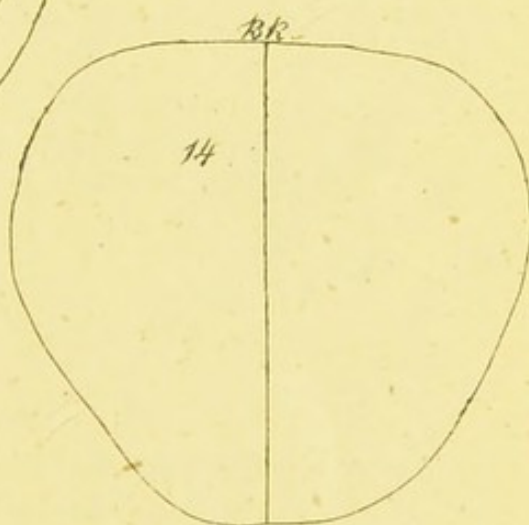
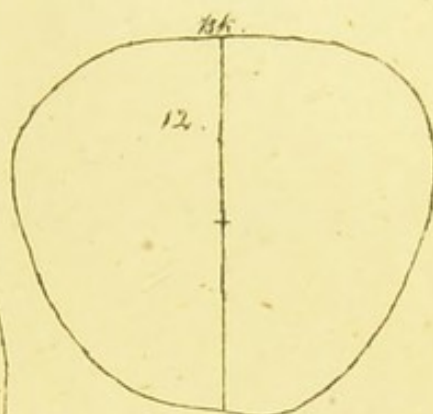
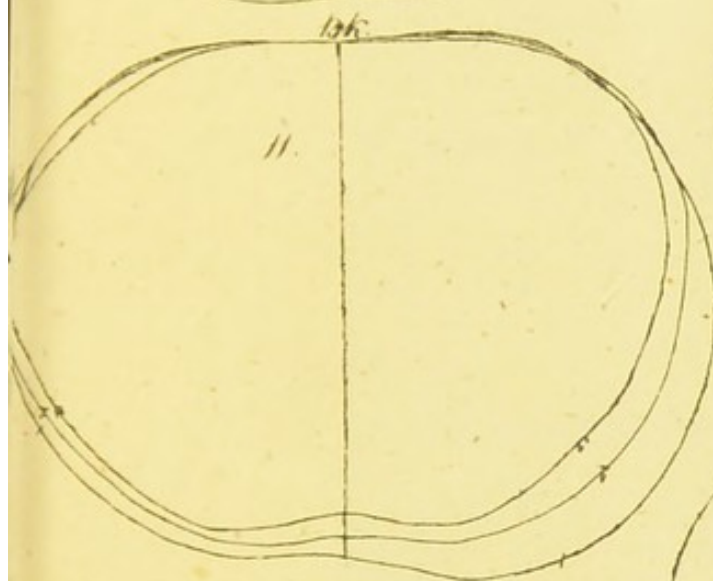
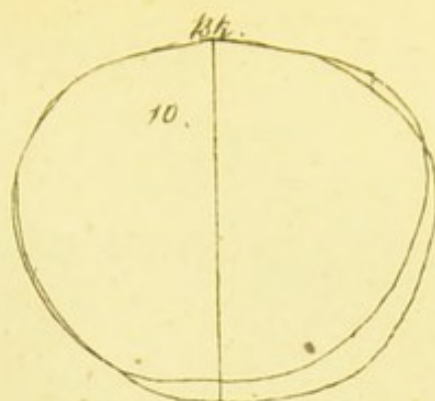
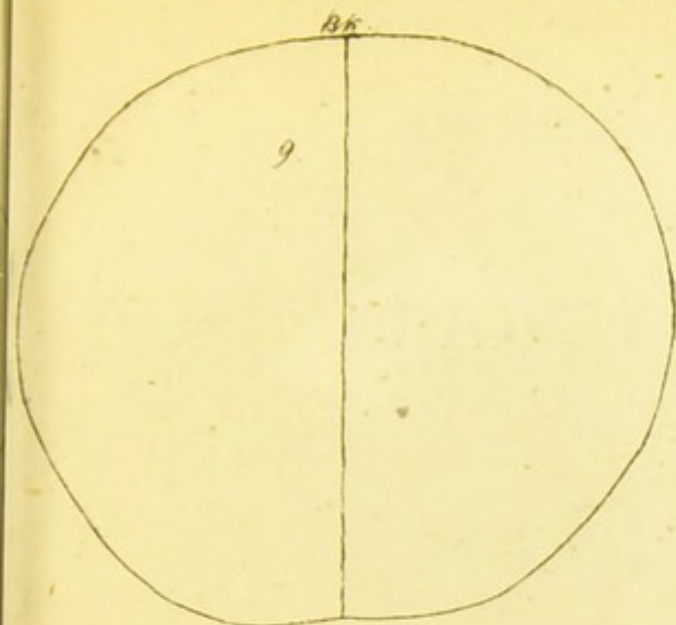
TABLE OF OUTLINES FIGURED.

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* Line 1, before paracentesis. 2, after. 3. On discharge.

THE END.





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AUTHORITY