cently developing itself again without at all interfering with the patient's health. She is in most perfect health—indeed, I have seldom seen anyone so well; but the tumour has attained an enormous size. [The operation was then performed by Mr. Baker Brown, step by step, as just described.]

This, gentlemen, has proved a very easy operation; only one slight adhesion, and, as you have seen, completed in less than a quarter of an hour, the opening being under four inches. In a subsequent lecture I shall state the result.

ON SPIROMETRY.

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(Concluded from p. 120.)

ALTHOUGH by the aid of any of these methods, or by their combination, we cannot determine the absolute amount of respiration of a particular individual, the spirometer does notwithstanding deserve a more general application than it has hitherto received. It should not, I think, be absent from any place where a great number of chronic diseases of the lungs are treated annually. If even the absolute capacity of the lungs of these patients could not be ascertained, the spirometer would certainly be the instrument which could show most effectively whether the permeability of the lungs had, after certain intervals of time, decreased or increased in the course of treatment; and it would point out the same thing in regard to those patients who, after several months of absence, come again under observation and treatment. I therefore, in my former position as physician in Reinerz, a German spa, where thousands of lung diseases come under observation, found the application of the spirometer of great use, not only during the course of the case, but also in order to acquire a control over the patient, even in again treating him after many years. Thus the natural desire awoke in me to find some means to determine the absolute amount of respiration, or, as this is impossible, a number approaching the absolute amount. I clearly knew from the commencement that the length of the body could not be a criterion, for I could not and cannot now think what influence the thigh and the skull can exert upon the air-capacity of the lungs. The only thing which may be here considered is evidently the repository of the lungs—the *thorax*; and if there is no proportion between the thorax and the capacity of the lungs, the thigh certainly cannot show any. Nobody will ever think of calculating the cubic contents of a box from the string with which it may be tied. I have tried to calculate the thorax as a cylinder; I have tried it as a truncated cone. I have tried to deduct a certain *quantum* for the heart and vessels from the received result, but the success was not satisfactory. At last an empirical formula was found, which, should it prove a safe one by further investigations, would be a considerable step towards the truth.

With a spirometer by Hutchinson that Dr. Munk, assistant to Professor Traube, had the kindness to forward to me from Luhme's manufactory at Berlin, I have measured healthy, well-built individuals, who have never been ill. I have made a memorandum of the numbers, and then compared them with those obtained by calculation based upon the formula, and the difference has, as the undermentioned cases prove, never reached 300 cubic centimetres. I am in hopes that by me, and perhaps by others, further experiments will be made, and I believe that much would be gained if we could approach the absolute amount of respiration within 300 cubic centimetres. The formula rests upon measuring the thorax, in order to calculate its volume (*V*) from it. The upper, middle, and lower circumference of the chest are added, and divided by three. This quotient (*x*) is raised to the square, and the result is multiplied by the front length of the chest (*h*). This result is divided by 36 (produced

by 12 π , with omission of the decimals). Thus the formula is,

$$\frac{V = x^2 h}{36}$$

The received quotient is taken in halves, and thus we obtain the amount of respiration. The following example will show it:—

Mr. A—, hotel-keeper; age, 38 years; size, 168 centimetres.

	Centimetres.
Upper circumference of the chest ...	96
Middle " " " ...	96
Lower " " " ...	95
Length of the chest in front ...	21
" " " on the sides ...	32
Acromial breadth ...	33
Amount of respiration ...	2400

Here is $x^2 = 95^2 = 9409$; this number $x h = x 21 = 189525$; divided by 36 = 5264; divided by 2 = 2632; the last number contains the result of the calculated amount of respiration. The difference of the one found through the spirometer would therefore amount to 232 cubic centimetres.

The following deviation must be mentioned:—If the calculated amount of respiration exceeds the number 3000, it is necessary, after the formula has been calculated as before, that *h* be subtracted from *H* (the side length); the remainder is then to be divided in halves, and the result (already divided by 2) divided by the dividing quotient, and this quotient to be subtracted from the quantity of respiration, as the following example teaches:—

Mr. S—, a clergyman; age, 26 years; size, 176 centimetres.

	Centimetres.
Circumference of the chest—upper ...	99
" " " middle ...	89
" " " lower ...	96
Front length of the chest ...	23
Side length " " ...	35
Acromial breadth ...	35½
Amount of respiration ...	2600

One centimetre of the body's size equal to 14·77 centimetres of air.

The calculated amount of respiration is = 3067 *H* minus *h* = 35 – 23 = 12; this number, in halves, = 6; divided, in 3067; result, 511. This number being subtracted from 3067, we obtain 2556 as the amount of respiration, which number deviates from the one found by the spirometer by 44.

I shall now proceed to communicate some measurements, from which it will be seen that I have not met with anybody here whose capacity of lungs reached or exceeded 3000, and where for one centimetre of length there were 20 or odd centimetres of air. I repeat that I have only made experiments with perfectly healthy individuals, and that yet some 10 centimetres of expired air came to one centimetre of bodily size. The cause of the great difference between these results and those of other authors I am unable to state.

1. Mr. B—, magistrate; age, 36 years; size, 173 centimetres.

	Centimetres.
Circumference of the chest—upper ...	89
" " " middle ...	87
" " " lower ...	83
Length of the chest—front ...	22
" " " sides ...	34
Acromial breadth ...	35
Amount of respiration ...	2800 cubic
Calculated amount of respiration ...	2930 "
Difference ...	130 "

1 centimetre of length of the body equal to 13·71 cubic centimetres of air.

2. Mr. T—, Secretary of the Post-office; age, 23 years; size, 173 centimetres.

	Centimetres.
Circumference of the chest—upper ...	90
" " " middle ...	88
" " " lower ...	84
Length of the chest—front ...	22
" " " sides ...	32
Acromial breadth ...	36
Amount of respiration ...	2600 cubic
Calculated amount of respiration ...	2314 "
Difference ...	286 "

1 centimetre of length of the body equal to 15·03 cubic centimetres of air.

3. Mr. H. B—, officer of the Guards; age, 26½ years; size, 175 centimetres.

	Centimetres.
Circumference of the chest—upper	90
“ “ “ middle	89
“ “ “ lower	85
Length of the chest—front	23
“ “ “ sides	38
Acromial breadth	34
Amount of respiration	2400 cubic
Calculated amount of respiration	2473 “
Difference	73 “

1 centimetre of length of the body equal to 13·71 cubic centimetres of air.

4. Mr. P. T—, tragedian; age, 40 years; size, 171 centimetres.

	Centimetres.
Circumference of the chest—upper	92
“ “ “ middle	91
“ “ “ lower	90
Length of the chest—front	21
“ “ “ sides	37
Acromial breadth	38
Amount of respiration	2500 cubic
Calculated amount of respiration	2415 “
Difference	85 “

1 centimetre of length of the body equal to 14·61 cubic centimetres of air.

5. Mr. H. W—, lieutenant of infantry; age, 37 years; size, 171 centimetres.

	Centimetres.
Circumference of the chest—upper	97
“ “ “ middle	98
“ “ “ lower	92
Length of the chest—front	21
“ “ “ sides	35
Acromial breadth	37
Amount of respiration	2400 cubic
Calculated amount of respiration	2632 “
Difference	232 “

1 centimetre of length of the body equal to 12·86 cubic centimetres of air.

6. Mr. J. K—, weaver; age, 26 years; size, 167 centimetres.

	Centimetres.
Circumference of the chest—upper	86
“ “ “ middle	93
“ “ “ lower	80
Length of the chest—front	20
“ “ “ sides	32½
Acromial breadth	34
Amount of respiration	1800 cubic
Calculated amount of respiration	1903 “
Difference	103 “

1 centimetre of length of the body equal to 10·75 cubic centimetres of air.

7. Mr. A. G—, merchant; age, 40 years; size, 170 centimetres.

	Centimetres.
Circumference of the chest—upper	87
“ “ “ middle	85
“ “ “ lower	83
Length of the chest—front	22
“ “ “ sides	34
Acromial breadth	34
Amount of respiration	2400 cubic
Calculated amount of respiration	2207 “
Difference	193 “

1 centimetre of length of the body equal to 14·11 cubic centimetres of air.

8. Mr. D. K—, glasscutter; age, 45 years; size, 163 centimetres.

	Centimetres.
Circumference of the chest—upper	99
“ “ “ middle	98
“ “ “ lower	96
Length of the chest—front	21
“ “ “ sides	31
Acromial breadth	39
Amount of respiration	2560 cubic
Calculated amount of respiration	2715 “
Difference	155 “

1 centimetre of length of the body equal to 15·70 cubic centimetres of air.

9. Mr. D. S—, merchant; age, 36 years; size, 169 centimetres.

	Centimetres.
Circumference of the chest—upper	92
“ “ “ middle	89½
“ “ “ lower	87
Length of the chest—front	22
“ “ “ sides	33
Acromial breadth	33
Amount of respiration	2400 cubic
Calculated amount of respiration	2420 “
Difference	20 “

1 centimetre of length of the body equal to 14·20 cubic centimetres of air.

10. Dr. M—, physician; age, 27 years; size, 175 centimetres.

	Centimetres.
Circumference of the chest—upper	93
“ “ “ middle	91
“ “ “ lower	88
Length of the chest—front	23
“ “ “ sides	34
Acromial breadth	34
Amount of respiration	2850 cubic
Calculated amount of respiration	2631 “
Difference	219 “

1 centimetre of length of the body equal to 16·28 cubic centimetres of air.

11. Mr. de S—, landed proprietor; age, 24 years; size, 170 centimetres.

	Centimetres.
Circumference of the chest—upper	92
“ “ “ middle	91
“ “ “ lower	84
Length of the chest—front	23
“ “ “ sides	34
Acromial breadth	33
Amount of respiration	2400 cubic
Calculated amount of respiration	2530 “
Difference	130 “

1 centimetre of length of the body equal to 14·70 cubic centimetres of air.

12. Mr. M. V—, student of medicine; age, 20 years; size, 171 centimetres.

	Centimetres.
Circumference of the chest—upper	91
“ “ “ middle	91
“ “ “ lower	87
Length of the chest—front	23
“ “ “ sides	37
Acromial breadth	33
Amount of respiration	2800 cubic
Calculated amount of respiration	2530 “
Difference	270 “

1 centimetre of length of the body equal to 16·43 cubic centimetres of air.

13. Mr. J. T—, hotel-keeper; age, 29 years; size, 170 centimetres.

	Centimetres.
Circumference of the chest—upper	87
“ “ “ middle	85
“ “ “ lower	83
Length of the chest—front	24
“ “ “ sides	35
Acromial breadth	34
Amount of respiration	2300 cubic
Calculated amount of respiration	2408 “
Difference	108 “

1 centimetre of length of the body equal to 13·52 cubic centimetres of air.

It is understood that care is required to avoid sources of error in the use of the spirometer. Most persons must first practise a powerful inspiration, and an expiration as perfect as possible, before their amount of respiration can be noted down. Only when one is convinced, by repeatedly trying, that the necessary proficiency has been acquired, can one allow them to blow into the spirometer and note the mean number. For women the necessary practice is more difficult; and with children I consider it almost impossible to draw any correct conclusions from the quantity of air found by the spirometer. To keep the nose closed in the expiration is, if the gums be not defective, altogether superfluous.

Woburn-place, Jan. 1864.