This case seems to suggest the possibility of curing aneurism by distal pressure, under favourable circumstances. If we can effect the consolidation of an aneurism by converting it into a *cul de sac*, there is reason to believe that with due regard to preparatory treatment this result might in some cases be obtained by choosing a spot between the sac and the distal collateral branch as the seat of pressure. We see in this case that not only the sac was filled up, but the artery also, which was exposed to the pulsatile wave of blood. When pressure is made on the distal side of an aneurism, we observe an increase of impulse for a few moments. If the compression is *complete, and firmly kept up*, this momentary irritation subsides, and the aneurism pulsates with perhaps less force than before. This principle of converting the aneurism into a *cul de sac* appears to act occasionally in compression at a distance. Dr. Carte, who has had great opportunities of observing the various phenomena which arise during the cure of aneurism, has stated it to me as his conviction that many, if not all, of the rapid cures are effected by a loose clot blocking up the distal portion of the artery. Certainly we can scarcely conceive it possible that a cure which occupies seven, ten, or even thirty or forty hours, could be effected by the slow process of a deposit, layer by layer, until the sac is filled. We see, also, that a similar result has been obtained purposely by manipulation of the sac, a process which is too dangerous to be other than exceptional in application. From all these circumstances, therefore, I think we may infer the probability of distal pressure being occasionally useful; it is at least worth a trial, where the position of the sac prevents our using the ordinary method; and if we can get a point for compression between the sac and the nearest collateral branch, I think the result of the case which I have now put upon record will give us encouragement, although indirect, to hope for success.

Art. XVII.—*Some Experiments on the Proportion of Carbonic Acid exhaled in Phthisis Pulmonalis.* By A. G. Malcolm, M.D. Edin., Physician to the General Hospital, Belfast.

In 1843 I published the result of some experiments performed in the Fever Hospital, Belfast, as to the per-centage of carbonic acid exhaled during respiration in typhus fever. This paper appeared in the January Number of the London and Edinburgh Monthly Journal of Medical Science. The experiments were performed by means of an apparatus which was essentially the same as that used by Dr. Prout, and described and figured by

him in Thomson's Annals of Philosophy, vol. II. The manner of using the instrument, and, indeed, the entire mode of conducting the experiments, I have fully detailed in the paper referred to. I shall not, therefore, allude now more particularly to this point further than to mention the principle upon which the amount of carbonic acid is ascertained. Caustic potass, when brought into contact with carbonic acid, instantly and completely forms a chemical union. The air expired, which is to be examined, is put into a glass globe containing 100 cubic inches, with a graduated stem. After the addition of the potass to this measured quantity a reduction takes place, in consequence of the combination referred to. The space thus vacated becomes occupied by the water which is introduced afterwards, and its amount may then be read off on the graduated stem. This amount, however, needs correction, as it has been calculated by Dr. Prout that at least one-tenth per cent. should be allowed for the absorption of carbonic acid.

Since the date of that paper I have instituted similar experiments to ascertain the proportion of carbonic acid exhaled in cases of phthisis. I was anxious to contrast the relative amount of this excretion in diseases alike characterized by quickened circulation, innutrition, and augmented temperature, though very different in other essentials. It is well known that cases of phthisis, especially when the stage of softening has been reached, progressively emaciate, though the appetite may be not merely unimpaired, but much increased,—while, on the other hand, the emaciation of fever is proportionately synchronous with the complete anorexia which obtains in fever. In the former case the carbon of the food is not deposited in the usual adipose receptacles, neither is it carried off by any excessive evacuations,—it must, then, one would suppose, disappear with the cutaneous or pulmonary excretions. *A priori*, then, I was led to anticipate an excess in the proportion of exhaled carbonic acid. In the case of typhus fever I ascertained that a very considerable diminution in this proportion occurred, which I ascribed to the fact, that as a minimum quantity of carbon is taken into the system, and as that contained in the tissues of the body was required for the maintenance of temperature, so little combustion of carbon is necessary, and, therefore, little carbonic acid should appear in the expired air; that little, however, as it is rapidly formed and parted with, tends to augment the temperature of the body above the natural standard.

Viewing the matter in another aspect, we might be induced to consider that the quantity of carbonic acid would be very much reduced in phthisis in consequence of the pathological

obstacles to a free interchange of gases through the respiratory membrane, and which obstacles must become increased with the increase of the disease. Pathologists have now ascertained, beyond all doubt, that tubercle is deposited in the air-cells, as well as parenchyma of the lung, and is, therefore, in contact with a large proportion of the surface of the respiratory membrane. In advanced cases this proportion must be, perhaps, equal to 90 per cent. Under these circumstances we must arrive at the conclusion, that either the respiratory changes take place through the diseased membrane equally with the healthy, or that they are limited to the latter. We have no evidence, however, that these respiratory changes can occur under the former condition, and it hence does seem natural to suppose that the inaction of the greater portion of the lung would lead to a diminution in the quantity of carbonic acid expired.

If, then, it can be shown that no decided relative diminution takes place, we cannot forbear from coming to the conclusion that the oxidation of carbon in the system is going on to a greater extent in cases of phthisis than in persons in health. In order that there might be no mistake as to the normal proportion of carbonic acid in the performance of these experiments, I was not satisfied with taking for granted the correctness of Dr. Prout's average, though it might be supposed that, as I had employed the same apparatus, I might have done so with perfect safety; but, as it might have occurred that these experiments were not performed under precisely the same circumstances as those of Dr. Prout, I considered it more judicious to ascertain an average, which, though it might not be precisely the estimate of any other observer, would better answer my purpose, as it would be the result of experiments performed under exactly similar conditions as regards the mode of respiration, the ages and condition of the parties operated upon, the time of day, and period of the year, all which have more or less influence.

The mode of respiration adopted in these experiments deserves mention. In phthisis the vital capacity of the lungs is small, the respiration short, and the amount of air changed, much below the average. Vierordt proved, from the result of 170 experiments, the important influence which differences in the rapidity and depth of breathing exercise. The per-centage of carbonic acid decreases in general with the frequency of the respirations, and increases in proportion to their depth. I, therefore, endeavoured in these experiments to arrive at what might be considered a medium result, and operated upon the air expired in

three to five respirations, and instituted the same regulations in the experiments with the healthy. In short, the manner of breathing in the two instances was precisely the same; and if any difference were possible, it would refer to the vital capacity which varies so much in different individuals, and especially in this disease as compared with health; for it is evident that a smaller vital capacity, *cæteris paribus*, must be attended with a diminished per-centage of carbonic acid.

Experiments like those whose result I am about to submit have been as yet conducted upon a limited scale. I shall here mention the results of the few observations which have been as yet instituted. Nysten, in his researches, came to the conclusion that the proportion is increased in the early stage of acute fevers, and diminished in obstructions of the lungs. Jurin stated as his opinion, that the cold stage of fevers diminished, while the hot stage increased, the amount of carbonic acid; and the combined observations of Lavoisier and Seguin generally corroborated these conclusions. Andral and Gavarret, 1843, in many experiments observed an increase in cases of amenorrhœa in pregnancy and after cessation of the menses. Hannover, 1845, noticed an increase in chlorosis and a diminution in phthisis. Macgregor, 1843, observed an increase in measles, small-pox, and cutaneous diseases. While Hervier, 1849, noticed an increase in the phlegmasiæ; with the exception of cases of inflammation of the heart and lungs, in which, as also in such diseases as impede the action of these organs, he observed a diminution; he observed a diminution also in the exanthemata, during suppuration, scurvy, purpura, typhoid fever, dysentery and chronic diarrhœa, anemia, anasarca, syphilis, cancer, scrofula, and the last stage of phthisis.

It will be seen from this enumeration that there is considerable difference of opinion as to the influence, for example, of the exanthemata and the phlegmasiæ; and further, two observers have distinctly stated that there is a diminution of the proportion in cases of phthisis; one of these, however, restricts this opinion to the last stage of the disease. It is difficult to reconcile these various opinions, and indeed it is not to be wondered at that so great a variety should exist in disease, when it is known that as much, if not greater, variety has been observed in experiments instituted to ascertain the healthy standard. These remarks furnish another reason in favour of the plan I adopted in experimenting at the same time, and under the same circumstances, upon the healthy and diseased.

The present series of experiments was performed in the summer months of 1853, and between the hours of 11 A.M.

and 1 P. M., which corresponds with the period ascertained by Dr. Prout to furnish the maximum proportion, and they were performed upon individuals at an average age of twenty-five; an age which corresponds to the average proportion. On the other hand, the high temperature of the season exercised a counterbalancing effect to the diurnal influence referred to.

The influence of diet, medicines, and other external agents, it would be needless to particularize here, as it cannot have a close bearing upon the question.

I shall now detail some of the circumstances connected with the subjects of the experiments.

Fifteen patients, nine males and six females, in decided consumption, were operated on thirty-two times; their ages averaged twenty-one years, and ranged between fifteen and thirty; their average height was 5 feet $4\frac{1}{2}$ inches, and ranged from 4 feet $10\frac{1}{4}$ to 5 feet $10\frac{3}{4}$; their average weight was 116 lbs., and their vital capacity a fraction above 100 cubic inches, which is about 100 less than that laid down in Hutchinson's Tables. The disease had reached the stage of softening in all but one, and in three there were cavities. The average duration of illness, up to the time of examination, was ten months; hemoptysis had occurred in all the cases but two, and in several repeatedly. I noticed the purple line on the edge of the gums in all but two; the pulse averaged 104, and the respirations 30. The physical evidence of phthisis was unmistakable, and is detailed in the Tables. The result of the experiments in these cases was this: the per-centage of carbonic acid averaged 4·467, and ranged from 3·7 to 5·5.

For comparison with these, I operated upon twelve healthy individuals, six males and six females, at an average age of 29, an average weight of 146 lbs., an average height of 5 feet 6 inches, and an average vital capacity of 180. The result of the experiments upon these showed an average per-centage of 4·6916, ranging from 4·2 to 5·9.

It may be said that these results do not contradict the statements of Hannover and Hervier, as there is a diminution to the extent of two-tenths per cent.; but it must be remembered how different the condition of the lungs in these two sets of cases. The vital capacity, for example, was diminished by one half, whereby a considerable diminution might be expected of the carbonic acid in air submitted to examination; and secondly, the existence of extensive disease of the respiratory membrane must have tended still further to diminish the proportion, were it not for the circumstance which I think is deducible, namely, a superabundance of carbonic acid in the blood, which is thrown

off by the healthy residue in nearly equal proportion to what is exhaled in the perfectly healthy respiratory apparatus. Taking these things into consideration, I do not see what other conclusion we can arrive at.

If, then, it should be ascertained by subsequent experiments that this view is correct, and I freely admit that further observations are desirable (more especially the results of a comparison between the influence of tubercular and pneumonic induration), I can perceive how important the fact would be in laying down the pathology of phthisis. Ancell, Bennett, and other recent writers, are of one mind as to morbid blood being the essential feature in tuberculosis, and as to the fact that this condition may exist an indefinite time prior to the deposit of tubercular matter. An examination of the blood itself has hitherto failed in identifying this predisposition state. Might not, then, the examination of the expired air supply at least a link in the diagnostic chain? This is one practical point; there are others in connexion with the theory of animal heat, and metamorphosis of tissues, upon which this subject impinges, and upon which it might be particularly interesting to dwell; but, considering the limited character of these observations, I shall content myself with merely submitting the subject to the notice of the profession, with the hope that some more competent, or with better opportunities, may test the view I have here advanced.

TABLE I.—*Showing the relative Amount of Carbonic Acid exhaled in Health.*

No.	Sex.	Age.	Weight in lbs.	Height.	Vital Capacity.	Per-centage of Carbonic Acid in Expired Air.	Temperature.	
							Air.	Water.
				F. I.				
1	M.	27	192	5 10	240	5·9	63	61
2	M.	23	162	5 6⅞	200	4·7	63	60
3	F.	30	154	5 3¼	156	5·1	63	61·5
4	F.	30	153	5 3½	120	4·6	64	61
5	F.	31	124	5 1¾	150	4·3	63·5	61·5
6	M.	33	. .	5 11¾	196	4·5	61·5	60
7	M.	22	. .	5 10	250	4·25	61·5	60
8	M.	58	126	5 6¾	120	4·8	62	59
9	F.	22	. .	4 10	125	4 25	64	62
10	F.	34	111	5 3	152	4·45	67	62
11	F.	16	134	5 2½	170	4·2	63·5	61·5
12	M.	22	154	6 0½	280	5·15	63	61
Average,		29	145·5	5 6	180	4·6916	63·25	61·71

TABLE II.—*Showing the Relative Proportion of Carbonic Acid*

No. of Patient.	No. of Experiments.	Sex.	Age.	Occupation.	General Appearance.	Height. F. I.	Weight in lbs.	Vital Capacity.	Stage of Disease.
1	4	M.	21	Hackler, . . .	Pale, slight, . .	5 8	. .	. .	Softening, .
2	2	M.	30	Moulder, . . .	Sallow, ...	5 5½	. .	90	Softening, .
3	2	M.	20	Foundry, . . .	Pale, thin, . . .	5 9¾	. .	130	Softening, .
4	2	M.	22	Ship Carpenter,	Sallow, thin, . .	5 10¾	134	116	Softening, .
5	2	F.	17	Weaver, . . .	Fair, ...	5 3⅜	100	110	Softening, .
6	2	F.	23	Mill Girl, . . .	Sallow, thin, . .	5 0	. .	100	Softening, .
7	2	F.	22	Servant, . . .	Sallow, thin, . .	4 10¼	. .	65	First stage, .
8	3	M.	30	Turner, . . .	Pale, thin, . . .	5 4	134	140	Softening, .
9	2	F.	30	. . . . .	Thin, ...	5 2½	107	103	Softening, .
10	1	F.	19	Servant, . . .	Clear Complexion,	5 3¼	. .	100	Cavity, . .
11	2	F.	15	Mill Girl, . . .	Sallow, ...	4 11¼	100	85	Softening, .
12	2	M.	17	Mill Boy, . . .	Thin, ...	5 2¼	91	82	Softening, .
13	2	M.	16	Mill Boy, . . .	Thin, ...	5 4½	119	105	Softening, .
14	2	M.	24	Bricklayer, . .	. . . . .	5 10	151	100	Cavity, . .
15	2	M.	18	Printer, . . .	Feeble, ...	5 7½	105	82	Cavity, . .
Mean,			21			5 4½	116	100½	

exhaled in Phthisis Pulmonalis, with other Points of Interest.

Time ill.	Complications.	Hemoptysis, when occurred.	Diarrhœa, when occurred.	State of Gums.	Pulse.	Respirations.
10 months,	Diarrhœa, . . .	April, 1853, . .	Since September, 1852.	Purple line,	120	24
14 months,	Laryngitis, .	1 year since, . .	Never, . . .	Purple line,	84	24
3 months,	Diarrhœa, . . .	Never, ...	Last 12 weeks,	Spongy, . .	92	28
5 months,	Ulcers of neck, .	Last April, . .	None, ...	Faint line, .	96	33
2 years,	Pleuritis, . . .	1 year ago, . .	Never, . . .	Slight red line,	132	32
2 years,	Dyspepsia, . . .	1 year since, repeatedly,	None, . . .	Purple line,	90	30
10 months,	Diarrhœa, . . .	Oct., 1852, and occasionally,	All winter, . .	Purple line,	120	30
8 months,	Laryngitis, . .	6 months since, and occasionally,	None, ...	Purple line,	140	28
12 months,	Amenorrhœa, .	Tinge, 3 weeks ago,	2 months ago,	Broad purple blush,	112	30
2 years,	Amenorrhœa, .	2 months ago, .	3 months ago,	Purple margin,	108	40
9 months,	Emansio, . . .	6 weeks ago, . .	None, ...	Purple line,	120	34
5 months,	Diarrhœa, . . .	4th July, and since,	2 months ago,	Purple line,	114	28
4 months,	Mesenteric disease,	2 months ago, .	15 months, .	Full, pale, .	108	24
. . . . .	Abscess, ...	Mixed blood and pus,	Diarrhœa, repeatedly,	Purple line,	100	32
9 months,	Pleuritis, . . .	None, ...	3 weeks ago, .	Purple line,	108	30
10 months.					103$\frac{3}{5}$	29$\frac{4}{5}$

TABLE II.—*Showing the Relative Proportion of Carbonic Acid*

No. of Patient.	Tongue.	Menses.	Axillary Circumference.	Infra-mammary Circumference.	Sterno-spinal Diameter.	Right Apex to Spine.	Left Apex to Spine.	Right Apex Movement.	Left Apex Movement.	Percussion Note.
1	Clean, red,	. . . . .	31½	31	6·625	5·1	5·125	10	10	R. apex dull,
2	Furred, .	. . . . .	32½	30½	6.875	5·5	5·5	.	.	No change, .
3	Clean, .	. . . . .	33	32¼	6·75	5·25	5·125	10	15	R. apex dull,
4	Clean, .	. . . . .	36	35½	7	5·25	5·625	.	.	R. apex dull,
5	Clean, .	Twice in last 2 years,	28¾	28	5·875	4·625	4·5	.	.	Clear, . . .
6	Clean, .	3 or 4 times annually,	31	28¾	7	4·875	5·5	5	20	R. apex dull,
7	Clean, .	Scanty, . .	30½	26½	6	4·562	4·75	3	5	No change, .
8	Clean, .	. . . . .	35	31¼	8	5·375	5·375	5	7	R. apex flat,
9	Clean, red,	. . . . .	30	28¾	6·75	5	5	8	10	Clear, . . .
10	Whitish,	Absent, . .	28¼	27	6·375	4·5	4·25	25	28	R. apex less resonant, .
11	Clean, red,	Absent, . .	27½	25	5·625	4·375	4·25	20	12	L. apex dull,
12	Furred, .	. . . . .	26	28	6·75	4·25	4·25	10	5	No change, .
13	White, .	. . . . .	27	27	6	4·25	4·25	10	5	Clear, . . .
14	Clean, .	. . . . .	33½	33¼	8·5	4·375	4·81	10	10	R. apex dull,
15	Slight fur,	. . . . .	31½	30	5·75	5	4·75	20	12	L. apex dull,

exhaled in Phthisis Pulmonalis, with other Points of Interest.—Continued.

Auscultation.	Per-centage of Carbonic Acid.	Temperature.		Dietary.			Other Particulars.
		Air.	Water.	Breakfast.	Dinner.	Supper.	
Coarse crepitus,	3·8	65	60	Tea and bread,	Potatoes and milk,	Meal and milk,	Debility, anorexia, perspirations.
L. apex, crepitus,	4·2	61½	58	Tea and bread,	Potatoes and fish,	Tea and bread,	Debility.
Crepitus,	4·175	61	59	Bread and milk,	Potatoes and milk,	Meal and milk,	Gastrodynia.
Clicking râle,	4·55	61½	60	Tea and bread,	Potatoes and milk, and fish,	Tea, bread, and milk,	Chills and heats, good appetite.
L. apex, crepitus,	5·1	62½	60½	Tea, bread, and milk,	Tea and bread,	Potatoes and milk,	Debility, perspiration, emphysema.
Clicking râle,	4·7	63	61	Tea and bread,	Potatoes and buttermilk, or stirabout,	Tea or stirabout,	Chills and heats, debility.
R. apex, less R. M.	4·25	64	62	Tea and bread,	Beef and bread,	Tea and bread,	Chills and heats, anemia, gastrodynia.
Clicking râle,	4·03	64	63	Tea and bread,	Beef and bread,	Tea and bread,	Debility, anorexia, and perspirations.
L. apex, clicking rale,	4·3	63	61½	Tea, bread, and eggs,	Bread and milk,	Tea and bread,	Chills and heats, dyspepsia.
Pectoriloquy,	4·0	63	61½	Tea and bread,	Beef, or potatoes and milk,	Tea & brown bread, or stirabout,	Chills and heats, dyspepsia.
Clicking râle,	4·45	64	61	Tea and bread,	Beef, potatoes and milk,	Stirabout and milk,	Chills and heats, dyspepsia.
L. apex, crepitus,	3·7	64	61½	Bread, milk, and eggs.	Beef and bread,	Stirabout and milk,	Perspirations.
L. apex, clicking râle,	5·1	. .	. .	Tea and bread,	Potatoes and milk,	Tea and bread,	Temperature high.
Clicking râle,	5·5	.	. .	Tea and bread,	Potatoes, ham, or beef,	Tea & brown bread,	Epistaxis frequent, chloasma, perspiration.
Clicking rale,	5·15	58	56	Tea, bread, and ham,	Bread and ham,	Tea & bread, stirabt., ham,	Chills and heats, palpitation.
	4·467						