THE STATIC LUNG TESTS.

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and that of Lécieux, with 348.* I have made use of 48 observations contained in an anonymous essay, published at Paris in connection with several treatises on midwifery.† Orfila has contributed 17 observations of his own, and 47 which he published on the authority of Eisenstein and Zébisch, and which were made under the eye of Bernt.‡ From Devergie's work I have obtained 17 facts,§ and from that of Jörg 6 facts.|| From domestic sources I have not been able to glean any large number of facts. To Mr Taylor's excellent essays,¶ and to his courtesy I am indebted for 8 facts. Five others I have gleaned from a paper by Dr Brady,** and I have added 20 observations of my own.†† I might have added to the number of my facts had the subject appeared of sufficient importance to require a more extended induction. Many single facts are doubtless scattered through the foreign journals, and many small collections of facts might be discovered if the search for them promised to repay the labour which it entails. As it is, the facts now brought together are much more numerous than any single collection which has been hitherto formed, and they are numerous enough to establish the principal data necessary for medico-legal inquiries. By stating the sources from which I have drawn my facts, as well as the number of facts from which each average is obtained, I have given every facility for adding to the collection which I have thus made, any new facts observed by myself or others; and as some of the averages are

* Considerations Medico-légales sur l'Infanticide, par A. Lécieux, à Paris, 1819. The number of facts published by Léceiux, is 400. Of these, I have been able to make use of 348 only, the remainder being so badly reported as to be utterly useless. Devergie has not made more than 200 available for his purposes; but he has limited his inquiries to children who have lived one month or less, whilst I have admitted a considerable number of observations on children above that age. This difference sufficiently accounts for the larger number of facts which I have been able to make use of. I have admitted as still-born, 30 observations on lungs, which, not being putrid or diseased, sank when placed in water, though it is not positively stated that respiration had not taken place. The only source of fallacy here is that extremely imperfect degree of respiration which is compatible with sinking of the lungs; but, as cases of this kind are of very rare occurrence, these observations may be safely embodied with those made on still-born children. I have been obliged to correct a large proportion of Lécieux's calculations.

† Proces-Verbal de la distribution des Prix, &c. 1812. Some of the observations contained in this paper seem to have been reprinted in Lécieux's treatise. In making use of these duplicates, I have not introduced any important fallacy.

‡ Traité de Medecine Legale, Vol. i. p. 404. The observations of Eisenstein and Zébisch are the only ones which I have not been able to procure and examine for myself. The title of the work from which they are taken is not given, and I have not been able to procure that in which they were most likely to be found. I have therefore trusted in this instance to Orfila's high authority.

§ Medeciné Legale. Vol. i. Article Infanticide.

|| Atelectasis pulmonum. By Dr Edward Joerg of Leipsig.

¶ Guy's Hospital Reports. No. 5. See also London Medical and Physical Journal for 1832 and 1833. One fact has been kindly forwarded to me by Mr Taylor since the publication of his essay in the Guy's Hospital Reports.

** Dublin Journal of Medical Science.

†† For the opportunity of making these observations, I am chiefly indebted to the kindness of my friend and neighbour, Dr Reid.

formed from insufficient materials, it will be easy to correct them at any future time, by increasing the number of observations.

The facts which have been thus brought together supply data for discussing the value of the absolute weight of the lungs, and of their weight compared with that of the body, as tests of respiration. I propose to examine each of these separately, beginning with the *absolute weight of the lungs.*

The following table shows the weight of the lungs in mature still-born children, of either sex, and of both sexes combined, the number of observations being 51 male, 44 female, and 109 of both sexes.

TABLE I.

	Before Respiration.		
	Male.	Female.	Male and Female.
Maximum,	1800	1492	1800
Minimum,	360	340	340
Mean,	986	818	896

In the case of the male, the numbers next below 1800 are 1726, 1661, and 1636, and those next above 360 are 494 and 498. In the female, the numbers next below 1492 are 1226 and 1193, and those next above 340 are 369 and 463. Of the fourteen observations in which the sex is not stated, the highest number is 1534, and the lowest 448.

The following table gives the weight of the lungs, in the two sexes separately, and in both combined, in the 6th, 7th, and 8th months of fœtal life.

It is necessary to premise, that, in all the observations which are made use of in constructing the tables, the lungs are either stated or inferred to be healthy. Where they are not stated to be diseased, they may fairly be assumed to be healthy, as all the authors who have written on the subject have taken pains to describe the condition of the lungs, and, in many instances, the fact of their being diseased is distinctly stated. As, moreover, diseases of the fœtal lungs are of very rare occurrence, no material fallacy is likely to be introduced by this assumption.

The numbers of observations from which the table is formed are as follow ; 6th month—male 8, female 8, male and female 16 ; 7th month—male 11, female 14, male and female 27 ; 8th month—male 20, female 12, male and female 37 ; total number 80.

TABLE II.

	6th month.			7th month.			8th month.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M. & F.
Max.	710	747	747	1081	1364	1364	1318	1462	1462
Min.	228	149	149	293	232	232	216	309	216
Mean.	393	349	371	626	633	612	714	697	701

This table is one of those which will require correction when a larger number of facts has been brought together. It presents many anomalies, only to be explained on the supposition that the facts are not sufficiently numerous. Thus, the maxima in the female exceed those in the male at each of the periods, whilst the maximum in the female at nine months falls short of the maximum in the male by more than 300 grains. The minima, too, present similar anomalies. This arises partly from the circumstance that, in the several groups of facts, the age has a range of one month, and partly from the difficulty which exists in fixing with certainty the age of the fœtus at the several periods of utero-gestation. In the instance of the female in the 6th month, the minimum 149 is the weight of the lungs of a twin fœtus, $5\frac{1}{4}$ months old; the number next above this is 262. In the female in the 7th month, the number next greater than 232 is 324, and in the male in the 8th month, the number next above 216 is 401. In the case of the maxima, the highest numbers are much greater than those next below them. Thus, in the 6th month, 455 is the number next below 710 in the male, and 340 that next less than 747 in the female. In the 7th month, 1081 is the maximum for the male, and 864 the second number on the list; but in the female, the three greatest numbers are 1364, 1019, and 819. In the 8th month the maxima for the male and female respectively are 1318 and 1462, the next greatest numbers 1081 and 1235.

The observations made on the males and females, taken together, present a greater degree of uniformity. Their results, combined with those already obtained for the 9th month, are seen in the following table.

Table III.

	6th month.	7th month.	8th month.	9th month.
Maximum,	747	1364	1462	1800
Minimum,	149	232	216	340
Mean,	371	612	701	896

I now proceed to state the corresponding results of observation made on children who have respired.

The following table presents the weight of the lungs after respiration in mature children who lived one month or less; the lungs being, as before, stated or inferred to be healthy. The number of observations is as follows: male 171; female 130; male and female 322.

Table IV.

	After Respiration.		
	Male.	Female.	Male and Female.
Maximum,	2440	1745	2440
Minimum,	432	479	432
Mean,	1121	986	1077

The six greatest weights in the male are, 2440, 2132, 2085, 2046, 1853, 1825; in the female they are, 1745, 1725, 1576 (two), 1561, 1544, (three), 1514, (three). There are also two observations on record which so greatly exceed the maxima in either sex that I have thought it right to omit them altogether. One is recorded by Mörike, the other by Haartmann. The former is 3426, the latter 3410. Jäger Junior considers the first a misprint, the second occurred in a case of suffocation. The minima require no particular remark, except that there is one observation on record, which makes the weight of the lungs in the male as small as 293, the number next above it being 432. This latter number is entered in the table as the minimum.

The following table shows the weight of the lungs after respiration in the 6th, 7th, and 8th months. The number of observations is as follows. 6th month—male 5, female 10, male and female 15. 7th month—male 19, female 16, male and female 39. 8th month—male 21, female 24, male and female 49. Total 103.

TABLE V.

	6th month.			7th month.			8th month.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M. & F.
Max. .	499	685	685	1278	1286	1286	1407	1534	1534
Min. .	247	232	232	309	386	309	262	384	262
Mean. .	328	441	404	595	694	641	780	734	762

This table presents the same anomalies as the corresponding table before respiration; these must be attributed partly to the small number of facts, and partly to some cause not easily discovered. The weight of the female lungs exceeds that of the male in more than one period both in the maxima, minima, and mean, and the same circumstance is observable in the table showing the weight of the lungs before respiration. In addition to the five observations on the male lungs at the sixth month, there is one not included in the table in which the weight of the lungs did not exceed 93 grains, and in the case of the female lungs, there is one instance of a twin fœtus at $5\frac{1}{4}$ months, where the weight was only 38 grains Troy. I shall take a future opportunity of detailing the particulars of this curious case, which came under my own observation.

The following table shows the weight of the lungs in the two sexes taken together at the 6th, 7th, 8th, and 9th months.

TABLE VI.

	6 months.	7 months.	8 months.	9 months.
Maximum, -	685	1286	1534	2440
Minimum, -	232	309	262	432
Mean, -	404	641	762	1077

The data furnished by the first of the three foregoing tables are scarcely exact enough for medico-legal purposes. In the majority of cases of infanticide, the crime is committed soon after the birth of the child, and is rarely delayed beyond the first twenty-four hours. Hence it is very important to ascertain the absolute weight of the lungs for different durations of respiration, and especially for the shorter periods. I have accordingly prepared the following tables for children at full term.

TABLE VII.

	Less than 1 hour.			12 hours.			1 day.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M.&F.
Max.	1621	1499	1621	1537	1010	1537	1576	1725	1725
Min.	510	384	384	463	556	463	479	548	479
Mean,	934	780	934	955	726	859	1001	1045	1018
No. of obs.	21	11	38	13	9	24	8	8	17

As I have already stated, there is one observation on record which makes the weight of the lung in the male at 9 months so low as 293 grains. This observation belongs to the first column.

The following tables show the average weight of the lungs after different durations of respiration.

TABLE VIII.

	Less than 1 hour.	12 hrs.	1 day.	2 days.	3 days.	4 days.	5 days.	6 days.	7 days.
Male,	934	965	1001	1073	942	1412	1097	1143	955
Female,	780	726	1045	725	980	927	882	1037	1061
M. & F.	934	859	1018	989	1001	1136	1020	1105	1008
No. of Obs.	21.11 38	13.9 24	8.8 17	14.6 23	9.9 21	9.16 28	10.11 22	10.7 18	7.7 14

TABLE IX.

	1 day & less.	1st week	2d week.	3d week.	4th week.	More than 1 month and less than a year.	more than 1 year.
Male,	958	1037	1231	1258	1385	1285	1699
Female,	838	901	1067	1033	1441	1496	1745
M. & F.	937	914	1170	1196	1417	1446	2051
No. of obs.	42.28 79	101.84 205	51.37 92	9.5 6	3.4 7	4.13 17	4.1 5

These tables confirm the general observation that respiration is a gradual process, causing the lungs to be more completely filled with blood the longer it lasts. The irregularities observed in the tables are sufficiently explained by the small number of observations from which some of the averages are deduced. If the increased weight of the lungs be a valid reason for inferring a more perfect respiration, we may expect to find the weight of the lungs greater in those cases where respiration is stated to be perfect, than where it is stated to be imperfect, and in these latter cases greater than when respiration has not taken place. The following table confirms this expectation.

Table X.

	Male.			Female.			Male & Female.		
	Still-Born.	Resp. impt.	Resp. perft.	Still-Born.	Resp. impt.	Resp. perft.	Still-Born.	Resp. impt.	Resp. perft.
Maximum,	1800	2132	2406	1492	1514	1725	1300	2132	2046
Minimum,	360	510	746	340	622	616	340	510	616
Mean,	986	1010	1227	818	947	1139	896	988	1195
No. of obs.	51	23	21	44	6	12	109	30	33

Having thus examined the weight of the lungs before and after respiration, at the several periods of gestation ; after different durations of the respiratory process ; and in its different degrees of perfection ; I now proceed to contrast the results obtained before and after respiration, making use for that purpose of the foregoing tables. The first table, which combines Table I. and Table VII., shows the weight of the lungs before and after respiration, in mature children, the duration of the respiration not exceeding one day. No distinction of sex.

Table XI.

	Before Respiration.	After Respiration.		
		Less than 1 hour.	12 hours.	1 day.
Maximum,	1800	1621	1537	1725
Minimum,	340	384	463	479
Mean,	896	934	859	1018

From this table it appears that the maximum weight of lungs observed in still-born children exceeds the maximum weight in those who have lived one day or less ; that the least weight after respiration exceeds the minimum before respiration by only 44 grains, and that the mean weight is increased by respiration lasting less than an hour only 38 grains, whilst at the end of 12 hours it falls short of the weight in still-born infants by 37 grains. Even when respiration has continued as long as one day, the average weight of the lungs is increased by only 122 grains. The following table, combining Table III. with Table VI., presents a view of the effect of respiration in increasing the weight of the lungs at 6, 7, 8, and 9 months.

Table XII.

	6 months.		7 months.		8 months.		9 months.	
	Before resp.	After resp.	Before resp.	After resp.	Before resp.	After resp.	Before resp.	After resp. (1st day.)
Max.	747	685	1364	1286	1462	1534	1800	1725
Min.	149	232	232	309	216	262	340	479
Mean,	371	404	612	641	701	762	896	1018

This table corresponds closely with the former, in exhibiting a very inconsiderable increase effected in the weight of the lungs by the act of respiration ; and both of them yield results very different from the general statements of authors, based on the authority of a small number of facts.

There is only one point connected with the weight of the lungs which requires investigation in addition to those illustrated by the foregoing tables, and that is the comparative weight of the two lungs. Seventeen observations of my own give the following results. (No distinction of sex, fœtal age, or duration of respiration.)

Table XIII.

Before respiration (11 observations.)		After respiration (6 observations.)	
Right lung.	Left lung.	Right lung.	Left lung.
313	243	465	353

Before and after respiration (17 observations.)	
Right lung.	Left lung.
367	282

These three averages agree in giving about the same proportion between the weight of the right and left lung, viz. 9 to 7. As this proportion is of no material importance, I have contented myself with my own limited number of observations.

An inspection of the tables and a close examination of the facts out of which they have been formed, lead us at once to the conclusion, that the absolute weight of the lungs, as a test of respiration, has been greatly overrated ; for, on comparing the absolute weight of the lungs at full term before respiration, with the absolute weight of the lungs at full term, after respiration has continued one day or less, I find that the maximum before respiration exceeds the highest number after respiration by 75 grains, the numbers being 1800 and 1725, whilst the minimum after respiration exceeds the minimum before respiration by only 139 grains. The average number before respiration also exceeds the average number after respiration has continued twelve hours by 37 grains, though it falls short of the average number when respiration has continued one hour or less by 38 grains, and when it has continued one day by 122 grains. After making all due allowance for the insufficiency of the facts collected, and admitting that the numbers now stated would be somewhat modified by using a greater number of observations, it will be impossible to deny that the value of this test has been greatly exaggerated. If the maximum after respiration, instead of falling short of the maximum before respiration, had considerably exceeded it, we should have been justified in considering all numbers intervening between the two extremes as affording a high probability that respiration had taken place. On the other hand, if the minimum before respiration had fallen considerably short of the minimum after respiration, we should have had an equally strong probability that all numbers intervening between the two minima belonged to lungs which had not respired. Again, had the average results after respiration uniformly and greatly exceeded the average before respiration, we might have regarded any number nearly approaching the one or the other average as affording a certain degree of probability that respiration had or had not taken place. The results, however, which have been obtained, entirely destroy the confidence which has been hitherto placed in this static lung test, and prove that neither the maxima, minima, nor mean numbers afford any indication which can be relied upon for medico-legal purposes. A comparison of the average and extreme weights of the lungs before and after respiration, confirms the view now taken of the utter uselessness of employing the absolute weight of the lungs as a test of respiration.

The results which have been arrived at, not only destroy our confidence in the value of this lung test, but tend materially to modify the prevailing views of the nature and effect of respiration. Physiologists and writers on forensic medicine have assumed that the lungs, before the establishment of respiration, are almost free from blood, and that, as soon as breathing takes place, blood flows to them in large quantities, so as to cause a considerable increase in their weight. In pursuance of this erroneous opinion, the weight of the lungs before respiration has been greatly under-estimated, and their weight after respiration proportionably exaggerated. Some of the earliest observations which I had an opportunity of making led me to doubt the correctness of the prevailing opinion; for in more than one instance I found the lungs of still-born infants congested with blood, whilst those of children that had breathed contained but a small quantity of that fluid. Of this fact two explanations may perhaps be given;—the one, that the fœtal lungs naturally contain nearly as much blood before as after respiration, the other, that, even where no air enters the lungs, ineffectual efforts to respire are made, which give place for the admission of an unusual quantity of blood into the lungs. Such efforts are probably made by many infants who perish before any air has found its way into the chest.

Though the difference between the weight of the lungs before respiration and after respiration has continued for a short space of time is certainly very considerable, this may, and most probably does, arise from the circumstance, that respiration is gradually established, and remains imperfect for many hours, or even for some days in the great majority of infants who die within that period of their birth. That this explanation is the true one will appear on an examination of Tables VIII. and IX., which represent the weight of the lungs as augmenting with the duration and consequent increasing completeness of the respiration ; and still more strikingly, on inspecting Table X., which exhibits the effect of different degrees of respiration on the weight of the lungs. But even here, the increase of weight is not so considerable as we should expect to find it, if the process of respiration really exercised so important an influence as it is generally assumed to do on the weight of the lungs.

Having thus examined the value of the absolute weight of the lungs as a test of respiration, I now propose to consider the proportion which the weight of the lungs bears to that of the body, or *Ploucquet's test.*

In discussing the value of this test, we have an advantage which Ploucquet did not possess, of reasoning from a considerable number of facts. A larger induction than that hitherto used has already demonstrated the insufficiency of the absolute weight of the lungs as a test of respiration ; by employing the same materials, we shall be able to ascertain the real value of Ploucquet's test. This test was first proposed on very plausible grounds. It was argued that, as the weight of the several organs of the body must vary with the weight of the body itself, it was necessary to take the weight of the body into account in all reasonings founded upon the weight of any of its organs. Nothing could be more natural than to expect, that, if in one case lungs weighing 500 grains belonged to a body weighing 30,000 grains,—a body weighing 60,000 grains would be furnished with lungs of 1000 grains; and nothing would at first sight appear more unreasonable, than to draw any conclusion from the weight of the lungs, without, at the same time, taking into account the development of the body to which they belonged. Had Ploucquet possessed a greater number of facts, he would in all probability have endeavoured to ascertain whether the weight of the lungs really does bear a fixed relation to that of the body, before he proposed his test with so much confidence. Hitherto this question, on the solution of which the value of Ploucquet's test really hinges, has been briefly decided in the affirmative, and the assumption has been carelessly received as a fact. The first step, therefore, to be taken in examining the value of this test is to determine whether or not the weight of the lungs does increase with the weight of the body, and if so, whether the increase in the one is exactly proportioned to that in the other.

That I might decide this question, I have arranged all the observations which I have collected on children at full term, in the order of the weight of the body, beginning with the greatest weight; and that the facts might be sufficiently numerous, I have made no distinction of sex. The following table, showing the rate of increase of the lungs and body respectively, in still born infants, will go far to decide the point in question.

TABLE XIV.

Number of Observations.	Weight of Body.	Average weight of Body.	Weight of Lungs.	Proportion.
1	20000—30000	27030	541	1 : 50
22	30000—40000	35139	700	1 : 50
26	40000—50000	45004	754	1 : 60
21	50000—60000	55595	1005	1 : 55
19	60000—70000	64453	1068	1 : 60
4	70000—80000	77382	1317	1 : 58
1	80000—90000	87336	1226	1 : 71
2	90000 & upwards	96330	1491	1 : 64

The following table, formed from a larger number of observations on infants after respiration, confirms the conclusions to be drawn from the foregoing table.

TABLE XV.

Number of Observations.	Weight of Body.	Average weight of Body.	Weight of Lungs.	Proportion.
2	10000—20000	18535	533	1 : 34
59	20000—30000	27079	863	1 : 31
141	30000—40000	34614	1061	1 : 32
69	40000—50000	43448	1136	1 : 38
32	50000—60000	54020	1318	1 : 41
15	60000—70000	64581	1603	1 : 4
9	70000—80000	76127	1378	1 : 55
2	80000—90000	88041	2193	1 : 40
3*	90000 & upwards	113783	3273	1 : 34

From these tables it appears, that, though the weight of the lungs increases with the weight of the body, that increase is by no means regular, but that the proportion of the lungs to the body decreases as the weight of the body increases. The irregularity which is seen in both these tables would probably disappear on the addition of a larger number of facts. It appears, then, that we are not jus-

* These high numbers belong to children who had survived their birth a very considerable time.

tified in assuming that the weight of the lungs, either before or after respiration, bears any fixed relation to that of the body.

But this question as to the proportion existing between the weight of the lungs and that of the body admits of a much more simple and satisfactory solution ; viz. by comparing two observations in which the weight of the body is the same, and noting the difference in the weight of the lungs ; or, *vice versa*, by taking the same weight of lungs, and noting the difference in the weight of the body. This comparison is made in the following tables, which are formed from observations on still-born infants at full term.

Table XVI.

Male.			Female.			Male & Female compared.		
Body.	Lungs.	Propor.	Body.	Lungs.	Propor.	Body.	Lungs.	Propor.
56631	1364	1 : 41	59018	1093	1 : 57	62769	852	1 : 74
	1280	1 : 44		937	1 : 63		1191	1 : 53
49806	892	1 : 55	57313	1193	1 : 48	55605	1023	1 : 54
	852	1 : 58		814	1 : 70		772	1 : 72
47882	880	1 : 54	44020	633	1 : 70	45364	1193	1 : 38
	710	1 : 68		571	1 : 77		649	1 : 70
40931	896	1 : 46	33981	682	1 : 44	30243	1112	1 : 27
	726	1 : 56		575	1 : 59		633	1 : 48

Table XVII.

Male.			Female.			Male & Female compared.		
Lungs.	Body.	Propor.	Lungs.	Body.	Propor.	Lungs.	Body.	Propor.
1193	66525	1 : 55	859	68230	1 : 80	896	49806	1 : 55
	45373	1 : 38		51852	1 : 60		38614	1 : 43
1148	57825	1 : 50	772	55605	1 : 72	860	62769	1 : 73
	42476	1 : 37		33981	1 : 42		51852	1 : 60
860	62769	1 : 74	688	53898	1 : 78	852	49806	1 : 58
	49806	1 : 58		38891	1 : 57		68230	1 : 80
741	45565	1 : 61	633	46735	1 : 74	741	30274	1 : 41
	30274	1 : 41		30243	1 : 48		47110	1 : 63

From these tables we gather the fact, that for the same weight of body the lungs vary within wide limits, and conversely, for the same weight of lungs the body varies within wide limits, the difference in more than one instance amounting to upwards of one-third. These facts, with others which might have been adduced, prove that for the same weight of body the lungs of the male are generally heavier than those of the female, and, on the other hand, that, for the same weight of lungs, the body of the female is often heavier than that of the male. In other terms, the lungs are proportionally smaller in the female than in the male.

The following table exhibits some of the more striking facts of the same kind in children after respiration.

TABLE XVIII.

Male.			Female.			Male & female compared.		
Body.	Lungs.	Propor.	Body.	Lungs.	Propor.	Body.	Lungs.	Propor.
39000	1344 757	1 : 29 1 : 52	41595	1390 780	1 : 30 1 : 53	41595	1390 785	1 : 30 1 : 53
25485	1235 664	1 : 21 1 : 38	54585	950 695	1 : 57 1 : 78	31664	741 1544	1 : 43 1 : 21
33981	1390 880	1 : 24 1 : 39	31664	1544 664	1 : 21 1 : 48	26258	1151 664	1 : 23 1 : 40
36298	1544 1004	1 : 24 1 : 36	30119	1313 710	1 : 23 1 : 42	25485	1235 541	1 : 21 1 : 47
37070	1853 1142	1 : 20 1 : 32	32436	1544 494	1 : 21 1 : 66	27802	772 1158	1 : 36 1 : 24

The results of this table are still more striking than those of the preceding one, though they are such as we should naturally expect when, to the original difference of weight of the lungs and body before respiration, is added the variable effect of the process of respiration itself. In more than one of the instances adduced, the weight of the body remaining the same, the weight of the lungs in one child is twice as large as in another, and in one example more than three times as large. Such anomalies as these meeting us at the very threshold of our inquiry into the value of Ploucquet's test, are sufficient of themselves to shake our confidence in it, and there is little reason to expect that a more minute examination will re-establish it in our favour. It is not, therefore, so much in the hope of finding Ploucquet's test more useful than it now promises to be, as with a view of completing the task I have undertaken, that I continue this inquiry.

There is one fact worth observing, partly on its own account, and partly from its connection with the present inquiry, viz. that the weight of the body is considerably greater in still-born children than in children who have respired. This will appear from the following table, in which the weights of the body before respiration, and in children of one day old are compared. The numbers of observations employed in forming the table are as follows :

Male before respiration,	44	After respiration,	31
Female do. .	37	do. .	22
Male and female do.	96	do. .	63

TABLE XIX.

	Male.		Female.		Male and Female.	
	Before Respiration.	After Respiration.	Before Respiration.	After Respiration.	Before Respiration.	After Respiration.
Max.	95,520	77,000	87,336	57,313	97,140	78,912
Min.	30,243	22,396	30,243	19,307	27,030	19,307
Mean,	52,461	43,527	50,831	38,821	51,685	44,266

The mean weight of the bodies of still-born children exceeds the mean weight of such as have lived one day by from about one-sixth to somewhat less than one-third. The natural inference from this fact is, that large children are most apt to perish in the birth. The bearing of the fact upon the value of Ploucquet's test is obvious; for on the supposition, that the weight of the lungs in the child who has lived one day, is so far increased by the process of respiration as to equal the weight of the lungs in the heavier still-born child,—a supposition which a glance at Table XI. will render highly probable,—then the increased weight of the body of the still-born child will have the effect of exaggerating the disproportion between the weight of the lungs and that of the body, and giving to the test a higher value than it deserves.

Another fact worth observing, in connection with Ploucquet's test is, that the weight of the lungs is subject to much greater variation than that of the body. Thus in still-born male children, at full time, the maximum weight of the body is 95520 grains, the minimum 30243; whilst the maximum weight of the lungs in the same children is 1800, and the minimum 360 grains. The variation in the weight of the lungs as compared with that of the body, is nearly expressed by the proportion 30 : 19. Nearly the same difference is observable in the body and lungs respectively in the female, and in the two sexes taken together. When respiration has continued one day, this proportion becomes for the male 32 : 21, for the female 4 : 3, and for the two sexes jointly, about 3 : 2. The influence of this fact on Ploucquet's test is not very important. By correcting the large variations in the weight of the lungs by the smaller variations in that of the body, it will bring the proportion existing between the two into somewhat narrower limits.

The facts which have just been adduced,—the great variation in the weight of the lungs, that of the body remaining the same; and the equal variation in the weight of the body, that of the lungs remaining the same; the disproportion in the weight of the body in still-born children, and in those who have survived their birth one day; and the great variations observed in the weight of the lungs both before and after respiration,—these facts would lead us to expect such variations in the proportion which the lungs bear to the body, as must effectually destroy all hope of any practical advantage to be derived from Ploucquet's test. The inferences drawn from these data are abundantly confirmed by the more careful examination, into which I am now about to enter. The several questions are discussed in the same order which has already been observed in examining the absolute weight of the lungs.

The first question is, what is the proportion existing between the weight of the lungs and that of the body in still-born infants at full term? For the solution of this question the numbers of facts employed are as follow: male, 44; female, 37; male and female, 96.

Table XX.

Before Respiration.

	Male.	Female.	Male and Female.
Maximum,	1 : 24	1 : 36	1 : 24
Minimum,	1 : 176	1 : 119	1 : 176
Mean,	1 : 52	1 : 62	1 : 56

In one case mentioned by Lécieux, the proportion was as low as 1 : 200; but in this instance, the lungs are stated to have been compressed. The proportion of 1 : 176 occurred in a case related by Devergie, in which artificial respiration had been employed. The proportion next greater than this is 1 : 81, so that 1 : 176 may be justly regarded as an exception to the rule. In the female the proportion next greater than 1 : 119, is 1 : 94. In those cases where the sex is not stated, there is one proportion as low as 1 : 99. The maxima and mean numbers confirm the statement already made, that the lungs are less developed as compared with the body in the female than in the male. The following table, corresponding with Table II. gives the proportion between the lungs and body at 6, 7, and 8, months of fœtal life. The number of observations employed is as follows: 6th month, male 7, female 6, male and female 13: 7th month, male 10, female 12, male and female 24: 8th month, male 17, female 12, male and female 34.

Table XXI.

	6th Month.			7th Month.			8th Month.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M. & F.
Max.	1 : 35	1 : 19	1 : 19	1 : 27	1 . 25	1 : 25	1 : 27	1 : 27	1 : 27
Min.	1 : 58	1 : 56	1 : 58	1 : 62	1 : 56	1 : 78	1 : 132	1 : 98	1 : 132
Mean,	1 : 39	1 : 40	1 : 39	1 : 40	1 . 38	1 : 41	1 : 46	1 : 44	1 : 45

From this table it appears that the proportion which the lungs bear to the body at 6, 7, and 8 months, is greater than at 9 months; in other words, that the lungs are proportionably more developed at the earlier periods of gestation than at the full term. The numbers in the table are merely approximations, as the facts are not sufficiently numerous to establish a true average.

The following table corresponds with Table III., and presents the maxima, minima, and mean results for the two sexes taken together at 6, 7, 8, and 9 months, and before respiration.

Table XXII.

	6th Month.	7th Month.	8th Month.	9th Month.
Maximum,	1 : 19	1 : 25	1 : 27	1 : 24
Minimum,	1 : 58	1 : 78	1 : 132	1 : 176
Mean,	1 : 39	1 : 41	1 : 45	1 : 56

Having now examined Ploucquet's test in the still-born, I proceed to construct similar tables for children that have respired; and, in the first place, in respect of children that have lived one month or less. The number of observations employed in constructing this table is as follows: male 162; female 124; male and female 314.

Table XXIII.

	After respiration.		
	Male.	Female.	Male and Female.
Maximum,	1 : 19	1 : 19	1 : 19
Minimum,	1 : 132	1 : 96	1 : 132
Mean,	1 : 35	1 : 43	1 : 38

In the males the proportion next greater than 1 : 132 is 1 : 119; and the next in order, 1 : 80. In the case of the females, the proportion next above 1 : 96 is 1 : 85. On the other hand, the proportion next less than 1 : 19 is 1 : 20 for the male, and 1 : 21 for the female.

The following table corresponds with Table V., and exhibits the proportion between the weight of the lungs and that of the body at 6, 7, and 8 months respectively.

Number of observations: 6 months, male 5, female 10, male and female 15: 7 months, male 17, female 14, male and female 36: 8 months, male 19, female 18, male and female 40.

Table XXIV.

	6th Month.			7th Month.			8th Month.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M.&F.
Max.	1 : 18	1 : 17	1 : 17	1 : 18	1 : 23	1 : 18	1 : 24	1 : 20	1 : 20
Min.	1 : 108	1 : 65	1 : 108	1 : 69	1 : 59	1 : 69	1 : 80	1 : 104	1 : 104
Mean,	1 : 30	1 : 34	1 : 33	1 : 41	1 : 35	1 : 38	1 : 36	1 : 36	1 : 36

The want of uniformity in this table may be attributed probably to the small number of observations employed in constructing it. The proportions 1 : 108 and 1 : 104, may be considered, perhaps, as exceptions to the rule, for the proportion next greater than 1 : 108 is 1 : 44; and the proportion next greater than 104 is 1 : 53.

Table XXV. exhibits the proportion between the weight of the lungs and that of the body, for the two sexes taken together, at 6, 7, 8, and 9 months.

TABLE XXV.

	6 months.	7 months.	8 months.	9 months.
Maximum,	1 : 17	1 : 18	1 : 20	1 : 19
Minimum,	1 : 108	1 : 69	1 : 104	1 : 132
Mean,	1 : 33	1 : 38	1 : 36	1 : 38

For the reasons already stated, when speaking of the absolute weight of the lungs; the numbers contained in Table XXIII. are insufficient for medico-legal purposes. To insure the accuracy required for such investigations, it is necessary to ascertain the proportion which the weight of the lungs bears to that of the body, when respiration has continued a larger or a shorter period. With this view I have made the following table, which corresponds with Table VII.

No of observations.	1 hour and less;	male 9, female 8, male and female 27.
Do.	More than 1 hour, and less than 12.	male 9, female 8, male and female 19.
Do.	More than 12 hours, and less than 1 day.	male 8, female 7, male and female 16.

TABLE XXVI.

	Less than 1 hour. M.	F.	M. & F.	12 hours. M.	F.	M.&F.	1 day. M.	F.	M.&F.
Max.	1 : 30	1 : 26	1 : 26	1 : 20	1 : 30	1 : 20	1 : 27	1 : 30	1 : 27
Min.	1 : 119	1 : 78	1 : 119	1 : 132	1 : 96	1 : 132	1 : 55	1 : 78	1 : 78
Mean,	1 : 50	1 : 42	1 : 51	1 : 51	1 : 56	1 : 53	1 : 38	1 : 44	1 : 39

The average values in this table agree with the averages in Table VII. They show that the weight of the lungs, as compared with the body, is somewhat greater where respiration has continued less than one hour, than where it has lasted twelve hours; but that when it has continued more than twelve hours and less than one day, it is considerably increased.

The following table, which is the counterpart of Tables VIII. and IX., shows the proportion which the weight of the lung bears to that of the body for the several periods mentioned in the table:—

Table XXVII.

Age.	No. of Obs.			Male.			Female.			Male and Female.		
	M	F.	M.& F.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.
1 day,	32	23	65	1 : 25	1 : 132	1 : 49	1 : 26	1 : 96	1 : 44	1 : 20	1 : 132	1 : 48
2 days,	14	5	21	1 : 30	1 : 60	1 : 41	1 : 49	1 : 85	1 : 56	1 : 30	1 : 85	1 : 44
3 days,	9	9	23	1 : 23	1 : 48	1 : 35	1 : 25	1 : 62	1 : 36	1 : 20	1 : 62	1 : 33
4 days,	17	14	34	1 : 20	1 : 48	1 : 33	1 : 21	1 : 60	1 : 37	1 : 20	1 : 60	1 : 34
5 days,	9	11	20	1 : 23	1 : 45	1 : 33	1 : 25	1 : 56	1 : 38	1 : 23	1 : 56	1 : 35
6 days,	9	7	18	1 : 25	1 : 52	1 : 32	1 : 29	1 : 44	1 : 35	1 : 25	1 : 52	1 : 35
7 days,	6	7	13	1 : 28	1 : 44	1 : 37	1 : 21	1 : 43	1 : 30	1 : 21	1 : 44	1 : 33
1 week,	97	77	202	1 : 20	1 : 132	1 : 38	1 : 21	1 : 96	1 : 40	1 : 20	1 : 132	1 : 39
2 weeks,	51	37	88	1 : 19	1 : 55	1 : 32	1 : 19	1 : 66	1 : 31	1 : 19	1 : 66	1 : 32
3 weeks,	9	4	14	1 : 20	1 : 35	1 : 28	1 : 24	1 : 37	1 : 32	1 : 20	1 : 49	1 : 31
4 weeks,	4	7	11	1 : 19	1 : 44	1 : 26	1 : 22	1 : 43	1 : 30	1 : 19	1 : 44	1 : 27

This table confirms the results deduced from Tables VIII. and IX., and shows that the weight of the lungs, as compared with that of the body, increases with the duration of respiration, and the consequent perfection of the respiratory process. The irregularities observable in the first part of the table may be fairly attributed to the small number of observations. These irregularities almost entirely disappear in the second part, where the observations are more numerous, and the periods of time and the intervals between them greater.

Having thus examined Ploucquet's test, both before and after respiration, I now proceed to compare the results obtained before respiration with those obtained after respiration. For this purpose I have arranged the following table, which is the counterpart of Table XI.

Table XXVIII.

	Before respiration.	After respiration.			
		Less than 1 hour.	12 hours.	1 day.	1 day and less.
Max. .	1 : 24	1 : 26	1 : 20	1 : 27	1 : 20
Min. .	1 : 176	1 : 119	1 : 132	1 : 78	1 : 132
Mean,	1 : 56	1 : 56	1 : 53	1 : 39	1 : 48

This table places in a very forcible light the real value of Ploucquet's test. It shows how greatly its advantages have been exaggerated, and adds another example to the many already on record of the futility of theories grounded upon one or two facts. Instead of Ploucquet's proportion of 1 : 70 before respiration, and 1 : 35 after respiration, we have 1 : 56 before respiration, and 1 : 51 after respiration has continued one hour or less, and 1 : 53 when it has lasted twelve hours. Now it is precisely at this early period after birth that the crime of infanticide is most commonly committed ; and to decide the question whether or not the child has breathed, we must make use of averages which differ so little as 1 : 56 and 1 : 53 or 51. Even in a case in which a child has been proved to have lived one day, we have no greater difference than 1 : 56 and 1 : 39, and this an average difference, with a wide interval between the extreme proportions. A glance at the table will show how little advantage can be gained by an employment of the extreme values as standards of comparison.

There now only remains to contrast the proportion existing between the weight of the lungs and that of the body at six, seven, eight, and nine months. This contrast will be formed by combining Tables XXII. and XXV.

Table XXIX.

	6th month.		7th month.		8th month.		9th month.	
	Before resp.	After resp.	Before resp.	After resp.	Before resp.	After resp.	Before resp.	After resp. 1 day.
Max.	1:19	1: 17	1:25	1:18	1: 27	1: 20	1: 24	1: 20
Min.	1:58	1:108	1:78	1:69	1:132	1:104	1:176	1:132
Mean,	1:39	1: 33	1:41	1:38	1: 45	1: 36	1: 56	1: 48

This table appears at first sight to confirm an observation already made by Devergie as the result of his own tables, viz. that the process of respiration is more completely established in the immature than in the mature fœtus. There can be no doubt that, both before and after respiration, the lungs of the immature fœtus bear a larger proportion to the body than they do at full term; but there is some room to doubt whether the process of respiration is more complete in the earlier periods. It is difficult, indeed, to make any comparison sufficiently exact to determine this question, for the duration of respiration in the immature children varies greatly, some having lived some hours, others some days, and the observations are not sufficiently numerous to allow of minute subdivision. On comparing, however, the results for 6, 7, and 8 months, with those obtained for children at full term, who have lived one month or less, we find that the averages are 1 : 33, 1 : 38, 1 : 36, and 1 : 38, respectively. Hence there is some slight ground for believing with Devergie, that the process of respiration (as far as the increased weight of the lungs may be considered a test of more perfect respiration) is more complete in the early periods of gestation, but, as the difference in the proportion before and after respiration is nearly the same for 6, 7, 8, and 9 months, we may consider this observation of Devergie to stand in need of further confirmation.

The observations which have been already made when speaking of the absolute weight of the lungs, are fully borne out by the facts just adduced in illustration of Ploucquet's test. Both orders of facts have an important bearing on a physiological and medico-legal question, which are closely connected, and are commonly discussed together. The physiological question virtually involves the practical one, but both may be decided by the same facts. The physiological question is this,—What effect has respiration on the supply of blood to the lungs? To what extent does it affect the weight of these organs? is the practical question.

A few observations on each of these questions in the order in which they are proposed, will bring this essay to a conclusion.

And, *first*, with regard to the physiological question—What effect has respiration on the supply of blood to the lungs? Few facts in physiology are better established than the intimate connection existing between the functions which an organ performs, and the quantity of blood which it receives, and, as a general rule, it may be stated that the more important these functions, the larger the supply of blood. It is but natural, therefore, to expect that, where an organ has no functions to perform, it will receive no more blood than is necessary to keep it alive, and preserve it as a part of the system to which it belongs. Now this is precisely the case with the fœtal lungs. Until respiration is established they have no function to perform, and it has been, therefore, somewhat hastily assumed that they receive a very limited supply of blood. This reasoning is specious but not sound; for there is no real analogy between the lungs and those organs of the body which are dependent upon their supply of blood for the due performance of their functions. The rule which applies to secreting organs, does not hold good when it is extended to viscera, which merely serve as reservoirs of blood. Now, the peculiar function of the lungs is that of exposing a large quantity of blood to the atmospheric air. Regarded in this light, there seems no sufficient reason for assuming that the lungs contain much less blood before respiration than after respiration. If a free flow of blood through the lungs be necessary to the support of life when respiration is once established, a full supply of blood seems equally necessary when that important function is about to be called into play. Nor does the peculiar character of the fœtal circulation place any great difficulty in the way of the supposition that the lungs, even before respiration, contain a considerable quantity of blood; for though the blood be not circulated through the lungs so rapidly before as it is after respiration, there is no physical obstacle to an accumulation of blood in the lungs preparatory to the establishment of the respiratory process. But it is not by *à priori* reasonings that such questions as this can be satisfactorily decided. In this, as in all other cases, an appeal to facts is the only means of coming to a decision. Now the facts contained in the tables prove beyond a doubt that the process of respiration does in some degree increase the weight of the lungs. But this increase of weight is so inconsiderable, as to militate strongly against the general opinion, that the fœtal lungs are nearly destitute of blood. It follows, therefore, that though the process of respiration does cause the lungs to receive an increased quantity of blood, it finds them already amply supplied with it; for there can be no doubt that the weight of the lungs before respiration very greatly exceeds the weight of their structure alone; a fact which can be accounted for only on the supposition that their vessels contain a very large quantity of blood.

This fact being established beyond the reach of doubt on the authority of the tables, a question arises, whether this large quantity of blood is always contained in the lungs, or merely enters them during the birth? There are no precise data for solving this question; but it seems highly probable, that, during or immediately after the birth of still-born children, the lungs may be gorged with blood. On the supposition that ineffectual efforts to respire are made by many still-born infants, it will not be difficult to explain the gorged state in which their lungs are sometimes found. These efforts consist in a raising of the ribs, and depression of the diaphragm, which tend to leave a vacuum in the chest,—a vacuum which must be continually prevented by the enlargement of some of the contents of the chest. Now the lungs are organs peculiarly susceptible of this increase of size, and will admit of easy expansion by the blood, which the heart is continually throwing out. It is not unreasonable, therefore, to suppose that, when these efforts to respire prove ineffectual in consequence of some impediment to the entrance of the air by the mouth or glottis, the blood should find its way into the lungs, instead of the air, which is excluded. This supposition derives strong confirmation from facts, which must have fallen under the observation of all those who have been in the habit of inspecting the bodies of infants. Thus in one case which I had an opportunity of examining, the lungs, though in a fœtal state, throughout, with the exception of three or four small points on the upper lobe of the right lung, were gorged with blood, and weighed no less than 1178 grains Troy. Here the child had given three distinct gasps merely, and the air had scarcely found its way into the lungs at all; but, nevertheless, they were found full of blood. I have observed a similar turgescence of the lungs in cases of still-birth. There is a close analogy, indeed, between the effect of abortive efforts at respiration in the infant, and similar abortive efforts in the adult. Thus in cases of suffocation, the efforts at inspiration have the effect of gorging the lungs with blood, though the air is prevented from entering, and some of the heaviest lungs of infants on record are those which have perished by suffocation. One instance of this sort has already been cited. But though it cannot be doubted, that the lungs do receive blood in considerable quantity before respiration takes place, yet the facts collected prove that the quantity is increased by the act of respiration, at first but slightly, after some hours or days more considerably. The tendency of respiration, therefore, is to add to the weight of the lungs; but, as respiration often continues for hours or days, nay, even for weeks, in a very imperfect manner, the full effect of respiration is not produced in the early periods of life; and comparatively few cases occur in which the lungs are found completely and universally permeated with air. On a future occasion I propose discussing this subject by the aid of single facts,—I content myself at present with more general results, and the conclusions which my reading or experience has forced upon me. The following general proposition seems to be warranted by the results of the tables and by experience of individual facts.

The fœtal lungs contain a considerable quantity of blood, and that quantity is not greatly increased by the process of respiration.

One other fact established by the tables is too interesting to be passed over in silence; viz. that, whereas the weight of the lungs is increased on the first establishment of the respiration, it is diminished when respiration has continued more than one hour, and less than twelve, and again increased when the child has lived more than twelve hours, and less than one day. This, though it appear paradoxical, may really admit of explanation, if it be allowed that the first efforts to respire, whether successful or not, are of necessity accompanied by an engorgement of the lungs, which passes off as the process becomes more completely established; and that, when the respiration has continued for a still longer period, the lungs receive a still larger quantity of blood, and a still further increase of weight.

These observations are open to the obvious objection, that the facts from which the tables are formed are not strictly comparable, nor sufficiently numerous. This objection, of which I am far from denying the force, may be met by a further appeal to individual facts, which I reserve for a future occasion.

If the facts are allowed to be sufficiently numerous, the practical question with regard to the value of the absolute weight of the lungs, and their weight as compared with that of the body, (Ploucquet's test), as tests of respiration, is already decided; and the following proposition will present a summary of the results obtained. *The static lung tests are utterly useless for all practical purposes, and ought not to be relied on in medico-legal inquiries.*

In a future essay I propose to examine the hydrostatic lung test, and to detail one or two cases of some interest which have come under my own observation.

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ADDITIONAL OBSERVATIONS

ON THE

STATIC LUNG TESTS.

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In a former number (No. 148) of the Edinburgh Medical and Surgical Journal, I examined the static lung tests by the aid of a larger number of observations than had previously been made available for that purpose, and I arrived at conclusions extremely unfavourable to the future employment of these tests in medico-legal inquiries. I now proceed to contrast the smaller groups of observations, collected by the several authors whose works I have laid under contribution, and to detail a few facts of interest which have come under my own notice. By this means some of the objections which lie against the conclusions contained in my former essay may be removed, and such statements as are well-founded may be confirmed. I shall treat the static lung tests in the same order as in the former essay, beginning with the absolute weight of the lungs.

The following table presents the highest, lowest, and average weight of the lungs of mature still-born children, and of children who survived their birth one month or less. The sex is either not stated, or the two sexes are thrown together.

TABLE XXX.

Name of Author.	No. of Obs. Before Resp.	No. of Obs. After Resp.	Before Respiration. Max.	Before Respiration. Min.	Before Respiration. Mean.	After Respiration. Max.	After Respiration. Min.	After Respiration. Mean.
Haartmann, .	4	7	1534	1066	1257	1619	1023	1327
Jörg, . .	2	3	677	612	645	1133	766	945
Eisenstein and Zebitsch,	7	18	1185	369	812	1537	616	980
Schmitt, .	36	27	1661	553	1056	2132	695	1271
Lécieux, . .	29	237	1636	340	773	2440	432	1048
Procès Verbal, &c.	5	13	1112	463	685	1514	476	976
Orfila, . .	5	5	586	448	528	1344	619	884
Devergie,* .	5	2	1011	360	771	1262	1019	1140
Taylor, . .	5	4	687	586	645	774	562	676
Dr Guy, .	3	3	1480	632	920	1178	510	805
Table I. and IV. .	109	322	1661	340	874	2440	432	1072

A single glance at this table will show the great difference which exists between all the values derived from small groups of observations, the insufficiency of the data hitherto employed in discussing the value of the static lung tests, and the consequent necessity for a more extended induction. My former essay was intended to supply this want as far as existing materials would permit; the present essay may serve to show that the necessity for a larger number of observations has not been exaggerated. On a closer inspection of the table it will be seen that the maximum weight of the lungs of still-born children is, according to the observations of Schmitt, as high as 1661 grains, and according to Orfila, as low as 586; the former number being nearly three times as great as the latter. In like manner the smallest weight observed in four still-born children by Haartmann is 1066 grains; the smallest number recorded by Lécieux is 340; the former number being more than three times as great as the latter. The average numbers present, as might be expected, less disparity, but the highest number is more than twice as great as the lowest.

If we now examine the second column of the table, we discover differences of nearly the same amount. The column of maxima presents 2440 as the highest number, and 774 as the lowest; the former being more than three times as great as the latter. In the column of minima, the highest number is more than twice as great as the lowest, whilst the least average is little less than half the highest.

That these differences are entirely due to the small number of facts collected by the several authors, and not to any error of cal-

* In the former essay, the maximum 1800 is given on the authority of Devergie. This is an error, the highest number observed by him in healthy lungs being 1011. In a case of œdema of the lungs the weight was 1537. The maximum before respiration, therefore, is on the authority of Schmitt, 1661.

culation, will at once appear if we compare the numbers in the several colmns. Thus, if 1661 appear too high a value for the lungs of a still-born child, the fact that Lécieux and Haartmann have recorded numbers as high as 1636 and 1534 respectively will at least lessen the improbability ; and if these latter numbers, reduced from French and German weights, seem exaggerated, they receive strong confirmation from the highest number which has fallen under my own notice, viz. 1480. In like manner, the small numher 586, (the maximum recorded by Orfila on his own authority), is to a certain extent confirmed by the low values obtained by Jörg and Mr Taylor. The same observations apply to the other columns. Hence it appears that the different values presented in the table are due solely to the cause now assigned,—the small number of facts from which they have been obtained.

A comparison of the weight of the lungs before and after respiration shows differences not less worthy of note between the values obtained by different observers. The maxima in the still-born, in more than one instance, fall but little short of the maxima in children who had lived one month or less, whilst in one case, the highest number in the still-born greatly exceeds the highest number in those born alive. This occurs in my own observations, which give 1480 before, and 1178 after, respiration. Again there are no less than three instances in which the minima in the still-born exceed the minima in those born alive. In one instance (that of my own observations) the average number before respiration exceeds the average after respiration by no less than 115 grains. In other instances, the difference, though on the other side, is extremely small. To show the total insufficiency of small numbers of facts, it will suffice to compare the observations of Mr Taylor with my own. The highest weight in five facts collected by Mr Taylor is 687 grains; the maximum of three observations of my own is 1480, or more than twice that number. Mr Taylor's average before respiration falls short of his average after respiration by 31 grains ; my own average for the still-born exceeds the average in children born alive by no less than 115 grains.

These remarks have an important practical bearing. In a court of law, a medical witness may be asked for the result of his own experience—his personal experience—as to the weight of the lungs before and after respiration, and the consequent value of a given weight of lungs in an individual instance as a sign of live or still-birth. If this question were addressed in turn to each of the authors named in the table, how widely different would be their answers ! If the word experience has any precise meaning, the numbers in the table represent that experience in the case of the several authors whose names are mentioned ; and the answer which they must give to the question proposed is already expressed by the figures themselves. The decision of the majority would be, that the weight of the lungs is not much greater after respiration than before it; one author, at least, would be bound to represent the weight as nearly the same before and after respiration; and my own personal experience would be opposed to that of all the rest in representing the weight of the lungs before respiration as exceeding by a considerable fraction their weight after respiration. It appears, then, that no medical witness can be justified in laying any stress whatever on his own personal experience in questions of this kind; and that if his personal experience be appealed to, he is bound to guard against the errors to which it may lead by pointing out its utter insufficiency. When it is recollected that the table contrasts the weight of the lungs of still-born children with that of the lungs of children who have lived one month or less, and that the crime of infanticide is generally committed soon after birth, when the process of respiration has often barely commenced, and is extremely imperfect, it will be quite unnecessary to say more in condemnation of the absolute weight of the lungs, as a test of respiration. The personal experience of all observers, if it do not condemn the general statement, that the weight of the lungs is materially increased by respiration, will at least reject the application of the theory to individual cases, and for medico-legal purposes.

According to the general and loose statement of authors, the weight of the lungs before respiration is about one ounce, or 480 grains, and after respiration, two ounces, or 960 grains. It is always extremely difficult to determine on whose authority such general statements as these are put forth. The only author whose observations give any countenance to such an estimate is Orfila, whose averages are not very remote from the assumed weights before and after respiration; but if the much higher authority of Schmitt be taken as our guide, the weight before respiration will be nearly doubled, and that after respiration increased by little less than one-half. A mere inspection of the table will show how far this general estimate of authors is remote from the truth.

As this subject is one of too much importance to be dismissed so long as any means remain unemployed by which its true bearings may be ascertained, I have endeavoured still farther to test the value of the static lung tests by arranging the numbers before and after respiration in children at full term in two columns, and comparing them with each other. This comparison, as might be expected, shows that by far the majority of the numbers occurring in the still-born have their counterparts in observations made in children who have survived their birth. Thus, the numbers 1534, 1492, 1480, 1449, 1364, 1297, &c. occur both before and after respiration. In like manner, the numbers 494, 510, 541, 556, 571, &c. are met with both in the still-born, and in those born alive. Again, there are only eight observations on children who have survived their birth one month or less, in which the number exceeds 1661, the maximum before respiration; in other words, assuming 1661 to be the real maximum in the still-born, there are only eight instances on record in which we should have been justified in asserting from the weight of the lungs alone that the child had survived its birth; and if we limit the comparison to those who have lived one day or less, this number dwindles down to one. On the other hand, there are only three instances recorded, in which the weight of the lungs in the still-born fell short of their weight in those who survived their birth; or, in other words, only three cases in which, assuming 432 to be the real minimum after respiration, the weight of the lungs alone would have sufficed to decide the question of live or still-birth. It is impossible to place in a more striking light the utter inutility of the average absolute weight of the lung as a test of respiration.

I now proceed to examine the weight of the lungs compared with that of the body, or Ploucquet's test, and in doing so shall follow the same steps which I have already taken in discussing the value of the absolute weight of the lungs. The following table presents the values obtained from the observations collected by the several authors whose names are given. Here, as in the former table, no distinction of sex is made,—the observations on males and females being all thrown together:—

TABLE XXXI.

Name of Authors.	No. Obs. Bef. rn.	af. rn	Before Respiration. Max.	Min.	Mean.	After Respiration. Max.	Min.	Mean.
Haartmann,	4	7	1 : 40	1 : 65	1 : 57	1 : 39	1 : 77	1 : 54
Jörg,	2	3	1 : 61	1 : 64	1 : 62	1 : 39	1 : 64	1 : 49
Schmitt,	36	28	1 : 34	1 : 81	1 : 58	1 : 23	1 : 78	1 : 43
Lécieux	29	237	1 : 24	1 : 176	1 : 65	1 : 19	1 : 132	1 : 37
Procès Verbal, &c.	5	13	1 : 27	1 : 86	1 : 58	1 : 21	1 : 71	1 : 45
Orfila,	5	5	1 : 50	1 : 99	1 : 72	1 : 32	1 : 53	1 : 44
Devergie,	5	2	1 : 34	1 : 176	1 : 74	1 : 38	1 : 49	1 : 43
Taylor,	5	4	1 : 49	1 : 91	1 : 63	1 : 41	1 : 82	1 : 53
Dr Guy,	3	3	1 : 46	1 : 74	1 : 60	1 : 55	1 : 65	1 : 60
Table XX. XXIII.	96	314	1 : 24	1 : 176	1 : 57	1 : 19	1 : 132	1 : 38

This table, like the former one, places in a strong light the insufficiency of small numbers of facts, and of the personal experience founded upon them. The several values differ widely from one another; some giving nearly the same proportion before and after respiration, and others presenting a difference nearly as great as that laid down by Ploucquet, viz. 1 : 70 before respiration and

1 : 35 after respiration. The most marked differences exist in the observations of Lécieux, Orfila, and Dévergie; the remainder are much less considerable. The small group of facts collected by Haartmann gives nearly the same values before and after respiration, and the same remark applies to the results of my own observations. The average values obtained from Mr Taylor's facts and from my own are worthy of notice, and of comparison with the numbers in the first table. On referring to this table it will be seen that the average weight of the lungs before and after respiration differs very slightly in Mr Taylor's observations, whilst in my own the weight of the lungs in the still-born infant greatly exceeds that of children born alive; but a reference to the last table shows that the proportion which the weight of the lungs bears to that of the body in Mr Taylor's observations is much less before than after respiration, and that in the case of my own observations the proportion is exactly the same. This circumstance is easily explained by the aid of a fact established in my former essay, viz. the greater weight of the body of the still-born infant. The average weight of the bodies of the five still-born infants examined by Mr Taylor greatly exceeds the average weight of the four who survived their birth, the former being to the latter as about 41 to 36; and in my own observations the weight of the still-born is to that of those born alive as 10 to 9 nearly. It is this great disparity of weight which has made the average proportions before and after respiration to differ much more than the absolute weight of the lungs in Mr Taylor's observations, and this same disparity has equalized the proportions obtained from my own facts. Here, then, is an obvious advantage of Ploucquet's test over the absolute weight of the lungs; and if the question to be decided was, which of the two should be preferred, there can be little doubt to which the superiority ought to be assigned.

The superior value of Ploucquet's test is still further shown by comparing the several proportions before and after respiration, in the same manner as the absolute weights of the lungs before and after respiration have already been contrasted. From this comparison it results, that whereas there were only eight instances in which the maximum weight of the lungs after respiration exceeded the maximum weight before respiration, there are no less than 29 instances in which the proportion which the lungs bear to the body is greater after respiration than before; that is to say, there are 29 instances in which, assuming the proportion 1 : 24 to be the true maximum, we could state with certainty that respiration had taken place. On the other hand, there is only one instance in which the proportion of the lungs to the body is less before respiration than the least proportion observed in children born alive;

in other words, there is only one case recorded in which, assuming 1 : 132 to be the real minimum after respiration, we should have been justified in asserting that respiration had not taken place. It appears, then, that Ploucquet's test has some advantage over the absolute weight of the lungs. But this advantage is gained, so to speak, at the expense of the very principle on which a numerical test ought to be founded, viz. an exact equality in all those particulars in which equality is attainable. In employing the weight of the lungs, or their weight as compared with that of the body, as a test of respiration, we compare an individual observation with an average previously ascertained; but this average has been shown to vary with the weight of the body, the weight of the lungs increasing more slowly than the weight of the body, and the proportion which the one bears to the other diminishing as the weight of the body increases. Hence, in order to construct a correct standard of comparison, we ought to contrast the weight of the lungs, both absolute and relative, before and after respiration for different weights of the body. This is done by combining tables XIV. and XV.*

Table XXXII.

No. of Obs. Before Resp.	No. of Obs. After Resp.	Weight of Body.	Average weight of Body Before Resp.	Average weight of Body After Resp.	Weight of Lungs Before Resp.	Weight of Lungs After Resp.	Proportion Before Resp.	Proportion After Resp.
1	60	20000—30000	27030	26888	541	869	1 : 50	1 : 31
23	138	30000—40000	35263	34638	714	1061	1 : 49	1 : 32
27	69	40000—50000	44932	43549	744	1141	1 : 60	1 : 38
21	29	50000—60000	55555	54021	996	1332	1 : 56	1 : 40
17	14	60000—70000	64679	64251	1032	1431	1 : 63	1 : 45
4	9	70000—80000	77382	76127	1317	1379	1 : 58	1 : 55
1	2	80000—90000	87336	88041	1226	2193	1 : 71	1 : 40
2	3	90000 & upwards	96330	113783	1491	3273	1 : 64	1 : 34

If, after the observations which have been made on the static lung tests, any doubt temains of the inutility of these tests, and it is thought advisable still to employ them for medico-legal purposes, a table on the principle of the foregoing, but founded on a larger number of observations, will form by far the most accurate and unexceptionable standard of comparison.

I now proceed to detail a few facts which have come under my own notice, and to inquire how far the weight of the lungs and their weight as compared with that of the body corresponds with the general statements of authors, and with the numbers contained in the tables.

Obs. 1. Female at full term, still-born.

Weight of lungs, right lung, 356 grains; left lung, 276 grains; both lungs, 632 grains.

* Some corrections have been made in this table.

Weight of body, 46735 grains.
Ploucquet's test, 1 : 74.

Obs. 2. Female at full term, still-born.
Weight of lungs, right lung, 372 grains ; left lung, 275 grains; both lungs, 647 grains.
Weight of body, 38172 grains.
Ploucquet's test, 1 : 59.

Obs. 3. Male at full term, still-born.
Weight of lungs. Right lung. ℥i. ʒvi. Troy = 840 grains.
Left lung, ℥i. ʒii. ℈ii. Troy = 640 grains.
Both lungs, ℥iii. ℈ii. = 1480 grains.
Weight of body, lb. ix. oz. 11½ avoirdupois = 68031 grains.
Ploucquet's test, 1 : 46.

In the first two of these observations the absolute weight of the lungs, and their weight as compared with that of the body, are such as to render it more probable that the children were still-born than that they were born alive ; the absolute weight of the lungs in both instances being much less than the average weight before respiration, viz. 874, and the proportion in both cases also falling below the average proportion, 1 : 57. Both values are also considerably less than the averages given in Table XXXII. Thus in the first observation, the weight of the lungs is 632, the average in the table for a body weighing between 40,000 and 50,000 grains being 744, and the proportion of the lungs to the body is 1 : 74, the average in the table being 1 : 60. In the second case, again, the values are 647 and 1 : 59, those in the table for bodies weighing between 30,000 and 40,000 grains, being 714 and 1 : 49. But it must be borne in mind that the numbers in the tables are merely averages, and that precisely the same numbers and the same proportions might be met with in children who had been born alive; so that taken alone, the static lung tests will furnish a very low presumption.

In the third case, the weight of the lungs is so much greater than the averages before and after respiration, as to raise a presumption in favour of respiration much stronger than the presumption in favour of still-birth in the first two cases. The average before respiration is 874, after respiration 1072 ; the weight of the lungs in this case was 1480, being 606 grains more than the average before respiration, and 408 grains more than the average after respiration ; whilst it falls short of the maximum before respiration by only 181 grains. As far, then, as the absolute weight of the lungs goes, it would seem nearly decisive of respiration having taken place ; Ploucquet's test gain tends to strengthen this conclusion, for the proportion which the lungs bear to the body, (1 : 46) falls little short of 1 : 38, the average after respiration has continued one month or less. On referring to Table XXXII, we have fresh reason for concluding that respiration has taken place for the absolute weight of the lungs corresponding to bodies, weighing from 60,000 to 70,000 grains, is 1431 after respiration, or somewhat less than the weight of the lungs in this case and Ploucquet's test gives 1 : 45 as the proportion after respiration being as nearly as possible the proportion in this instance. Hence, then, both the absolute weight of the lungs, Ploucquet's test, and the modified test of Ploucquet, would strongly incline us to the belief that the child had breathed; and yet, in this instance, respiration had certainly not taken place.

Obs. 4. Male, full term; survived its birth a few seconds, and was distinctly seen to respire more than once. Both lungs, however, sank, when placed in water, and the air-cells were not developed.

Weight of lungs, right lung, 300 grains; left lung, 210 grains; both lungs, 510 grains.
Weight of body, 31063 grains.
Ploucquet's test, 1 : 61.

Obs. 5. Male, full term; respiration imperfect, and of short continuance; air-cells developed in parts of the upper lobe of the left lung; and of the middle lobe of the right lung; the remainder of the lungs in the fœtal condition.

Weight of lungs, right lung, 690 grains; left lung, 488 grains; both lungs, 1178 grains.
Weight of body, 11 pounds avoirdupois = 77,000 grains.
Ploucquet's test, 1 : 65.

Obs. 6. Male, full term; respiration imperfect, but more extensive than in Obs. 5. The child had lived about an hour.

Weight of lungs, 726 grains.
Weight of body, 39,812 grains.
Ploucquet's test, 1 : 55.

Obs. 7. Male, eight months and a-half, lived two days. Respiration perfect in right lung, extremely imperfect in left lung. Blood effused in spots of variable size on the surface of both lungs. These spots small and few in number in the right lung, more numerous and larger in the left lung, especially on its posterior surface.

Weight of lungs, right lung, 295 grains; left lung, 251 grains; both lungs, 546 grains.
Weight of body, 32,375 grains.
Ploucquet's test, 1 : 59.

The first of these four observations is classed with those in which respiration has taken place, though the effects of respiration did not manifest themselves in the lungs. The air probably did not penetrate beyond the bronchial tubes, and left the lungs, to all appearance, in the fœtal condition. The small weight of the lungs, and the low proportion which the lungs bear to the body, afford a probability in favour of still-birth. The child, however, was born alive, and was distinctly seen to respire.

In the next case, (Obs. 5) there was abundant evidence of respiration, and the appearance of the lungs corresponded with the statement of the midwife, that the child had breathed. The lungs weighed 1178 grains, which exceeds the average weight in children who have lived one month or less by more than 100 grains. The absolute weight of the lungs, therefore, furnishes a low probability in favour of respiration. This probability is strengthened if the weight of the lungs is compared with the mean weight of the lungs of children who have lived less than one hour, the average being 918 grains, or with the average weight in cases of imperfect respiration, which for males is 1010 grains, (see Table X.) On the other hand, it must be borne in mind that the body of this child weighed no less than 77,000 grains. Ploucquet's test, therefore, gives the proportion of 1 : 65, which affords as strong a probability in favour of still-birth, as the absolute weight of the lungs did in favour of respiration. By comparing the weight of the lungs with the average weight for bodies exceeding 70,000 grains in weight (see Table XXXII.) this probability in favour of still-birth is still further increased.

The weight of the lungs in Obs. 6, viz. 726 grains, though below the average weight before respiration, is not low enough to afford a very strong presumption either way, and the proportion 1 : 55 gives a slight probability in favour of still-birth, (see Tables XXXI. and XXXII.) In the last case, (Obs. 7,) the weight of the lungs, and the proportion which the lungs bear to the body, are such as to give a strong presumption in favour of still-birth; but in this instance, the child had lived two days, and the weight of the lungs was increased by the effusion of blood on the surface of the lung, around the superficial air-cells, and beneath the pleura. I may observe in passing, that this is the only case out of twenty-two which I have had an opportunity of inspecting, in which any disease of the lungs existed, and in this case, with the exception of the pulmonary apoplexy, the structure of the lungs was perfectly healthy.

The question of respiration in the seven cases which have been mentioned would have been decided by means of the static lung tests as follows. Of the three still-born children, two would have been pronounced probably still-born; in the third there would have been a strong presumption in favour of respiration. Of the four children who had survived their birth, the first would have been pronounced still-born; in the second, the absolute weight of the lungs would have furnished a strong probability in favour of respiration, and Ploucquet's test, as well as the modified test, (see Table XXXIII), as strong a presumption against it; in the third case, there would heve been a slight presumption in favour of still-birth; and in the child who survived its birth two days, a still stronger presumption on the same side. Thus out of the seven cases, the static lung tests would have given correct indications in two, they would have left two others doubtful, and would have led to erroneous conclusions in the remaining three. These remarks apply to the average weight of the lungs, and the average proportion which the lungs bear to the body when used as tests of respiration; but if the highest and lowest weights and proportions had been employed as standards of comparison, the question whether the child had or had not breathed would have remained unanswered. Now it admits of great doubt whether it is allowable to employ an average value as a standard of comparison in medico-legal inquiries. Even in the practice of medicine, where many low probabilities are allowed to assist us in our diagnosis, average values are amongst the least useful and the least trusted of our standards of comparison, and very few physicians would be hardy enough to rest any important conclusions upon so insecure a basis. What medical man, for instance, would think of placing much reliance on an average frequency of the pulse, or the average proportion of the pulse and respiration as a standard of comparison in a case of disease? They would furnish a low presumption, and nothing more. On the other hand, a comparison between the frequency of the pulse in a given case of disease, and the highest or lowest ascertained frequency in a state of health, would furnish important indications on which he would be justified in laying great stress. A mode of reasoning which would be inadmissible in a case of disease where a low probability derived from one symptom is confirmed by the presence or absence of a considerable number of other signs, can scarcely be trusted to in medico-legal inquiries, which demand a much higher accuracy, and a much stricter logic. If in a court of law, a medical witness were to state that, in a certain case, he had found a certain weight of lungs, and a certain proportion between the weight of the lungs and that of the body, and that he regarded this as a proof of respiration or of still-birth, or even as a presumption in favour of one or the other, he would be immediately met by the question—has not precisely the same weight of lung, or the same proportion, been met with in cases where the exact reverse of your inference was known to have existed? To this question an answer must be given in the affirmative, except in those instances in which the weight exceeded the highest recorded weight or proportion, or fell short of the lowest; and these cases have been shown to be extremely few in number. But even when the extremes are employed as our standard of comparison, our inference in individual cases is open to the obvious objection, that the real extremes have not yet been ascertained. The force of this objection must be allowed, and to obviate it, it would be necessary to strengthen the presumption by collateral evidence derived from other signs.

If the static lung tests were always regarded in the same light as the symptoms of a disease; that is to say, as furnishing merely one element of our diagnosis or prognosis, little mischief could arise from attaching some slight value to them. The low presumption which this test, taken by itself, would furnish, might be increased by other collateral evidence, so as to amount to a high probability, or even to certainty. But this is not the case, for not only are the static lung tests employed in combination with other tests, such as the size and shape of the chest, the position of the diaphragm, the size, position, consistence, and appearance of the lungs, (all of which furnish their presumptions in favour of or against respiration,) but they are also recommended, as one of the surest means of distinguishing the effects of respiration from those of inflation. It is obvious that the lungs are not increased in weight by inflation, and, taking one case with another, it is as certain that their weight is increased by respiration, for this reason, the weight of the lungs has been regarded as a means of diagnosis. Now it has been already shown that the static lung tests are not to be relied on as a means of distinguishing lungs which have respired from those which have not; and as inflated lungs are assumed to remain as far as weight is concerned in the condition of lungs which have not breathed, it follows that the weight of the lungs is not a sufficient diagnostic mark of respiration and inflation. Whatever value is assigned to these tests as tests of respiration, exactly the same value must be given them as tests of inflation. How slight this value is has already been shown.

Those who are familiar with the changes produced in the appearance of the lungs by respiration, will readily admit that, in at least ninety-nine cases out of a hundred, the question of respiration is nearly decided by the first glance at the surface of the lungs themselves, without having recourse to the static lung tests at all, or even to the hydrostatic test. Simple inspection is sufficient to show that either respiration has taken place, or that inflation has been practised. The static lung tests, therefore, are not required to distinguish respiration from non-respiration, but merely to serve as a diagnostic mark between respiration and inflation. Here, then, where alone these tests are wanted, they fail us, just as they fail us in almost every instance in which they are used to determine the question of respiration. If we had as certain means of distinguishing respiration from inflation, as we have of determining that one or the other has taken place, the static lung tests would be as unnecessary as they are useless. Whether or not we possess a means of diagnosis in the effects of pressure must be left for future consideration.

The conclusions drawn from the examination of the seven mature children are fully borne out by observations made at earlier periods of fœtal life. Some of these observations will find a place in a future essay on the hydrostatic test. I shall content myself for the present with detailing a case of some interest in more than one point of view, and instructive in its relation to the static lung tests. For an opportunity of inspecting the lungs, and for the minute particulars which give completeness to the case, I am indebted to the courtesy of Mr Streeter, who has kindly allowed me to copy from his note-book that part of the case which came under his own notice.*

" Mrs J. R., aged 28. Her second pregnancy. She menstruated last on Whitsunday, June 7th 1840, and was taken with pains, December 1, about ten A. M. She came to bespeak my attendance for March next. I gave her an opiate mixture to take on her return. Of this she took one dose, but the pains continued increasing till she sent for me between two and three P. M. On my arrival I found on examination, in the intervals of the pains, that the *os uteri* was open to the size of an orange, and a bag of waters protruding. At half-past four, the bag broke, and a very large quantity of waters came away. The head of one fœtus was expelled through the *os externum* ; the body was extracted after some slight resistance, and the funis tied. A second gush of waters now took place, and I found the placenta occupying the vagina. I slowly brought this through the *os externum*, but, as it was still retained, I again examined, and found the arm and face of the second fœtus presenting. Fixing the arm steadily with the finger and thumb of my left hand, I passed the fore-finger of the right hand over the neck of the fœtus, and so succeeded easily in dislodging it from the upper part of the vagina, without causing much pain. The uterus was found firmly contracted above the pubis.

Both fœtuses were females ; they made respiratory efforts, but without oral sound, and, of course, shortly expired. The largest is marked 1, the smallest 2.

Weight of body, -	1. 21½ oz. avoirdupois. 2. 10½
Circumference of the head, -	1. 8½ inches. 2. 7
Abdomen, - -	1. 7½ 2. 5
Length, - - -	1. 12½ 2. 10
Length of cord, - -	1. 16 2. 11

* This case was detailed at one of the meetings of the Westminster Medical Society, and is reported in the Lancet 1840—41.

To the foregoing extract from Mr Streeter's note-book, I add the following account of the *post mortem* examination, which took place December 6.

Both fœtuses were found contained in a common chorion, but in distinct amnia. * The placenta belonging to the larger fœtus was of the common size; that corresponding to the smaller fœtus was about half as large, and had the cord inserted into its edge. Both placentæ were quite healthy. Having secured the vessels of the lungs by ligature, those organs were weighed, and the following numbers were noted down on the spot.

Largest Fœtus.—Weight of lungs, right lung, 73 grains; left lung, 55 grains; both lungs, 128 grains.

Weight of body, 9406 grains.

Ploucquet's test, 1 : 73.

Smallest Fœtus.—Weight of lungs, right lung, 23 grains; left lung, 15 grains; both lungs, 38 grains.

Weight of body, 4594 grains.

Ploucquet's test, 1 : 121.

The lungs of the larger fœtus, when placed in water, sank at once to the bottom, without showing any degree of buoyancy. All the lobes and the several portions into which they were divided, likewise sank, and the lungs presented no trace of respiration. The lungs of the smaller fœtus presented the following appearances:—On the convex surface of the upper lobe of the right lung the air-cells were distinctly developed in four or five different points, and nearly the whole of the concave surface was studded in the same manner. The inferior and middle lobes of the same lung had a great number of such points on the convex surface, and also on the concave surface, especially along the anterior margin. This lung, however, on being placed in water, sank at once to the bottom. The left lung presented no trace of respiration, the surface of the lung being perfectly uniform, with not a single air-cell developed. This lung also sinks on being placed in water. The right lung was now divided into its three lobes, and each lobe submitted to experiment. They all sank to the bottom of the vessel. On cutting off a small portion of the lower lobe of the right lung, containing several developed air-cells, and placing it in water, it sank rapidly to the bottom. A portion of the middle lobe, towards the posterior margin, being placed in water, floated. Very strong pressure applied to this portion did not destroy its buoyancy, but, on increasing the pressure with the finger and thumb, the buoyancy was somewhat diminished. After the entire destruction of the texture of the lung by repeated pressure, this portion slowly sank to the bottom.

* This fact was verified by a very careful examination, and admitted by more than one competent authority.

This case is interesting and instructive in so many points of view, that I have given it entire, though my present business is merely with that part of it which refers to the static lung tests. The ages of these fœtuses might have been six months at the most, five months at the lowest calculation, and five and a-half months reckoning from the middle period between the last menstruation and the next menstrual period. Mr Streeter thought five and a-quarter months the most probable age. In any case the abortion took place in the sixth month. Both fœtuses had made efforts to respire, the larger one without success, (for if any air did reach the lung, it did not expand any of the air-cells,) the smaller one successfully, the air-cells being developed in large numbers on the surface of the right lung. The small quantity of air admitted was insufficient to give buoyancy either to the entire lung, or to any of its lobes, but it caused a small portion of one lobe to float. As inflation was not practised in this case, there is no room to doubt that the child had breathed. Here, then, we have two twins of the same sex, inclosed in a common membrane, and the product of the same conception, the one more than twice as large as the other, and, to appearance, far better prepared to respire, both making respiratory efforts, and yet the smaller and feebler child alone succeeded in drawing air into the lungs. The lungs of the larger child were found filled with blood, those of the smaller almost bloodless; the one weighed 128 grains, or $\frac{1}{73}$ of the weight of the body, the other 38 grain, or $\frac{1}{121}$. The weight of the bodies were as 2 to 1, that of the lung as 3 to 1. Is it not at least probable that the comparatively large quantity of blood contained in the lungs of the larger child was an obstacle to the admission of air; whilst the almost bloodless condition of the lungs of the smaller was peculiarly favourable to respiration? If this supposition be not allowable, and the larger quantity of blood contained in the lungs of the larger fœtus was not in the lungs previous to the efforts made to respire, then these efforts must themselves have caused an influx of blood, whilst in the smaller child the same efforts led to the admission of air. My own experience, as far as it goes, has led me to the conclusion, that the presence of a large quantity of blood in the lungs is a frequent occurrence in still-born children, and in cases of extremely limited and imperfect respiration; and that where respiration has been most complete, the quantity of blood is often small as compared with their bulk. The case of the smaller fœtus is peculiarly interesting, as the weight of the lungs is much less than in any other instance on record. The smallest recorded weight which I have met with occurred in a six months' child entered in Lecieux's tables. It is 93 grains. It is stated that this child made efforts to respire, but the lungs were compact. The body weighed 10,040 grains, and Ploucquet's test gave the proportion of 1 to 108. I have not admitted this into the tables, as there is not sufficient evidence of respiration having taken place. 38 grains, then, is by far the smallest weight yet reported in a case where respiration has taken place, and there can be no doubt that the static lung tests, taken alone, would have led to the conclusion that the child was still-born.

There are other points of interest in this case on which it is not my present object to enlarge; such as the existence of a common chorion; the evidence thereby afforded of contemporaneous conception; the unequal weight of the two bodies, in the absence of any disease in the placenta; the correspondence of the size of the bodies with that of the placentæ to which they were attached; and the absence of buoyancy in lungs in which the air-cells were so visibly developed by the entrance of the air; these points, as they do not belong to my present inquiry, I content myself with merely alluding to, and shall, therefore, conclude what I have to say upon the static lung tests, reserving the hydrostatic test for a future occasion.

The following short summary will embody the principal conclusions which I have been led to form, and will at the same time give me an opportunity of correcting some errata contained in my former essay.*

* The calculations contained in the former essay were, with one exception, originally correct, and I can only attribute the alterations which I was induced to make to my great anxiety to avoid all sources of fallacy, and the pressure of an unusual number of engagements at the time when the proof-sheets reached me. From these causes I was induced to make alterations which I subsequently found to be uncalled for. I discovered my mistake almost as soon as I had made it, and wrote to the editor, begging that he would allow the tables to remain as they were, but the proof-sheets had already gone to press. Finding that I had committed one error, I carefully reviewed my observations, and tested the accuracy of all my calculations from the French and German weights, and I discovered one other error. The maximum weight before respiration in mature children was stated on the authority of one of Devergie's observations at 1800. On examining the case from which this number was taken, I found that I had taken the weight of the heart, lungs, and thymus, instead of the weight of the lungs alone. Those who are familiar with Devergie's work, and with the manner in which his cases are recorded, will not attribute this mistake to mere carelessness. The discovery of this error has led me to convince myself of the accuracy of the rest of my calculations. I have taken considerable pains to correct this error, as well as the more important one just mentioned, and have reconstructed the whole of the tables. The corrections, with the exception of the observation from Devergie, are not material, and in no way affect the general reasoning employed. I subjoin a list of the errata.

P. 47, omit the passage beginning "In reducing, &c." and ending with "calculations," the grains in the table are Troy grains.

Table I., *for* 1800 *read* 1661; *for* the average values substitute 950, 809, 874. In the paragraph succeeding the table omit 1800 and 1726.

Table II. *For* the mean values, substitute 382, 349, 361, 600, 678, 625, 695, 690, and 686.

P. 50, line 5, *for* more than 300 *read* nearly 200.

Table III. *For* 1800 *read* 1661; *for* the mean values write 361, 625, 686, and 874.

Table IV. The averages are 1121, 982, 1072.

Table V. The averages are 320, 411, 401, 589, 694, 638, 761, 734, 751.

Weight of the Lungs.—1. The weight of the lungs of still-born hildren of the same age varies within wide limits; the chief cause of difference being the sex and the weight of the body.

2 The weight of the lungs in mature still-born children is as follows: greatest weight, 1661; least weight, 340; average weight, 874.

3. The weight of the lungs in mature still-born children of the male and female sex respectively is as follows: greatest weight, 1661, 1492; least weight, 360, 340; average weight, 950, 809.

4. The weight of the lungs in children who have respired also varies within wide limits; the chief causes of difference, in addition to those which affect still-born children, being the degree and duration of respiration.

5. In children who have survived their birth one month or less, the highest recorded weight is 2440 grains; the lowest 432 grains; and the average 1072 grains.

6. The weight of the lungs for males and females respectively, at the same ages, is as follows: greatest weight, 2440, 1745; least weight, 432, 479; average weight, 1121, 982.

7. The weight of the lungs increases with the increasing perfection of the respiration, but is very slightly augmented by imperfect respiration.

8. The weight of the lungs also increases with the duration of the respiration; but appears to be less when respiration has continued more than one hour and less than twelve, than when it has lasted less than one hour.

9. The mean weight of the lungs in mature children who have

Table VI. The averages are 401, 638, 751, 1072.

Table VII. The averages are 911, 780, 918, 955, 726, 853; 1001, 1018, 1000.

Table VIII. In the male *read*, 911, 955, 1001, 1067, &c.; in the female 780, 726, 1018, 725, 980, 913, &c.; and in the third line *read* 918, 853, 1000, 985, 1001, 1128, &c.

Table IX. Under the head one day and less, *read* male 943, female 826, m. and f. 925.

Table X. *For* 1800, *read* 1661. In the first column of the line of averages, write 950, and in the last but two 874.

Table XI. *For* 1800 *read* 1661. The average values are 874, 918, 853, 1000.

P. 9, in text following table XI., *for* 38, *read* 44, and *for* 34, *read* 21.

Table XII. The averages are 361, 401; 625, 638; 686, 751; 874, 1000.

P. 54, 9 lines from bottom, *for* "exceeds," *read* "falls short of," *for* 75, write 64; for 1800, *read* 1661, *for* 37 *read* 21, *for* 38 *read* 44, and *for* 122, *read* 126.

Tables XIV. and XV. are connected and combined in table XXXII. of the present essay.

P. 60, *for* 1800, *read* 1661.

Table XX. The averages are 1 : 53, 1 : 63, and 1 : 57.

Table XXI. The averages are 1 : 40, 1 : 41; 1 : 41; 1 : 41, &c.—1 : 46

Table XXII. The averages are 1 : 41, 1 : 41, 1 : 46, 1 : 57.

Table XXVIII. The averages are 1 : 57, 1 : 51, &c. In the text *read* 57 *for* 56.

Table XXIX. The averages are 1st column, 1 : 41, 5th column, 1 : 46, 7th column, 1 : 57.

Many of the above corrections are merely repetitions, and some are typographical errors, which were unavoidable in so large a mass of figures.

lived one month or less exceeds the mean weight in mature still-born children, by somewhat less than one-fourth, the numbers being 574 and 1072.

10. The average and extreme values drawn from small numbers of facts differ widely from each other, and cannot be depended upon for medico-legal purposes.

11. The average values cannot be safely employed as standards of comparison, and the extreme values admit of very rare application.

12. If the absolute weight of the lungs is employed as a test of respiration, the value obtained in an individual case ought to be compared with the average or extreme numbers obtained for the same weight of body. (See Table XXXII.)

The following propositions have an important bearing on Ploucquet's Test.

1. The weight of the lungs both before and after respiration increases with the weight of the body; but the proportion which the lungs bear to the body decreases as the weight of the body increases.

2. For the same weight of body the weight of the lungs varies within wide limits, and *vice versa*, for the same weight of lungs the weight of the body varies within wide limits. This variation is more considerable after respiration than before it.

3. The weight of the body in still-born children is greater than in children born alive; the former exceeding the latter by nearly one-third.

4. The weight of the lungs is subject to much greater variation than that of the body.

5. The weight of the lungs is much greater in the male than in the female.

1. *Ploucquet's Test.*—The proportion which the weight of the lungs bears to that of the body, like the absolute weight of the lungs, varies within wide limits; the proportion in mature still-born children being as follows: greatest proportion, 1 : 24; least proportion 1 : 176; average proportion, 1 : 57.

2. The proportion in males and females respectively is as follows; greatest proportion, 1 : 24, 1 : 36; least proportion, 1 : 176, 1 : 119; average proportion, 1 : 53, 1 : 63.

3. In children who have survived their birth one month or less, the highest recorded proportion is 1 : 19; the lowest, 1 : 132; and the average, 1 : 38.

4. The proportion for males and females respectively at the same ages is as follows: greatest proportion, 1 : 19, 1 : 19; least proportion, 1 : 132, 1 : 96; average proportion, 1 : 35, 1 : 43.

5. The proportion which the lungs bear to the body increases

with the increasing perfection of the respiration, but is very slightly augmented by imperfect respiration.

6. The proportion also increases with the duration of the respiration, but appears to be less when respiration has continued more than one hour and less than twelve, than when it has lasted less than one hour.

7. The average proportion in mature children who have lived one month or less, exceeds that in mature still-born children ; the numbers being 1 : 57 before respiration ; and 1 : 38 after respiration.

8. The proportions calculated from a small number of facts differ widely from each other, and cannot be depended upon for medico-legal purposes.

9. The average proportions cannot be safely employed as standards of comparison, and the extreme values, though more to be depended on than the highest and lowest weight of the lungs, are of very limited application.

10. If the average or extreme proportions are employed as standards of comparison, the proportion obtained in any individual case must be compared with the average or extreme numbers calculated for the same weight of body. (See Table XXXII.)

The observations contained in the present essay lend strong confirmation to the unfavourable opinion expressed on a former occasion of the static lung tests as tests of respiration. Whether employed to distinguish respiration from non-respiration, or respiration from inflation, they are alike insufficient, except in cases of extremely rare occurrence, where we can make use of the extreme values. On the supposition that the question of inflation has no place, the static lung tests are as unnecessary as they are useless ; if we have proved that either respiration or inflation has taken place, they can only be employed with advantage in the extremely rare instances just alluded to, viz. where we can employ the extreme values. Hence, then, the proposition which concludes my first essay requires to be slightly modified, and will stand thus.

The static lung tests are utterly useless for all practical purposes, and ought not to be relied on in medico-legal inquiries, except in rare instances, where the extreme values can be employed.

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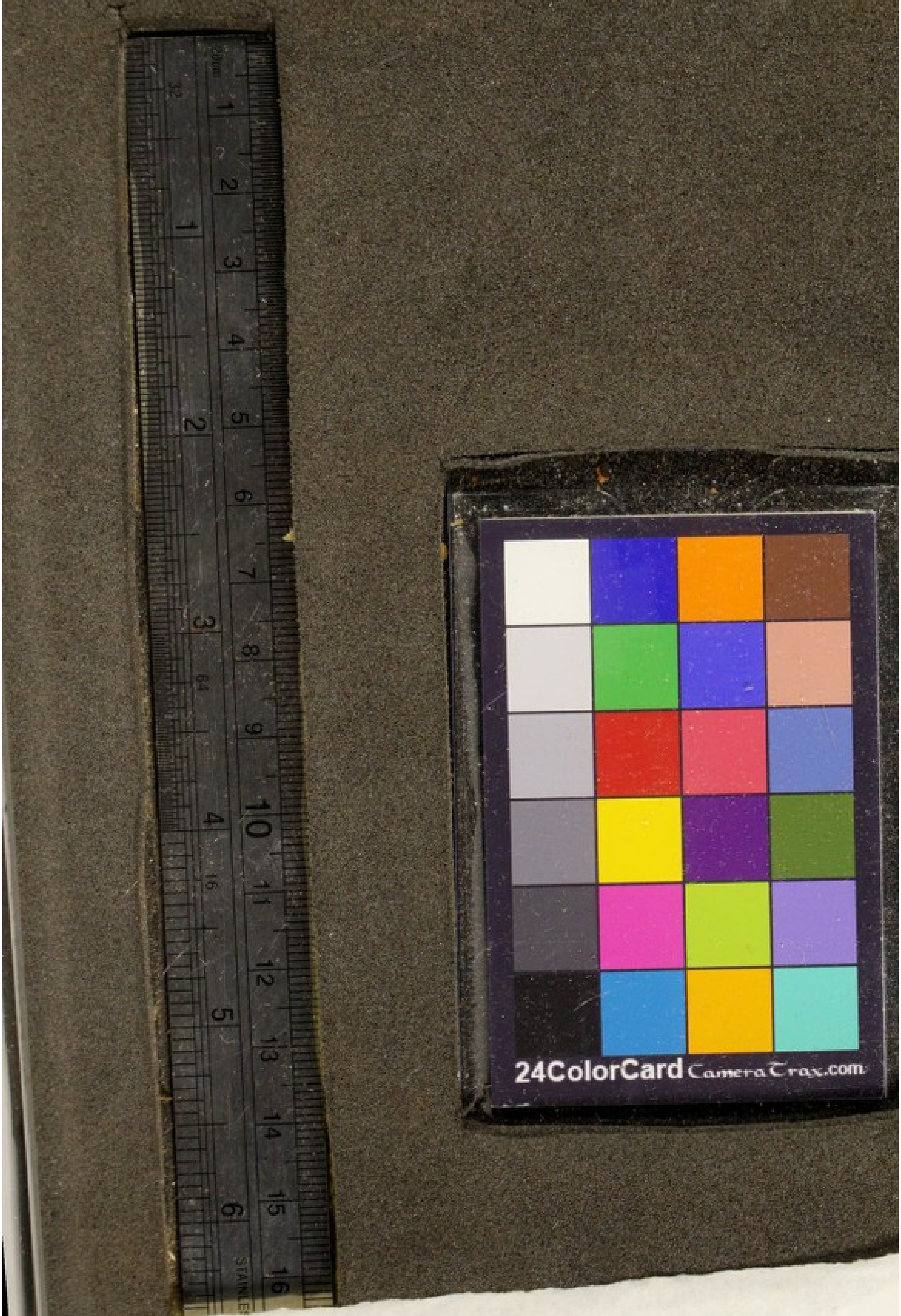

TIGHT GUTTERS