INTRODUCTION.

Preliminary remarks—Observations on the average weight of organs—On the discoloration of parts—On the softening of textures, and on putrefaction—On the temperature of the body after death—On air in the vessels, and effused fluids—On the post-mortem condition of the blood, and rigor mortis—On the situation of organs.

THE importance of distinguishing between the normal and abnormal, between the sound or healthy and the unsound or diseased, can hardly be too much insisted on in pathological enquiry. Under this impression the following preliminary remarks are offered, and with a double object: one, that of showing the cautions which have more or less been kept in view in conducting the post-mortem examinations—an account of which will form a considerable part of the following work; the other, with the hope of affording some aid to the young medical officer in his necroscopical labours.

The subject in its greatest generality, it must be confessed, is a difficult one. Normal forms pass by almost insensible gradations into the abnormal, sound structure as insensibly into the unsound: so too as regards functions; in these likewise there is that insensible gradation from the most perfect health to a high state of disease. And what specially adds to the difficulty is the complexity of organization and its subtilty as regards structure, and, as regards function, the more or less dependence of one organ or part on another, giving rise to that exquisite sympathy which is characteristic of animal life.

1. *Of the Weight of Organs.*—The knowledge of this in their healthy state must of course be ascertained before we can be prepared to draw any conclusion from what it may be found to be in cases of fatal disease. Average weight is that which it is the desideratum to have determined, as we cannot doubt that, in individuals in health the most perfect, it—the weight of a part—will vary within certain limits, according to age, size, condition of body, and even idiosyncrasy. Further, I think it may reason-

ably be inferred that, even within the range of health, some organs will be found more subject to variation than others, from the nature of their function and position, and *à fortiori*, still more so from the effects of disease.

Of all of them, it may be presumed that the brain, both from its nature and the manner in which it is confined in an unyielding case, will be least subject to fluctuating increase and decrease of volume or weight. In the adult man its weight has been estimated at 3 lbs. 2 oz. 3 drms.* The results of the trials I have made in nineteen instances accord very nearly with this, the average obtained having been 3 lbs. 2 oz. 2 drms. The individuals whose brains were weighed were soldiers, all of average height, or rather exceeding a little the average; men who had died of different diseases, chiefly phthisis, and who varied in age from 18 to 40 years. The heaviest brain of the whole number weighed 3 lbs. 7 oz. 4 drms. and the lightest 2 lbs. 11 oz.—both from men who had died of pulmonary consumption, the former 19 years of age, the latter 28.†

The lungs situated so differently, so subject to expansion and contraction and the influx of variable quantities of blood, might *à priori*, even irrespective of differences in the capacity of the chest, be expected to vary more in weight than the brain. The lighter they are, may they not be considered the healthier? From such trials as I have made, I am disposed to place the average weight of these organs at 2 lbs., or even under. The lungs of a Maltese boy ætat. 14 years, killed when in good health by an explosion of gunpowder, weighed 1 lb., that of each was 8 oz. They were in a state of collapse. Those of a private soldier ætat. 46, shot by a comrade through the head when in perfect health, weighed 1 lb. 11 oz. Those of a private ætat. 26, who when apparently in good health shot himself, weighed only 17½ oz.; the left lung 8½ oz., the right 9 oz. The wound was immediately fatal and was attended with much hæmorrhage. The lungs of another private who committed suicide in the same way, ætat. 30, also in apparently good health at the time, weighed 1¼ lb.: the

* Quain's Anat. by Sharpey and Ellis, ii. p. 434. According to another estimate, the average weight is less than the above, viz. 49⅔ oz. See Dunglison's Human Physiology," vol. i. p. 328.

† The lightest brain I ever weighed, was that of an old woman, in Malta, ætat. 98; it was 2 lbs. 4 oz. 48 grs. 44 oz. is stated to be the average weight of the female brain (op. cit.).

left, in which was some blood, ¾ lb.; the right, ½ lb. There was little hæmorrhage in this instance; and he lived an hour after the infliction of the wound. Those of a private ætat. 35, who had died of chronic dysentery, weighed 1 lb. 6 oz.; of another private who had died of the same disease, and whose lungs like those of the last seemed quite sound, the left weighed 10 oz., the right 9 oz.; of another, who died of ascites, the right lung weighed not quite half a pound; it was so collapsed, so small in volume in consequence, that it might have been covered almost by both hands. The left lung was heavier, but it was diseased; it contained three masses (the largest of which was about the size of a filbert) of curd-like scrofulous matter: even in the right, on careful examination, a few small clustered granular tubercles were detected. Of another, ætat. 28, who died labouring under a complication of disease —one of the lesions, effusion into the right pleura to the large amount of seven pints—the lung of that side weighed 8 oz.; of the opposite, 1 lb. 4 oz.: the volume of the former was equal to that of a pint of water, it displaced so much; of the latter to 23 oz. of water. The right lung contained a few granular tubercles; the left was similarly diseased, and to a greater extent. Of another, ætat. 29, who died labouring under chronic dysentery, the left lung weighed 11 oz., the right 14 oz.; both were healthy, with the exception of some superficial bronchial branches which were much dilated and, with the exception of some vesicles (probably air cells enlarged), filled with air, immediately under the pleura pulmonalis.* When the weight of the lungs has exceeded 2 lbs., I have always found them more or less diseased: thus in the instance of a private who died of inflammation of the pleura, with copious sero-purulent effusion, though each lung weighed only 1 lb. 1 oz., the right contained numerous tubercles and a few small vomicæ; the left, though fewer tubercles, pretty much effused serum.

The liver, though less subject to sudden variations of volume than the lungs, yet probably is more variable in weight, at least without manifestations of disease: this partly owing to its more mixed composition chemically considered, partly to the

* Before opening into the chest a ligature had been applied to the trachea: one vesicle contained ·03 cubic inches of air, which was found to consist of 2·5 oxygen, 5·5 carbonic acid, 92·0 azote. Air collected from one of the large bronchial tubes was composed of 4·0 oxygen, 3·1 carbonic acid, 92·9 azote.

elaborate and large venous system belonging to it, and partly to the little sensibility that its substance possesses. Its average weight deducible from the trials of which I have a note is about 3 lbs. 6 oz. * These trials were sixty in number. The ages of the defunct varied from 18 to 46 years. The fatal diseases were very various, many of them pulmonary consumption. The heaviest of the whole number was 6 lbs., the lightest 2 lbs. 4 oz.; the former from a private ætat. 32, the latter from one ætat. 35; the former had died of peritonitis, the latter of paralysis from a softening of the brain: in neither did the organ appear to be diseased. As an indication of disease, I am inclined to attach less importance to weight in the instance of this viscus than in that of any other, excepting perhaps the spleen; and for the reasons already assigned when adverting to the circumstances likely to conduce to variations in its weight even in health, or to speak more correctly, without recognised disease. Even corpulency, or the opposite state, may have a marked effect. Proof of this is afforded in the two following columns: No. 1, of the weight of the liver in seven instances, of men who had died of aneurism; No. 2 of seven others, who had died of wasting diseases, chiefly phthisis, and were much emaciated.

No. 1.	No. 2.
6 lbs.	2 lbs. 8 oz.
4 lbs.	2 lbs. 12 oz.
5 lbs.	4 lbs.
3 lbs. 3 oz.	3 lbs. 8 oz.
4 lbs. 12 oz.	3 lbs. 12 oz.
4 lbs. 8 oz.	5 lbs.
4 lbs.	3 lbs. 8 oz.

Of the spleen, the average weight, judging from the trials I have recorded, these fifteen in number, is 7 oz.† The heaviest of these was 12 oz.; the lightest, 2 oz. 4 drs.; the former from a private who had died of otitis, with suppuration extending to

* Haller (Element. Physiol. vi. 455) gives the weight of the liver, in health, as about 45 oz.: this the average of ten; but of the ten specified, three weighed only 1 lb. Now, omitting these three, the average of the seven would be nearly the same as that I have assigned, viz., 3 lbs. 7 oz. Dr. John Reid found the average of sixty male livers to be 52 oz. 12⅔ drms.—Dunglison's Physiol. ii. 302.

† Haller (Element. Physiol. vi. 394) states "Solent lienies pondus in sano homine inter sex uncias et semisse et decem, duodecem et quatuurdecem, demum sedecem uncias definire."

the brain; the latter from one ætat. 33, who had died of paralysis. The liver of this man weighed 4 lbs. 5 oz.; of that 3 lbs. 8 oz. Most of the fatal cases from which the organ weighed was obtained, were of pulmonary consumption; and, in all, with the exception of a variable degree of softness, it had a tolerably healthy appearance.

Of all the glandular organs, so far as my experience allows me to form an opinion, the kidneys are least liable to variation in weight. Their accordance, too, comparing the one with the other in the same body, is remarkable, implying a degree of harmony we do not witness in the lungs, especially under the influence of morbid action. The average weight of the right kidney, deduced from sixteen trials, is 5 oz. 3 drms.; of the left, from fifteen trials, 5 oz. 3 drms. The heaviest of the whole number, 7 oz. 5 drms.; the lightest, 3 oz. 5½ drms. The greatest difference between the left and right kidney was 1 oz. 3 drms.; only in three instances was the weight of each in the same individual exactly the same. The bodies affording the specimens tried, had mostly died of pulmonary consumption; the organs in question were all of them apparently free from disease.*

The only other organ, the average weight of which I shall attempt to give, is that of the heart. It is obtained from seven examples only. The subjects of four of these had died of pulmonary consumption, three of other diseases. In all the organs appeared to be sound. In each instance it had been emptied of blood before being put into the balance. The average weight was 8 oz. 4 drms.; the heaviest, was 9 oz. 4 drms.; the lightest, 8 oz. The ages varied from 21 to 40 years.† Considering the function this organ performs, it may be presumed, as in the instance of the lungs, that the lighter it is commonly, the healthier it is, especially as the tendency of muscle from exercise is to increase not diminish in volume; and under morbific influences to suffer from hypertrophy rather than from atrophy.

2. *Of the Discoloration of Parts.*—Color is one of the qualities that first attracts the eye; and is, perhaps, that which

* From 65 trials, Dr. John Reid has deduced the average weight of the left male kidney to be 5 oz. 11⅓ drms.; of the right, 5 oz. 7 drms. Op. cit. ii. 326.

† M. Bouillaud estimates the average of the male heart 8 oz. 3 drms., the result of 13 trials. Op. cit. ii. 82.

is least to be depended on. I make the remark reflecting on the difficulty often experienced in distinguishing between the redness the result of inflammation, and the redness the result of staining or dyeing effected on the white tissues of the body by the coloring matter of the blood with which they may happen to come in contact. The similarity of appearance is sometimes so deceptive, that, judging from mere sight, the most experienced may, I believe, be led astray. The staining in question is chiefly witnessed in warm weather, and when the *post mortem* examination has been delayed, and putrefaction has in some degree commenced. It is well exemplified by immersing white tissues, such as the blood-vessels, in cruor which has been kept some time, and which, on the addition of hydrate of lime or potash, emits ammonia. The higher the temperature of the air at the time of making the experiment, the more rapidly will the dyeing effect be produced: so, in the same manner in the cadaver, the warmer the weather, so much sooner may the discoloration be expected; and, as excess of blood in the body favors acceleration of putrefaction, the greater that abundance, the readier also will the staining appear. Here, it may be remarked, that owing to the many circumstances which either promote or retard the effect, it is necessarily uncertain, indeed so uncertain, that no exact rule as to time or temperature can be fixed for its occurrence, there being an unknown quality in the problem, that is, the degree of proclivity in the dead body to change,* that

* I find it noted in a case of phthisis which occurred in Malta in August, when the temperature of the room in which the body was kept was between 82° and 83°, that no appearance of staining was seen in the vessels, where the blood was in contact with them, although 22 hours had elapsed between the time of death and the autopsy: the cadaver was greatly emaciated. This may be considered an extreme instance of exemption, and it is given as such, in support of the remark in the text. I may mention another extreme case of the contrary kind, in which the vessels containing blood were stained of a "bright red," though only $16\frac{1}{2}$ hours had intervened between the death and the examination of the body. The case was also one of phthisis, that of a soldier ætat. 26, at home, the time April, the temperature of the room 56.° In this instance, the blood, the cruor which did not coagulate, mixed with quick lime gave off a strong smell of ammonia. Further, it may be remarked that the staining was confined to the deep seated vessels of the trunk; the temperature under the liver was 70°: there was no trace of it in the vessels of the colder extremities: in the aorta, in which there was no blood, the inner coat was colorless. I shall give a third case, that also an extreme one. It occurred in Malta, the death also was from phthisis of a chronic kind, and the body was greatly emaciated. The examination was made 39 hours after death; the temperature of the air at the time (the middle of August) was between 80° and 86°; the wind, the south-east, the moist sirocco. The cadaver emitted an offensive smell and was livid; the abdomen was distended and tympanitic; on opening into its cavity, the intestines were found

varying according to the nature of the fatal disease, and the condition of the individual, so as to baffle all precise calculation: but yet, with due consideration of what aids and what retards putrefaction, allowing of inference at least approaching the truth. It might, perhaps, be supposed that the difference between a stained part and an inflamed part, would be distinguishable by subjecting them to the process of washing; but on trial I have been disappointed; the color of the one not being more readily removed by water than the other. In cases of extreme doubt, as when the *post mortem* examination has been unduly deferred, the only conclusive evidence, I am disposed to think, is the presence of effused lymph.

Other cases of discoloration may be deserving of some attention. I shall mention two or three; there may be more than I can now call to mind, or am acquainted with. In the brain, a yellow ochery stain is sometimes met with, sometimes diffused, sometimes limited to a small circumscribed spot. Wherever it occurs, I believe it to be owing to blood that has been effused and afterwards absorbed with the exception of the iron belonging to the coloring matter of the corpuscles, which has remained in the state of peroxide. In the few instances I have tested this stain, I have found this oxide present; and mostly, in the appearance of the texture of the part, there has been corroborative proof of blood having been at a former period extravasated. After dysentery, after the ulcers have healed, and death has resulted from some other disease, or from gradual exhaustion the effect of the former, dark bluish stains, or stains approaching to this color, may be seen marking the cicatrices in the large intestines. I have watched their formation, if I may so speak, in the progress of the ulcers to healing in individuals who have died in different stages of the disease; and hence the identification of the stain and the cicatrix, which latter otherwise might not be recognized. The color I am disposed to refer also to residual iron, but in the state of the black oxide or sulphuret

very much distended with gas; and both in this cavity and in the chest, the blood in the vessels was frothy, disengaging air; and the same was observed in the substance of the liver and of the other viscera, and in the cellular tissue, and even in the thoracic duct. All the membranes and vessels were more or less colored by the coloring matter of the blood. Notwithstanding this rapid and advanced putrefaction, the temperature of the body, it is worthy of remark, differed very little from that of the air; there was no indication of the production of heat; a thermometer under the lobulus Spigelii was 83°; in the air of the room 82·5.°

so rendered in consequence of the action of the gases in the intestines. This, however, is only conjecture, for I have never examined the parts chemically. We have a striking example of the permanency of a metallic stain in the discoloration of the skin, which occasionally appears from the long-continued use of the nitrate of silver taken internally. In confirmation of the durability of such a stain, I may mention that so long as fifty years ago, when engaged in a chemical experiment, I received a wound from the explosion of some fulminating silver: after its healing a grey mark was left, made by a minute portion of the metal having been injected into the cutis. That mark still remains, without the least fading of its intensity.

Further, I need hardly observe, that in judging of the color of parts after death, the medicines used, the treatment previously employed, should not be lost sight of. The application of a blister, as is well known, is apt to produce strangury, —an affection owing to the action of the cantharides on the bladder, producing a state of phlogosis, often of ecchymosis of the mucous membrane of that organ, and also not unfrequently of the ureters and pelvis of the kidneys.* Now, without making allowance for this effect, the appearance would be referred to the disease existing at the time, so leading to an erroneous conclusion of a morbid complication. In like manner, if an irritant medicine be given, such as colchicum, its administration ought to be taken into account in estimating the redness of the stomach, if inflammation of that organ be a question. Even a mechanical cause may have an influence on the coloration of a part, such as the pressure of air or of fluid distending the cavities of the thorax and abdomen. For instance, if the latter be much inflated by gas disengaged in the stomach and intestines, and, in the *post mortem* examination, the brain be the first part laid open, the tendency of the inflation by pressing on the great vessels, in case they contained any liquid blood, will be to drive it towards the part where there is least resistance, viz., the brain, the confining skull-cap being removed, and so occasion the injection of the cerebral vessels, which, without reference to the cause producing it, might be pronounced to be morbid.

* The strangury from this cause, I may remark, I have always found relieved by introducing a catheter into the bladder; how it acts, I am ignorant; rarely more than a few drops of urine are obtained.

Relative to the effect of gravitation on the blood in producing discoloration, sugillation of the integuments of the decumbent parts, and engorgement of certain deep seated parts, especially the lungs, it is nowise necessary to insist, it being so well known and thoroughly understood. And much the same remark applies to the staining effect of bile, exuding from the gall-bladder after death, it being so very obvious. However, being so conspicuous and unquestionable, it affords a good illustration of the pervious quality of the tissues, after the extinction of life, and how it proceeds in an increasing degree with the length of interval between death and the observation, and, under the influence of the other circumstances before adverted to favoring putrefaction.

3. *Of the Softening of Parts.*—By this expression, I wish to imply a diminution of cohesive power, so that a part is more easily torn, or more easily broken under the pressure of the nail or fingers, in contradistinction to that softness which may belong to the same in health,—a softness distinguished by toughness, or power of resistance. The morbid condition in question is difficult of appreciation, is one specially requiring the *tactus eruditus*, that tact gained by experience, sharpened by science. The pathologist is oftenest called on to exercise it on mucous membranes and on the glandular organs; of the former, most of all on the stomach; of the latter most frequently on the brain,* the spleen, and the liver. The stomach, perhaps of all organs, offers the greatest difficulty, in consequence of the peculiarity belonging to it, its liability to be softened and even dissolved by its own gastric juice. Instances of this kind, as is well-known, were first described by John Hunter. Amongst my collection of cases, I find two remarkable ones, which will hereafter be given, in both of which, in the *post mortem* examination, not only was a portion of the stomach, its great arch, dissolved, but also the diaphragm adjoining, and yet the residue, even the nearest portion, had not in either instance become unusually

* The circumstance of the brain being incased, and more than any other organ protected from the influence of external air after death, should be kept in mind. This remark is made reflecting that it is sometimes found firm after putrefaction has commenced in other parts, and they have become softened thereby. In fifteen cases of men who died in Malta and Corfu (6 in the warmer, 9 in the colder months) of pneumonia, peritonitis, and aneurism,—cases in which there was no reason to believe that the brain was affected, this organ was found of its normal consistence after an average interval of 24 hours between the death and the examination.

soft. The softening from the action of the gastric juice, or to speak more correctly, in connexion with the presence of that juice in the stomach at the time of death, seems to be most uncertain, and this even in instances of death from accidents. In many cases of such deaths, though the persons previously were in vigorous health, I have not been able to detect any traces of it. As regards the softening of organs generally, considered as a *post mortem* change, and nowise to be taken into account as the effect of fore-existing disease,—length of time reckoning from the death, and the temperature of the air at the time, may be held to be the two circumstances most deserving of attention; to which may be added, the condition of the body as regards its tendency to putrefaction,—this hardly of less importance for the purpose of arriving at a just conclusion. These circumstances scarcely require comment. It is well-known to every one, how rapidly meat becomes tender, and how very short a time it will keep during the warm weather of summer, and how the contrary is noticeable in winter. Within the tropics, at a temperature of 80° and higher, so great is the proclivity to putrefy, that meat cannot be salted with a chance of its preservation, unless immersed in brine as quickly as possible after the slaughtering of the animal; indeed the pieces should be immersed whilst still warm. This aptness to putrescence necessitates in hot climates the speedy funeral of the deceased, a service commonly performed on the day of the fatal event, or at the farthest not beyond the following. The same reason is assignable for the examination of the body very soon after death, many instances of which will be found specified in the following pages. In addition to the preceding circumstances, as regards the stomach and the parts immediately adjoining it, I am disposed to think another should be taken into account, viz., the contents of the organ. In one instance in which the putrefaction had commenced and much gas was disengaged, the stomach, which contained a good deal of fermenting chyme, was not at all softened, nor was the spleen adjoining. Might not the carbonic acid disengaged have preserved the stomach? The case was one of death from an accident; the examination was made 23 hours after death. Blood abounded in the body; the temperature of the air of the room was 74°. In this instance, air-bubbles were found even in the anterior chamber of the eye,—a