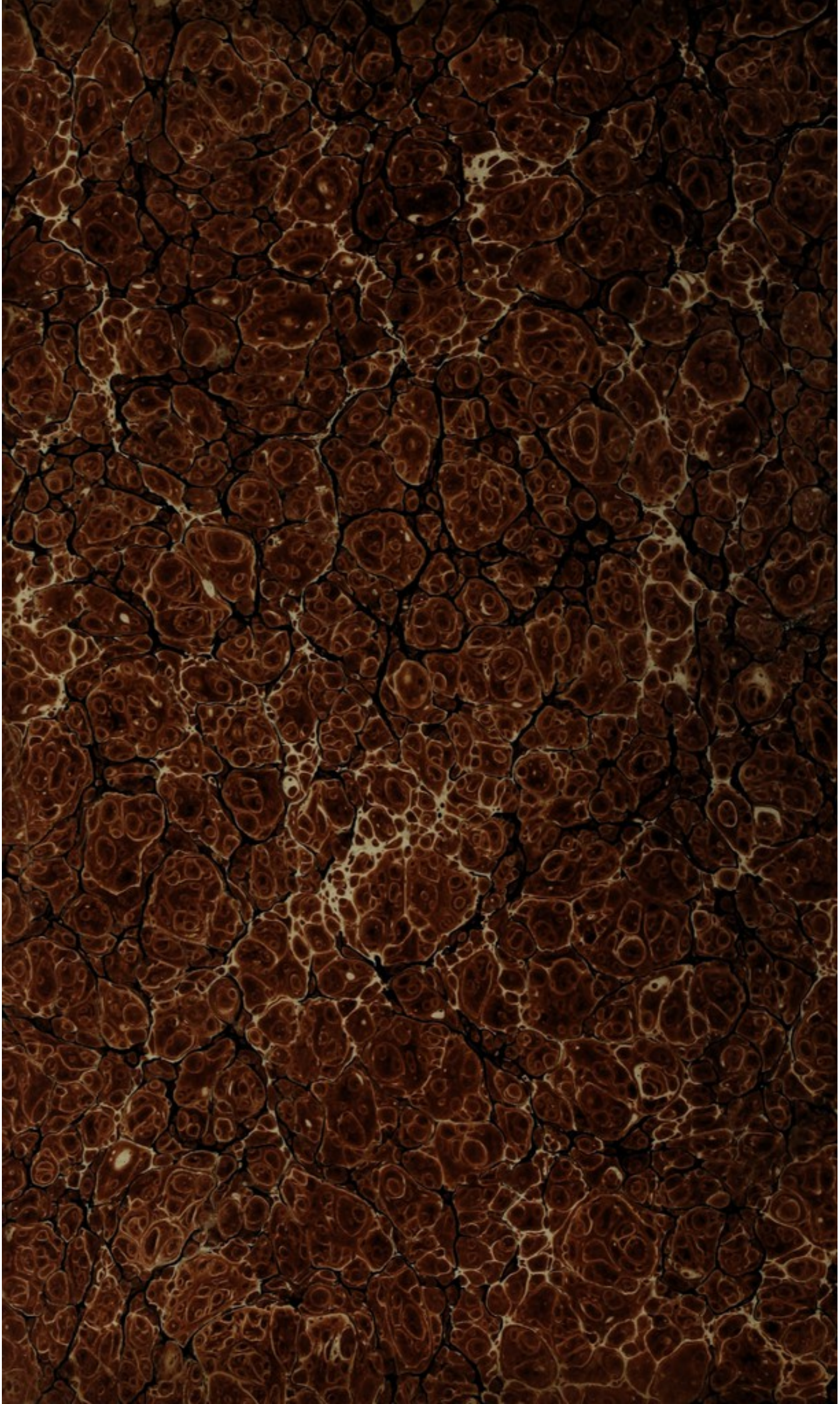
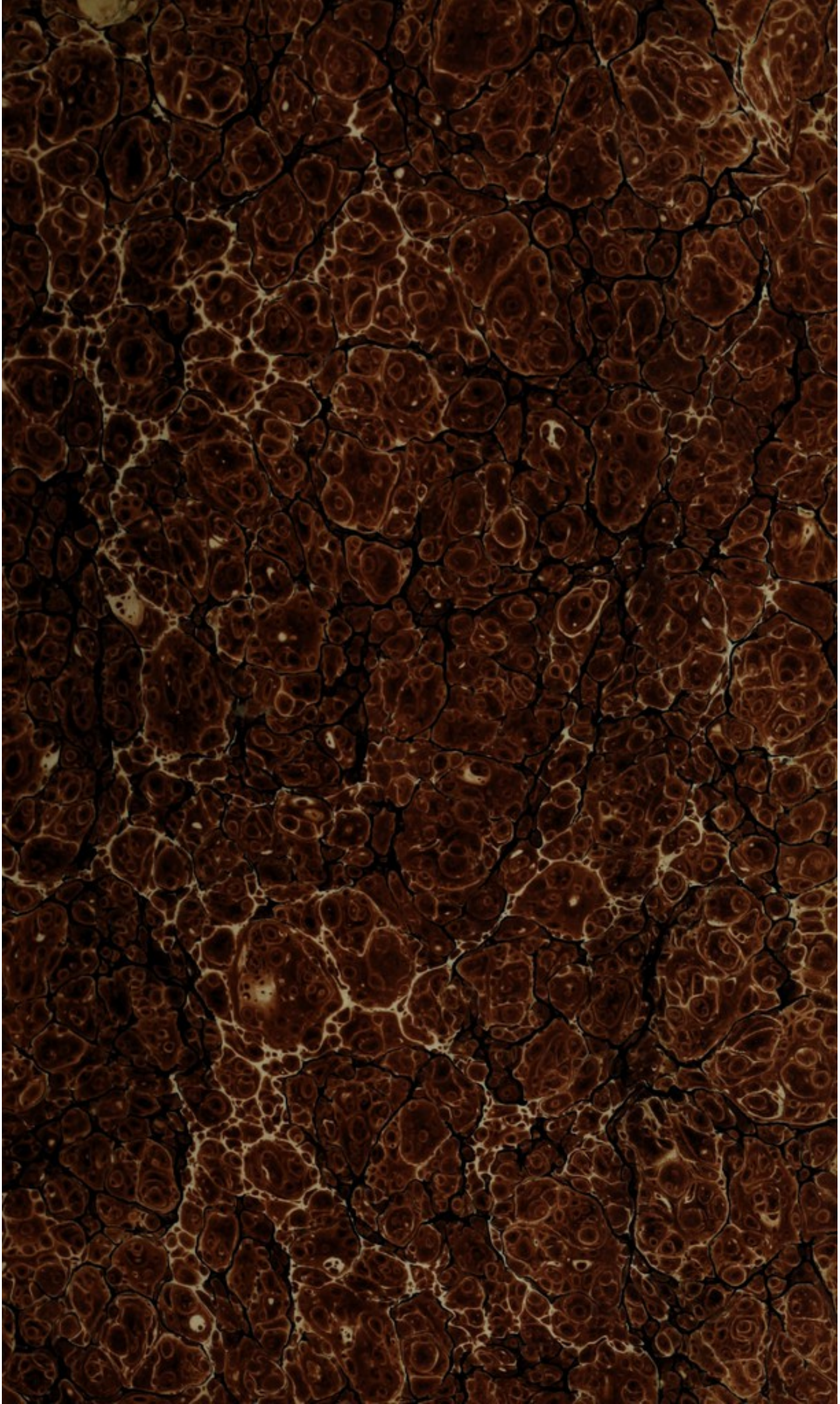
An inquiry into the action of mercury on the living body / [Joseph Swan].





AN

INQUIRY

INTO THE

ACTION OF MERCURY

ON THE

LIVING BODY.

By JOSEPH SWAN,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, AND SURGEON TO THE LINCOLN COUNTY HOSPITAL.

Sed assiduitate quotidianâ et consuetudine oculorum assuescunt animi; neque admirantur, neque requirunt rationes earum rerum, quas semper vident: perinde, quasi novitas nos magis, quam magnitudo rerum, debeat ad exquirendas causas excitare.

CICERO *de Natura Deorum*, lib. 2.

Second Edition.

LONDON:

PRINTED FOR

LONGMAN, HURST, REES, ORME, AND BROWN,

PATERNOSTER-ROW.

1823.

LONDON:
Printed by A. & R. Spottiswoode,
New-Street-Square.

PREFACE.

NOTHING has been more difficult than the explanation of the action of mercury; and though, perhaps, what I have written may not be altogether conclusive, still I am not without hope that it may lead others to prosecute the subject with different views from those they have hitherto taken of it. I should have been very glad to have presented my observations to the public in a more perfect form; but as it is not probable that I should have the opportunity, in any reasonable time, of dissecting those who have either died under the influence of mercury, or have suffered so much from it at some previous time as to have never

recovered from its effects ; and as it is thus only I should be enabled to bring the matter to a more accurate test, I think it better to offer what I have to say in its present state, rather than wait till a period which, after all, might never occur.

PREFACE

TO

THE SECOND EDITION.

In presenting a Second Edition of this work to the Public, I do it with considerable hesitation; because, though the varied experiments I have made, sufficiently convince me that mercury produces a specific action on the ganglia of the grand sympathetic nerves, yet I am aware that my investigations have not been carried so far as the subject demands.

The ganglia of the grand sympathetic nerves may be affected by other medicines, and likewise by diseases. In the sporadic

abdominal typhus of young people*, Dr. Autenrieth has found, on dissection, a peculiar inflammatory state of the nerves, principally of those of the abdomen. And I particularly examined, myself, several of the ganglia of the grand sympathetic nerves in four subjects. In those of one I found a very great vascularity; in the second this appearance existed, but in a less degree; whilst in the other two, there was not the least appearance of blood-vessels. In the first, the lungs were solid from inflammation, and there was a small abscess in the superior lobe of the right side. In the second and third, there were tubercles in a state of suppuration in the lungs and ulcerations of the intestines, and in the fourth, both the liver and lungs were studded with small tubercles, and there was an aneurism of the pulmonary artery which communicated by ulceration with the aorta. In the first I could not ascertain whether mercury had

* Edinburgh Medical and Surgical Journal, July 1822.

been used. In the second, it had not been used for some time, and with regard to the other two it was very doubtful.

I conceive it can be decided only by a number of cases and examinations after death, whether the increased vascularity of the nerves is owing to the peculiarity of the disease or the medicines: and with this view I consider that it may be highly advantageous to give active medicines to healthy animals, in order that, by a careful dissection afterwards, it may be discovered, as far as possible, in what manner every part of the body is affected by them.

Many reasons prevent my prosecuting these enquiries any further at present, and one of considerable influence is the necessity for sacrificing the lives of so many animals. Nevertheless, should it hereafter appear of importance, I shall again return to the investigation, not only of the point

at present more immediately under consideration, but likewise of the effects of many other active medicines.

To point out more decidedly the necessity that exists for further investigation, I will briefly relate the following case.

A strong healthy man, thirty-seven years old, was seized with slight symptoms of tetanus on the 6th of May; on the 9th they became very violent, and he died on the 12th. He had the misfortune about three weeks before to pierce with a spike the joint between the metacarpal bone and first phalanx of the little finger. In about the last seventy-two hours, he took two ounces of spirits of turpentine, and thirty-two grains of submuriate of mercury, and the same quantity of opium.

The examination of the body took place about sixteen hours after death.

After opening the spinal canal, the sheath formed by the dura mater was divided, and was found to contain a small quantity of limpid fluid. Many adhesions were found between the loose tunica arachnoides, and that covering the dura mater. On the loose tunica arachnoides there were a few small spots of cartilaginous matter. The veins of the pia mater were much loaded with blood. The medulla spinalis was divided in many places, and appeared perfectly healthy, but in the beginning of the dorsal portion there was a spot of coagulated blood of the size of a small pin's head in the midst of the medullary substance; many of the ganglia of the spinal nerves were examined, but they did not exhibit any altered appearance.

There was an effusion of bloody serum between the tunica arachnoides and pia mater of the brain at the situation of

the squamous portion of each temporal bone. The veins were turgid, but there was not any diseased appearance in the brain.

The lungs were very purple and in a state of expansion, and were much loaded with blood. On the pericardium covering the heart, there was a patch of coagulable lymph as big as half a crown, and there was another about the origin of the aorta. There was an increased vascularity of the outside of the aorta through the chest.

The villous coat of the stomach, especially at the cardiac extremity, was exceedingly vascular. There was not any unhealthy appearance in that of the intestines. The mucous membrane of the bladder was very vascular. The rest of the abdominal viscera appeared sound.

Both psoæ muscles had blood effused into their substance in a manner similar to what happens in cases of fracture.

The par vagum in the neck was quite healthy, but at the root of the right lung the nerve had an increased vascularity which did not exist in that of the opposite side.

There was an enlargement, and a greatly increased vascularity of all the ganglia of the grand sympathetic nerves in the chest and also of the semilunar ganglia; in several of those in the abdomen the same appearance existed, only in a less degree, but in some there was neither the least redness nor enlargement.

The nerves of each arm, and the sciatic nerve examined, appeared perfectly healthy.

In this examination no part of much importance, except the ganglia of the grand sympathetic nerves, decidedly deviated from the healthy state; and, in the present state of our knowledge, I conceive it difficult to determine whether the appearances were in any way connected with the disease; or were caused entirely by the submuriate of mercury, the opium, or the spirits of turpentine.

AN INQUIRY, &c.

THERE is, I believe, no active medicine, the employment of which is more general, or its operations less understood, than mercury; and, therefore, when we observe how many suffer from its effects, not only when it has been used indiscriminately, but even in the hands of judicious practitioners, it seems to be a matter of some moment to ascertain how it acts, or what are the changes produced by it, that, when its use has been long continued, or its operations severe, the system so slowly, and frequently never, returns to its former condition.

It has been in vain attempted to discover mercury either in the blood or any of the secretions; and, as its effects increase ac-

cording to the quantity used, we must suppose either that it is absorbed and accumulates in the body, or that an increased action, or very material change, is produced in some very important part of the body by it.

Two things only lead to a supposition that mercury is absorbed, and taken into the system: viz. the peculiar taste frequently experienced on its use, and the change in silver worn about the body. With respect to the former observation, I do not conceive it is always to be depended upon, because I have known the same taste complained of, where no mecury has been used; and the latter is, in my opinion, extremely fallacious. If mercury could be collected on silver applied to the surface of the body, when it has not been used externally but taken only by the mouth, we might then indeed judge that it penetrated the minutest vessels. But when mercury has been used by friction, some portion of the ointment may have come in contact

with the silver and have tarnished it; and even if it should have been taken by the mouth only, yet unless it could be proved that the discoloration of the silver was formed by the combination of silver and mercury, no proof that it extends through the minutest vessels could be drawn from this circumstance.

When mercury is taken into the body in only a small quantity, it proves a gentle stimulant to the secretory and absorbent systems, and causes the functions of them and the viscera to be performed in a more perfect manner, and no disturbance of the system is the consequence. But when it is taken in continued doses, it excites salivation or an increase of other discharges, as urine; and not only does this, but likewise frequently produces a furred tongue and much irritative fever. In some, the nervous system is much affected, debility and lowness of spirits are produced, and even after the mercury is discontinued, the system is very long in recovering.

Mr. John Hunter thought * that mercury was in state of solution in the juices of the body, and he tried to ascertain whether this opinion was just; and therefore he says, "I made the following experiments upon myself. I put some crude mercury into my mouth, as a standard, and let it stay there working it about so as to render it easier of solution, till I tasted it sensibly: I then put into my mouth the mercurius calcinatus, and let it remain till I perceived the taste of it, which was exactly the same; but I observed that it was easier of solution than the crude mercury. I tried calomel in the same way, and also corrosive sublimate after being diluted with water, and the taste was still the same. It was some time before I perceived the taste of crude mercury in my mouth. I tasted the calx and calomel much sooner. The corrosive sublimate had at first a mixed taste, but when the acid was diluted, it had exactly the same taste with the former: all these different preparations producing the same sensation or taste in the mouth.

* Treatise on the Venereal Disease, p. 363.

"From the effects of these experiments it would appear, that the mercury in every one of them was dissolved in the spittle, and reduced to the same preparation or solution.

"To try whether mercury in the constitution would produce the same taste in the mouth, I rubbed in mercurial ointment upon my thighs till my mouth was affected, and I could plainly taste the mercury; and, as far as I could rely upon my memory, the taste was exactly the same as in the former experiments.

"I allowed some time for my mouth to get perfectly well and free from the taste; I then took calomel pills till it was affected again in the same way. I afterwards took mercurius calcinatus and also corrosive sublimate. All these experiments were attended with the same result; the mercury in every form producing the same taste, which was also exactly the same as when the several preparations were put into the mouth.

"From the above experiments it must appear that when mercury produces evacuation by the mouth, it certainly goes off in that discharge; and from thence we may reasonably conclude, that when other evacuations are produced from the medicine when in the constitution, as purging, sweating, or an increased flow of urine, that it also goes off by these evacuations, which become outlets to the mercury."

I conceive the preceding observations prove nothing more than that mercury, when taken into the mouth, excites a peculiar taste; and that the same taste may be produced when it is used by friction. Had it passed off in the saliva or any other secretion, it most certainly must have been detected by the eminent chemists who have analyzed them.

When a preparation of mercury is taken into the mouth, it is an impression on the gustatory nerves which produces the peculiar taste; and may not the same effect be excited by its pecular action on the nervous

system, supposing it to affect the whole of this system, even though it be rubbed on the skin and none taken into the mouth? I conceive this may take place just as easily as that sound can be communicated to the auditory nerve through other nerves, or that the teeth should be set on edge through the auditory nerves, or that purging should be produced through the olfactory nerves by the smell of purging medicines, or that the Iris should be affected by Belladonna applied on the eye-brow. And when we know that the immersion of part of the body in the nitro-muriatic acid bath produces the same effect on the gustatory nerves as mercury, it appears to me strongly to confirm the opinion that the taste is not owing to the mercury itself having been absorbed and brought into contact with the tongue, but to its action on the nervous system in general.

In proof of the absorption of mercury, it has been stated, that it has been found in various parts of the body after death. I own it appeared to me very improbable that

it should be taken into the circulation by the absorbents, and deposited by the terminations of the arteries in its metallic form; but, as opinions in favour of this hypothesis are still insisted on, I do not think it right to pass them over without a few observations.

I believe that mercury may have been found in the bones, and even in the soft parts. When mercury has been swallowed without having been evacuated from the bowels before death, on the separation of the flesh by putrefaction, some of it may have insinuated itself into the bones of the most open texture. I conceive it not impossible that even in the living body it may have made its way from the intestines into other parts. I have known two instances where a large quantity was given in obstructions of the bowels. In the one, a large portion was found in the enlarged appendix vermiformis cæci; in the other, the whole of it was collected into one place near the obstruction, and had the life of the patient been protracted a few more days, it might

have escaped into various other parts: or, had the dissection been delayed until putrefaction was far advanced, the weight of the mercury might have forced a passage through the ulcerated portion of intestine, and have escaped into different situations.

Mercury is frequently used in anatomical investigations, and, if the subject is afterwards buried, part of it may get into the bones; or if it is preserved in spirits, and is dissected after much time has elapsed, globules of mercury may show themselves, and it may be forgotten that this metal had ever been used. It is thus that I conceive the opinions I am alluding to have been erroneously formed, as I cannot at all believe myself that mercury is ever taken up, either from the skin or intestines, and deposited in its metallic form. If such were the fact, it must have occurred so frequently that it could not have escaped the penetration of the many eminent anatomists who have investigated the subject with the express view of ascertaining the fact, and

especially of Mr. Hunter, whose opinions I shall take the liberty of subjoining. * "It may be supposed to be unnecessary to mention, in the present state of our knowledge, that it never gets into the bones in the form of a metal, although this has been asserted by men of eminence and authority in the profession, and even the dissections of dead bodies have been brought in proof of it; but my experience in anatomy has convinced me that such appearances never occur. These authors have been quoted by others, imaginary cases of disease have been increased, the credulous and ignorant practitioner misled, and the patients rendered miserable."

Mercury cannot circulate with the blood, for when it is introduced into the veins of a living animal it is stopped either in the lungs † or liver ‡; and when it is injected

* Treatise on the Venereal Disease, p. 340.

† See Experiments 14 & 15. and Mémoire sur le Mercure, par M. Gaspard, dans le Journal de Physiologie, tome 1. par Magendie.

‡ See Mémoire sur le Mercure par M. Gaspard.

into the arteries*, it cannot permeate the most minute branches. It is not probable that it can collect in any part of the body without acting as an extraneous substance, either by becoming encysted or producing inflammation and suppuration, as in the following case †, part of which I shall take the liberty of transcribing.

In July, 1753, a young man in making an experiment with a glass tube full of quicksilver, broke it, and to prevent the loss of the liquid, which ran out with force, he placed the thumb of his right hand on the broken end, which had assumed the form of a pen, and the point of this entered the thumb about the middle of the last phalanx to which the nail is attached. A small wound was the consequence, to which the patient paid very little attention: he applied a plaster, and it appeared reunited in about six days; but at that time the finger became tense, and pain and fever, and every symptom of constitutional irrita-

* See Mémoire sur le Mercure par M. Gaspard.

† Mémoires de l'Academie de Chirurgie, tome 3.

tion supervened. His surgeon applied to the thumb a digestive ointment and emollient cataplasm. The pain became more severe, and the fever increased; proper remedies were used, and a small abscess formed at the first phalanx.

As soon as the abscess appeared to be in a proper state it was opened, and bloody matter and quicksilver escaped. He suffered so much pain when he was dressed, that he several times fainted. On the dressings, and at the bottom of the wound, globules of quicksilver were always observed, and it was supposed that a drachm and a half at least had escaped. At some distance from the nail there was a slight oozing, and at its root, and the patient complained of much pain whenever this part was touched. The wound was cicatrized in about ten days, and the bad symptoms disappeared, but the finger appeared swoln, and small pimples often rose, which the patient opened, and either quicksilver or thick matter was discharged. He always felt acute pain at the joint of the two last phalanges, and at the

side of the nail. Occasionally there were shooting pains in the thumb, which he compared to thrusting a needle in the direction of the tendon.

After using various means for his relief, which were thought of use, the author goes on to state, that his progress towards recovery abated; the pimples situated between the joint and extremity of the thumb, became again hard and red, and appeared to extend sensibly, and caused fresh alarm. Such was the exact state of the patient on the eighth of January, 1754.

It was supposed the bone might be diseased, and an incision was made in the part, which allowed the quicksilver to pass out more freely, and the patient got quite well.

When the submuriate of mercury is given, it irritates the villous coat of the intestines, and then passes off. In the stools of a gentleman who had taken it combined with antimonial powder every four hours, I ob-

served a blackish substance, which I took for submuriate of mercury changed into the oxydum hydrargyri cinereum. In the stomach of a man who had taken two boluses, each containing three grains of antimonial powder and one grain of submuriate of mercury, part of them had become black in the same way. In the intestines of a lady who had strangulated hernia, and who had taken quicksilver and submuriate of mercury, the same black substance was found just above the stricture. I had laid it aside for examination, but it was unfortunately lost.

I conceive that mercury acts upon the villous coat of the stomach and intestines, by producing a peculiar irritation; for it is not the quantity used which excites salivation and the usual consequences of mercury, but the irritating form in which it is administered. Blue pill irritates the least; submuriate of mercury next, and the oxymuriate the most. The latter medicine, indeed, must be diluted, that the intestinal canal may bear it. If it be sufficiently diluted,

it produces the irritation in the system mercury causes in its mildest form ; if it be stronger, it stimulates the villous coat too much and produces pain, and, if still stronger, violent inflammation and a destruction of its substance.

It is not necessary that mercury and many other medicines, taken into the alimentary canal, should be absorbed and received into the circulation before their usual effects are produced ; but in the same manner that various substances excite different sensations in the pituitary membrane, when applied to the nose entirely through the olfactory nerves, so the different degrees of excitement arising from mercury and other medicines, may be caused by their coming in contact with the villous coat of the stomach and intestines by means of the branches of nerves distributed to them.

When I observe the effects produced by mercury, and find that it cannot be detected in any part of the body after its use, I can-

not help supposing that it acts on the nervous system *, and most particulary on that part of it formed by the grand sympathetic nerve. The brain does not seem to be primarily affected by it; and, I think, the following case and experiments will prove that my conjectures were well founded.

On dissecting the grand sympathetic nerve, I found its ganglia and branches larger than I ever observed them before; I also observed an increased size of the par vagum. I could not satisfy myself the other nerves were enlarged. The subject had an encysted tumour in the liver about the size of a pigeon's egg, and the substance of this viscus when divided was streaked with red, in a peculiar manner, which appearance seemed to me the effect of inflammation.

I supposed the system had been under the influence of mercury, for both sides of

* It is very probable that the nitro-muriatic acid acts in the same manner.

the face were much swoln; the salivary and absorbent glands were much enlarged; the teeth were loose, and there was a separation of the gums.

On opening the spinal canal, I found much glairy fluid on the surface of the dura mater; and I never observed its existence in the same degree in any other subject. The body was emaciated, but as far as I could judge, death had taken place rather suddenly, for the emaciation was not in the greatest degree. I did not observe disease in any of the other viscera. The brain was firm and sound, but the medulla spinalis was very soft.

On finding this state of the grand sympathetic nerve, and par vagum, I was led to suppose, that it was, as I have before stated, the effect of mercury; and it being allowed that this medicine cannot be traced either in the blood or any of the secretions, and that its effects increase in proportion to the quantity used, if it be not accumulated in the system, as I do not conceive to be

the fact, we must necessarily imagine that a change is produced in some very important part by it: and this change, from considering the symptoms produced by mercury, I cannot help concluding is in the nervous system, and that the enlargement of the nerves in this instance was the effect of the mercury. I could not learn the history of the case.

To find out whether the nerves really become affected by the use of mercury, I made the following experiments:

EXPERIMENT I.

A moderate-sized full-grown dog had five grains of submuriate of mercury given her on the 2d of July, 1822, in the morning, and the same quantity at night.

3d. She took the same quantity.

4th. She took four grains in the morning, and the same quantity in the evening, and

a grain of opium was added to each dose to prevent its purging her too much.

5th. She took three grains in the morning, and the same quantity at night, without opium.

6th. She took four grains in the morning. In the evening, she took four grains more, and to this dose a grain of opium was added. In the morning a large ulcer, having the characters of a chancre, was perceived on each side of the upper lip.

7th. She took four grains, and one grain of opium. She appeared to swallow with difficulty.

8th. She took four grains without opium. Other ulcers were perceived about the gums.

9th. She took four grains with one grain of opium. She would not touch either milk or water. About four o'clock P. M. bloody saliva kept constantly running from the

mouth; at six P. M. I could not rouse her, and she appeared dying.

10th. In the morning she appeared better, and was on her legs. She would not take any thing but water. In the evening she lay in the same state as on the preceding evening, and in the morning I found her dead. She never eat any thing after the first two or three days, but always appeared to be excessively thirsty. The use of the legs, and especially the hinder ones, appeared dimished.

Examination.

There were several small ulcerations on the inside of the cheeks, and many of the teeth were loose. The brain appeared sound, but its membranes were too full of vessels, much more so than in health. The medulla spinalis appeared soft, but otherwise neither it nor the membranes inclosing it were unhealthy. The stomach and all the thoracic and abdominal viscera were sound. There were some reddish spots on the vil-

lous coat of the small intestines, and the mucous membrane of the large intestines was very red, having the appearance of being affected by chronic inflammation.

The ganglia of the grand sympathetic nerves were very vascular, and likewise the par vagum, and all the nerves were more vascular than in a state of health, and on one of the sciatic nerves there was a spot of ecchymosis. The aorta on its outside and especially about its arch was unusually vascular.

It will here perhaps be of use to state the manner in which I have found the examinations to be most easily made.

After removing the skin, the pectoral muscles are to be divided at their origins so as to allow of the shoulders being forced back, but care must be taken not to wound the axillary veins. The abdomen is next to be opened; and then the ribs are to be divided so that each of them may be left only three or four inches long; and for this

purpose a pair of scissors* used by gardeners for pruning trees will be found the most convenient instrument. When the ribs have been divided, the diaphragm is to be separated as far as is necessary, the inferior part of the sternum is then to be raised and turned back towards the chin, and after a ligature has been put on the internal mammary vessels, it is to be entirely removed. After this every drop of blood is to be washed away with a sponge and water. The grand sympathetic nerves will be seen on each side the spine, and may be most easily dissected with the forceps and one blade of a pair of scissors. In making the examinations, it is absolutely necessary to avoid wounding the veins, and if it be required to remove any of them for the purpose of observing the parts behind them, two ligatures must be placed on each of them before a division is made, as it is impossible to draw such satisfactory conclusions from the appearances when the nerves

* One blade is narrow and very thick, and is concave at the edge; the edge of the other is convex, broad, and much thinner.

have been covered with blood. I may further remark, that in a healthy dog, neither the ganglia of the grand sympathetic nerves, nor those of the spinal nerves, are by any means red, but on the contrary, have a pearly appearance, when the examination has been made soon after death, and care has been taken to prevent their coming in contact with blood. If, however, it unavoidably happens that the nerves should be covered with blood, it is necessary to wash them with cold water, and it will then be found that, whilst an immersion of several hours will be required for the removal of the redness, when it has been caused by the use of mercury; on the contrary, when they have been merely covered with blood, a comparatively short time will be required to effect the same purpose.

In every examination of the human body, the state of the par vagum and grand sympathetic nerve may be readily observed, if the body is opened in the following manner: An incision being made through the skin from the middle of the neck to the

symphysis pubis, and the skin turned back, the pectoral muscles are to be raised from their origins. The abdomen is to be opened through the linea alba, and then the attachments of the abdominal muscles to the ribs are to be divided as far as convenient. The clavicles are to be sawn through about their middle, and the ribs divided near their angles; for which purpose the scissors recommended for the division of the ribs in the dog, will be found equally useful in the human subject. It is better to begin at the lowest rib, and divide two or three on each side, and then separate the diaphragm as far as it is attached to them. When the sternum and portions of ribs attached to it have been removed, the viscera of the chest and abdomen are to be examined in their situation. The pleura may then be stripped from the ribs by taking hold of it at the part where they were divided, and turning it back towards the posterior mediastinum, when the nerves may be very easily dissected.

EXPERIMENT II.

I procured a large healthy dog of about a year old, and gave her on the 12th of July, 1822, three grains of submuriate of mercury.

13th. She had three grains more. She ate very well, and did not appear affected by the mercury.

14th. She took three grains more. She would eat very little, was thirsty, and unwilling to move.

15th. She took three grains more. Her gums were red, but in other respects the symptoms were the same.

16th. She took three grains more. There were ulcerations just where the cheeks and gums join. In other respects the symptoms were the same.

17th. She took three grains more, and after this no more was given.

19th. She would not take either milk or water, and lay perfectly quiet.

20th. The sores in the mouth have increased. She has purged every day. At first the stools were black, but for the last two days have been of a dark orange colour.

21st. She has taken some water in the night. The sores in the mouth are more extensive, but do not appear so deep. She never stirs.

23d. The sores in the mouth are larger. In other respects she is the same.

27th. She died at 7 P. M. after being convulsed for several hours. She had not eaten any thing since the 14th, and had drunk very little for several days. Within the last few days the stools were of a chocolate colour, and occasionally contained a few drops of blood.

Examination.

I examined the body nine hours after death. On dissecting off the skin, the whole of it on the inner surface was very vascular.

On opening the abdomen, the viscera had a sound appearance. The villous coat of the small intestines had a few red spots upon it; and the mucous coat of the large intestines was red, but not near so much so as in the former experiment. The thoracic viscera appeared sound; but the external coat of the aorta was very vascular, as in the preceding experiment. There were several large ulcers in the mouth, and the membrane covering the whole of the throat was too red. The par vagum was inflamed, and especially at its superior part, it was then not so red, and then again, where it communicates with the inferior cervical ganglion, it was very red. All the ganglia of the grand sympathetic nerves were inflamed, and likewise portions of their nerves, and one portion of the nerve, especially

before it formed the left semilunar ganglion, was much inflamed and thickened, and there was a red substance about it like the coagulable lymph effused by nerve when it has been wounded. The pia mater of the brain was too full of vessels, but the brain was sound. On opening the spinal canal there was a little fluid in the inferior part of the sheath, formed by the dura mater, but the membranes and medulla were sound: indeed, if any deviation existed from the healthy state, the pia mater might be said to be a little too vascular, and the medulla rather softer, but there was no material change. The sciatic nerves were more vascular than usual, but this appearance was very much increased near the ischiatic notch. The axillary plexus was very vascular, but this appearance existed in a very trifling degree in the nerves lower down the leg. I examined the ganglia of several of the spinal nerves fifty-six hours after death, and though the animal had been kept in water since the first examination, these were still found so full of vessels as to leave no

doubt in my mind that they had partaken of the inflammatory action.

The results of these experiments lead me to believe that mercury produces first an irritation in the grand sympathetic nerve, communicated to it from the termination of its branches on the villous coat of the intestines; and if its use is persevered in, inflammation is soon the consequence; whilst, at the same time, the same irritation is communicated to the other nerves. But it may be necessary to inquire why the nerves of the limbs are not found enlarged, or inflamed always, as well as those of the grand sympathetic nerve. I conceive that mercury acts more decidedly on the grand sympathetic than on any of the other nerves, and that it is only after a length of time that these other nerves become affected. In the second experiment, the par vagum, the nerves forming each axillary plexus, and those of the sciatic nerves, were very red from vessels near their communication with the grand sympathetic nerves, and the diminished vascularity was

very evident the further they were removed from these. I therefore think it probable that the enlargement of the grand sympathetic nerve in the dissection I have mentioned, without any enlargement of the other nerves except the par vagum, is what usually takes place, and that the other nerves become enlarged only where the use of mercury is very long continued. The increased vascularity of all the nerves will, I think, account for the pains of the limbs and frequently for their weakness. Will not the decided effect produced on the par vagum, likewise account particularly for the aggravation or the coming on of consumptive symptoms where there was a predisposition to that disease, by a long course of mercury, and explain why a few doses of mercury, given where the symptoms are those of consumption, and depending onlyon a disordered state of the chylopoietic viscera, will remove such disorder?

With a view of ascertaining how mercurial preparations acted on being intro-

duced into the veins, the following experiments were made:

EXPERIMENT III.

January 28, 1823, at two P. M. * Ten grains of submuriate of mercury mixed in an ounce of water were injected into the right jugular vein of a spaniel bitch. About a quarter of an hour after, she appeared to wish to lie still, and had tremblings of the whole body. At a quarter before four, she breathed with difficulty, and would neither eat nor drink. At five, the difficulty of breathing was very great, and continued so at nine; and in the course of the night she died.

Examination.

The lungs presented numerous purple patches, and their substance was very firm,

* When the submuriate of mercury is mixed with water, it is so soon precipitated, that it is impossible to inject every particle; and as far as I could judge, only eight grains were introduced into the vein.

whilst here and there a vesicle was observed on their surface. The heart appeared sound.

All the ganglia of the grand sympathetic nerves were very red, and especially the inferior cervical. The par vagum was more red than natural.

The peritoneum appeared inflamed. The villous coat of the stomach and small intestines was very red, and covered with bloody mucus. In the upper portion of the small intestines there were several ulcerated patches. In the lower portion there were only a few red spots. The rectum was very red, and covered with bloody mucus.

The membranes of the brain were very vascular, and the brain itself was rather too vascular. The medulla spinalis and its ganglia appeared healthy.

To see whether the appearances I have described were produced by the submuriate

of mercury as an extraneous substance merely, I made the following experiment.

EXPERIMENT IV.

January 30th, 1823, at half past twelve at noon, I injected ten grains of prepared chalk, mixed with an ounce of water, into the right jugular vein of a large dog, not quite six months old. He soon after ate some meat with a good appetite. At three P. M. he ate again, and appeared quite well.

31. He ate heartily, and appeared quite well.

EXPERIMENT V.

January 31st, 1823, at half past nine A. M. I injected ten grains of submuriate of mercury, mixed in an ounce of water, into the left jugular vein of the dog, who was the subject of the former experiment. He vomited soon after, and appeared to be in pain. At one P. M. he breathed with great difficulty. About five he ate some meat, and drank

water. He continued to breathe with difficulty, and I found him dead at half past eight P. M.

Examination.

This took place at eight the next morning. I found the superior dorsal ganglion of each grand sympathetic nerve much inflamed, and likewise all the other ganglia in the chest. The left semilunar ganglion was much inflamed, but there was very little redness in the right, or any of the other ganglia in the abdomen. The superior cervical ganglia were much inflamed. The right par vagum, just where it communicates with the inferior cervical ganglion, was much inflamed. The cardiac nerves were red. The nerves of the axillary plexus were redder than natural, much more so than the sciatic.

The membranes of the brain were very vascular. There was a large mercurial ulcer on the inside of the left cheek. The lungs were inflamed, and solid. The heart was sound. The peritoneum was not in-

flamed. Neither the villous coat of the stomach, nor small intestines, showed the same redness as in the preceding experiment; but the inner coat of the large intestines was very red, and covered with bloody mucus. The spleen had a peculiar appearance, being studded with white spots.

EXPERIMENT VI.

April 8th, 1823. I injected eight grains of submuriate of mercury, mixed with six drachms of water, into the left jugular vein of a puppy about six weeks old. He died within half an hour after.

Nothing particular was observed on dissection, except a few purple spots in the lungs, and a slight redness of the ganglia of the grand sympathetic nerves.

I wished to try whether a division of the par vagum, of one side, would cause any difference in the effect of mercury on the nerves of that side, and therefore made the following experiments.

EXPERIMENT VII.

I divided the right par vagum in a small dog, and then injected ten grains of submuriate of mercury, mixed in an ounce of water, into the jugular vein. He lost much blood, but not enough to affect him in a great degree. He breathed with great difficulty, became convulsed, and died about half an hour after the injection.

The viscera were quite healthy in appearance. The ganglia of the grand sympathetic nerves were unchanged.

EXPERIMENT VIII.

February 5th, 1823, at nine A.M., I removed ten-twelfths of an inch of the right par vagum of a large dog. At first she breathed with difficulty; this affection however soon went off. A short time after the operation the right eye appeared inflamed, and she had frequent twitchings about the chest. She ate with a good appetite.

7th. She appeared nearly well, and had only some slight twitchings about the neck and chest.

At half past nine A.M. I injected into the left jugular vein ten grains of submuriate of mercury, mixed in an ounce of water. Difficulty of breathing soon came on, and she died a quarter before four P.M.

Examination.

This took place the same evening. The right lung had several very purple spots on it, which, on being divided, had the appearance of ecchymoses. Both lungs were more solid than natural. The heart was healthy. The villous coat of the small intestines, and the inner coat of the rectum, were very red. Food was contained in the intestines.

The right par vagum above and below the division was very red. The ganglia of the right grand sympathetic nerve in the neck and chest were inflamed, but the semi-

lunar ganglia of the same side were so in a very trifling degree. In the left side the ganglia of the neck and chest, and likewise the semilunar ganglia were inflamed, but none of the ganglia were so red as in the third and fifth experiments.

I found it impossible to cut off entirely the communications between the lungs and grand sympathetic nerves, and as no satisfactory conclusions could be drawn from more experiments unless this could be accomplished, I did not repeat them.

EXPERIMENT IX.

April 9th, 1823, at half past seven A.M. I injected one drachm of mercury with chalk, mixed with two ounces of water into the left jugular vein of a very large dog. He did not at first appear much affected; still, however, difficulty of breathing came on, and he died at half past twelve at noon.

Examination.

This took place about an hour and a half

after. All the ganglia of the grand sympathetic nerves were inflamed, but the superior cervical, the superior dorsal, and the semilunar were so in the greatest degree. The par vagum, likewise the axillary plexus, and sciatic nerves, and the brain and medulla spinalis, and their membranes, and the ganglia of the spinal nerves were more vascular than natural.

The lungs were inflamed and solid, and not so purple as when the submuriate and oxymuriate of mercury have been used. The lining of the trachea was very vascular. There was much fluid in the chest, which, on being removed, had in some degree a gelatinous appearance. The posterior mediastinum was loaded with the same fluid. The thoracic duct was full of lymph, which had no taste, and did not tarnish silver in the least. The peritoneum appeared inflamed, the villous coat of the stomach and small intestines was very vascular. The inner coat of the rectum was red, but not in a very great degree. The inner coat of the bladder was very vascular.

EXPERIMENT X.

March 13th, 1823. I injected into the jugular vein of a full-grown small dog a grain and a half of oxymuriate of mercury, dissolved in an ounce and a half of water. He soon after breathed with difficulty, and coughed much; he became insensible, and died about three quarters of an hour after the operation.

Examination.

This took place three hours after death. The lungs had the peculiar purple appearance, generally exhibited after the injection of mercurial preparations into the veins, and they were firm and distended. The villous coat of the small intestines was red. The internal surface of the rectum was more red than natural. The ganglia of the grand sympathetic nerve were much too red, so that they appeared to be in an incipient state of inflammation.

EXPERIMENT XI.

March 15th, 1823, at half past seven A.M. I injected one grain of oxymuriate of mercury, dissolved in an ounce of water, into the left jugular vein of a full-grown dog of moderate size. He breathed with difficulty; and purged several times, and vomited. He died at twelve at noon.

Examination.

This took place two hours after death. All the ganglia of the grand sympathetic nerves were inflamed. The par vagum was more red than usual at the places where it communicates with the grand sympathetic nerve. The brain and medulla spinalis were rather more vascular than usual. The ganglia, formed by the fifth pair of nerves just before they leave the cranium, were red as if slightly inflamed, and the ganglia of the spinal nerves were red in the same degree, but they were not near so much so as the ganglia of the grand sympathetic nerves.

There was much fluid in each cavity of the chest. The cellular membrane in the posterior mediastinum was loaded with serum. The inferior lobe of each lung was inflamed, thickened, and purple, and several vesicles were observed on that of the right side. The other lobes were hardly altered, either in appearance or to the touch; and the superior lobe of the left lung was not altered in the least.

The villous coat of the stomach and intestines was much inflamed, and especially the superior part of the small intestines, and the rectum. The whole peritoneum was inflamed. The mucous membrane of the bladder was inflamed.

EXPERIMENT XII.

March 21st, 1823. At a quarter before eight A. M. I injected one grain of oxymuriate of mercury, dissolved in an ounce of water, into the left jugular vein of a large dog, eight months old. At a quarter past

eleven she had purged several times, and pure blood was in her stools. In the evening she eat with an appetite.

22d. She appears to have vomited what she eat yesterday. She is thirsty; has purged much, and is upon the whole much the same as yesterday.

23d. She is much the same as yesterday. In the afternoon she became much worse. She was constantly grinding her teeth, and had a spasmodic affection of every part of the body. Saliva flowed continually from her mouth.

24th. She was found dead this morning, and I examined her at seven A. M.

Examination.

All the ganglia of the grand sympathetic nerves were inflamed, but not in the same degree as in the preceding experiment. The right superior dorsal ganglion was inflamed in a greater degree than any of the rest.

The right semilunar ganglion was more inflamed than the left. There was more redness of the par vagum than in the preceding experiment. The ganglia of the fifth pair of nerves were more red than natural. The brain was healthy, but its membranes were very vascular. The medulla spinalis was healthy, but its pia mater was too vascular. The ganglia of the spinal nerves were not vascular. The nerves forming each axillary plexus were much more vascular than natural, but near the elbow no vessels could be distinguished. The sciatic nerves were not so vascular as those of the axillary plexus.

The inferior lobe of the right lung was purple and solid; the superior lobes had purple spots on them, but they were not solid. The left lung had purple spots on it, and its inferior lobe was the most affected, but it was not near so much diseased as the right.

The liver was much darker than usual, and I supposed it was inflamed. The pan-

creas was much more red than natural. Neither the stomach nor small intestines had any redness on their villous coat, but the mucous coat of the rectum and bladder was very red. The stomach and intestines contained an unusual quantity of bile. There were several red spots on the inside of the cheeks, but there was not the least ulceration. The absorbent system appeared to be in a state of irritation.

As I wish to state every fact I am acquainted with, whether it be favourable or not to my opinions, I shall add the following experiment, which is at variance with all the rest where active mercurial preparations have been used.

EXPERIMENT XIII.

October 25th, 1822. At nine o'clock A. M. one grain of oxymuriate of mercury dissolved in an ounce of water was injected into the right jugular vein of a large dog, four months old. At ten he had trembling

of whole body; at noon he had convulsive motions of his hind legs. He eat with a good appetite.

26th. He appeared worse, and could not stand; he had a good appetite, but vomited up his food soon after eating it, and then eat it again.

27th. At eight A. M. he appeared nearly in the same state as yesterday. At five P. M. he was much better, and took his food with the same consequences as yesterday.

28th. He appeared quite recovered. At nine o'clock A. M. one grain and a half of oxymuriate of mercury, dissolved in an ounce and a half of water, was injected into the left jugular vein. He purged and made water immediately. Two hours after he had tremblings, and died about three P. M.

Examination.

The brain, the medulla spinalis, the nerves, the stomach and intestines, were

particularly examined, but there did not appear any morbid change in them. The nerves had a very healthy appearance, and were very unlike those of the animals which were the subjects of the former experiments. Much inflammation existed in the parts about the right jugular vein, and I conceive that this was occasioned by some of the solution of oxymuriate of mercury having insinuated itself amongst the cellular membrane. The lungs had purple patches on them in many places, and this appearance was observed in their substance on dividing them, and they felt firmer than natural. Fluid was contained in each cavity of the chest.

The appearances of the nerves of the subjects of the experiments in which mercurial preparations were injected into the veins, corresponded with those in which the submuriate of mercury was given by the mouth, except that in the latter the inflammation of the nerves existed in a greater degree.

It may be a matter of some interest to ascertain how mercury acts when injected into the veins. At first sight the experiments may appear to favour the opinion that it is absorbed and taken into the circulation; but the violent symptoms produced by the small quantity introduced into the veins, lead me to conclude that this is not the fact; because, if it were, it is most probable, from this circumstance, that inflammation of the lungs would very frequently be the consequence of its administration; I therefore believe that mercurial preparations introduced into the veins, exert their chief influence on the minute terminations of the pulmonary artery and the air-cells of the lungs, on which these are distributed. From these parts the irritation is communicated by the nerves distributed on them to the ganglia of the grand sympathetic nerves, and the rest of the nervous system. Had the mercury circulated with the blood through the whole arterial system, no parts could have escaped its influence, and especially those generally affected by it; and we cannot suppose that it was deposited on

the inflamed portions of intestines, and the ganglia of the grand sympathetic nerves, as though those parts had an elective attraction for it.

I do not conceive it necessary that mercury should be in the circulation, and taken to every part it influences, for, under many circumstances, when one organ is irritated, another takes on the same action from sympathy. Thus, when matter forms in the brain after an accident, an abscess is frequently found in the liver. And so the stomach will become organically affected from an injury of the skin, as from a burn. Vomiting is produced by injecting an emetic into the veins, exactly in the same manner as when it is taken into the stomach. It is not necessary that the emetic should circulate with the blood, and be applied to the stomach itself, for even after the removal of the stomach, vomiting has been produced when an emetic has been injected into the veins.

In the eleventh experiment the inferior lobe of each lung was inflamed, but the other lobes were almost unaltered, and the superior lobe of the left lung was quite healthy. From this it must appear, that nearly the whole of the solution of oxymuriate of mercury passed through the inferior lobes, and there produced its chief influence. Had it been returned with the blood from the lungs and circulated through the whole arterial system, would not every part of the lungs have become affected as well as the intestines? This not being the case, convinces me, as I have before stated, that the peculiar irritation is produced in the lungs, and communicated by sympathy through the nerves to the other parts affected.

For the purpose of ascertaining whether quicksilver, introduced into the veins, affected the nerves, the following experiments were made:

EXPERIMENT XIV.

February 20th, 1823. At ten A. M. I injected nine drachms of quicksilver, by means of a bone syringe, into the right jugular vein of a moderate sized dog, about six months old. I soon after gave him some meat, which he eat with an appetite. At one P. M. the difficulty of breathing was very great. At nine he was much the same.

21st. He breathed with greater freedom, and appeared more lively.

22d. He was much the same, except that he appeared weaker.

23d. He continued in the same state.

24th. At eight A. M. he was found dead. He did not take any food, except once immediately after the operation.

Examination.

The ganglia of the grand sympathetic nerves were natural; or, if there was any difference, it consisted in the slightest possible redness, but the appearance was very different from that presented by the ganglia when mercurial preparations had been either taken by the mouth, or injected into the veins. There was a slight redness of the par vagum, just before it passes behind the lungs. In every other respect the nerves had a healthy appearance.

There was some bloody fluid in each cavity of the chest. The pleura was inflamed. The lungs were inflamed and quite solid, and when cut into exhibited numerous globules of quicksilver, surrounded by purulent matter. The heart was sound. The viscera of the abdomen appeared quite healthy, and there was not the least redness of the villous coat of the stomach and intestines. A small quantity of quicksilver was contained in the stomach, and at the termination of the small intestines. There

was neither redness nor ulceration in the mouth.

EXPERIMENT XV.

February 26th, 1823. At half after nine A. M. I injected thirteen drachms of quicksilver into the left jugular vein of a full-grown pointer. He became convulsed almost immediately after. At half past one he breathed with great difficulty.

27th and 28th. He breathed with great difficulty.

March 1st. He continues in the same state, except that he is much weaker. He has not taken any food since the operation.

2d. He was much the same; but took a proper quantity of food.

5th. He continued in the same state. He had taken sufficient food every day since the second, and as it was uncertain how long he might yet live, and it was thought

his continuing longer would not be of any consequence to the experiment, he was destroyed by hanging about eight o'clock A. M.

Examination.

This took place at twelve at noon.

There was not any inflammation either of the ganglia of the grand sympathetic nerve or the par vagum, The pleura and lungs were very highly inflamed. On dividing the lungs, abscesses were observed in every part, containing quicksilver. In a few places ulceration appeared to have taken place, and so as to allow of the escape of some of the quicksilver from the lungs.

On opening the abdomen all the viscera appeared sound. There was a redness on the villous coat of the stomach and intestines which I believed to be only accidental, and most probably owing to the presence of food. There was not the least redness in the rectum.

The want of inflammation in the ganglia of the grand sympathetic nerve in the two last experiments, shows that the preparations of mercury produce a specific action in the lungs, and other parts to which they are applied. For had the inflammation of the ganglia, in the experiments in which mercurial preparations had been injected into the veins, been merely the effect of inflammation communicated from the lungs, the redness ought to have been much greater in the two last experiments, as the lungs were diseased in a much greater degree than when the submuriate and other preparations of mercury were used.

If mercury, then, affects the grand sympathetic nerves, it may fairly be asked, how its influence is communicated when rubbed on the skin? I conceive it probable that it may irritate the nerves of this part, and that this irritation may spread from its nerves to the rest of the nervous system; but whether the influence of mercury is communicated by the nerves of the skin to the other parts of the system, or in

any other manner, I am firmly persuaded that it is exercised almost entirely on the nervous system.

For the purpose of ascertaining how mercury acts when rubbed on the skin, the following experiments were made:

EXPERIMENT XVI.

Sept. 12th, 1822, the hair was removed from part of the back of a common sized shepherd's dog, and one drachm of strong mercurial ointment was well rubbed on it.

13th. Two drachms of ointment were used.

14th. More hair was removed, and two drachms of ointment used. The part rubbed yesterday was rather sore. She had a good appetite, but seemed to swallow as if her throat was sore.

15th. Two drachms of ointment were used. Her appetite was good. The gums were slightly red.

16th. Two drachms of ointment were used. Her appetite was good. The gums were more red than yesterday.

17th. Two drachms of ointment were used. Several ulcers were observed in the the cheeks. Her appetite was good.

18th. Two drachms of ointment were used. Her appetite was not so good, and she had difficulty in eating bones.

19th. No ointment was used. The sores in the mouth have increased.

20th. No ointment was used. She was in all respects as yesterday.

21st. No ointment was used. She had a good appetite, and could eat bones, but the ulcers in the mouth continued.

22nd. No ointment was used. She was in all respects as yesterday.

23d. One drachm of ointment was used. The ulcers in the mouth appeared healing.

24th. One drachm of ointment was used. All the ulcers but one were healed, and this looked much better.

29th. One drachm of ointment has been used every day since the 24th; and she is in every respect the same as on that day.

30th. Two drachms of ointment were used. The sore continues in the mouth, but it is not larger. The gums are red, and she has some difficulty in swallowing.

October 2d. Two drachms of ointment were used yesterday and to-day. She has had a good appetite. Her mouth is in the same state.

6th. Two drachms of ointment have been used each day since the 2nd. Her mouth is in the same state. Her appetite is not near so good, and there is some blood in her stools.

10th. Two drachms of ointment have been used every day since the 6th. Her appetite has been very bad, and she has continued to void blood with the stools.

12th. No ointment has been used for the last two days. Symptoms the same.

13th. No ointment was used. She had again a good appetite. Two slight excoriations were on the cheek.

14th. Two drachms of ointment were again used. The excoriations remained. The gums were slightly red and swelled. She had a good appetite, and appeared in better spirits than she had been for some time.

15th. Two drachms of ointment were used, but it was rubbed in the thigh on account of the soreness of the back.

18th. Two drachms of ointment were used both yesterday and to-day. The excoriations in the mouth continue. The stools

have been yellow, and without blood since the 13th; to-day they were black, but still without blood. Her appetite was bad.

19th. Two drachms of ointment were used. The excoriations in the mouth could not be perceived. The stools were black as yesterday, and again bloody.

20th. Two drachms of ointment were used. Her appetite is bad; and the stools as yesterday.

21st. Two drachms of ointment were used. Her appetite is better. Her mouth is very red, and the stools as yesterday.

22nd. Since the 16th the ointment has been rubbed on the thighs, but to-day it was again rubbed on the back. The symptoms as yesterday.

23d. Two drachms of ointment were used. The stools were black, and contained part of her food, which was boiled flesh, perfectly undigested. Her appetite was good, and she appeared in better spirits.

24th. Two drachms of ointment were used. Her appetite was good, but the food passed through the alimentary canal quite unchanged about three hours after it was eaten. The lower extremities appeared very weak.

25th. Two drachms of ointment were used. Some of the stools were quite yellow, but others were mucus tinged with blood. Her lower extremities were not so weak as yesterday, and she appeared more lively.

26th. Two drachms of ointment were used. The stools were black. Her appetite was good. In other respects she was the same.

28th. Two drachms of ointment were used yesterday and to-day. The symptoms have been the same.

29th. Two drachms of ointment were used. Her back began to be again sore from the friction. Her appetite was bad, and she was unwilling to move.

30th. Two drachms of ointment were used. Her appetite was bad, and she was unwilling to move. Her stools were chiefly bloody mucus, but one was quite yellow. She has for some time been losing her flesh, and is now very much emaciated.

31st. Two drachms of ointment were used. In other respects she is the same as yesterday.

November 1st. No ointment was used. She was hanged on the 2nd. She was kept muzzled all the time, except for a day or two about the 20th of September, and when she was fed, so that she was prevented from licking any of the ointment from the parts to which it was applied.

Examination.

This took place an hour after death. The inner surface of the skin was more red than natural. All the ganglia of the grand sympathetic nerves were inflamed, but the semilunar were so in the greatest degree. The

par vagum was not more vascular than the other nerves. All the nerves had a slightly red appearance, and were different from those of a healthy dog, in not having their usual whiteness. The brain and medulla spinalis were healthy, but the pia mater inclosing the latter was rather more vascular than natural; and there was a small quantity of fluid in the sheath formed by the dura mater. The ganglia of the spinal nerves were not more red than usual. There was more vascularity about the aorta than usual. All the thoracic viscera appeared sound. All the abdominal viscera were sound except the intestines, the villous coat of which was highly vascular throughout, so that considerable inflammatory action must have existed there. The absorbent glands in the abdomen were enlarged.

EXPERIMENT XVII.

March 29th, 1823. The hair was removed from part of the back of a dog of moderate size, and two drachms of strong mercurial ointment were well rubbed on it.

30th. Two drachms were used; she has a good appetite.

31st. Two drachms were used. Her back is rather sore. She has a good appetite.

April 1st. At eight A. M. her mouth is very much inflamed, and there is an appearance of red spots on the cheeks. She has a good appetite. At four P. M. she appears dull and unwell. She has purged twice. A piece of gold was put in a small bit of cold boiled beef, which she swallowed at four.

2nd. The gold has passed the bowels, and is not in the least tarnished by the mercury.

She was hanged soon after six A. M., and was dissected at seven.

Examination.

The mouth had become quite pale, except in a few spots, where, in all probability,

ulcers would have formed. The inner surface of the skin about the back was very vascular. The ganglia of the grand sympathetic nerves were in an incipient state of inflammation, which existed in the greatest degree in the superior cervical. The ganglia formed by the fifth pair of nerves were more red than natural. The brain, the medulla spinalis, and the other nerves had a healthy appearance, but some of the ganglia of the spinal nerves were more red than natural. The heart was sound. The lungs were more firm than usual, and they were very purple, but I supposed the kind of death might have made the difference. The villous coat of the intestines was very vascular, and likewise the inside of the rectum. The thoracic duct was full of lymph, which was quite tasteless.

EXPERIMENT XVIII.

April 1st, 1823. Two drachms of strong mercurial ointment were rubbed on the back of a large dog, four years old, after the removal of the hair; and the same quantity was used daily.

3d. He has a good appetite. His gums are swelled and very red. The part of the back on which the ointment has been rubbed is rather sore. He has not had a stool, and therefore some sulphur was given him.

4th. He has had a small stool. His mouth and back are much the same as yesterday.

5th. He has had one evacuation of the bowels. His mouth is much inflamed, and has red spots on each side. His appetite is good.

6th. There are ulcers on each cheek. His appetite is good. He has not had another stool.

7th. His mouth is as yesterday. His appetite is good. His back is very sore, so that the ointment was rubbed on it for two or three minutes only. He has not had another stool, and therefore more sulphur was given him.

8th. He has had two stools, one very costive, the other loose and very yellow. His mouth is much the same. His appetite is good. I gave him a gold ring in a bit of meat at nine A. M.

9th. He has had a stool. His mouth is much the same. His appetite is good. His back is very sore.

10th. He has not had another stool. His appetite is good, but he loses his flesh.

11th. His mouth is no worse. His appetite is good. He had a stool this afternoon, when the gold ring was passed. I showed it to a skilful silversmith, and he assured me that it had not come in contact with mercury.

12th. The ulcers in the mouth are rather better. His appetite is good.

13th. The ulcers in the mouth appear to be healing. He makes much water. He has had a stool. His back is very sore.

17th. He has not had another stool. His back is very sore. The ulcers in the mouth are nearly healed. To-day his appetite is very bad, and he continues to lose his flesh.

18th. He has not had a stool. His mouth is much the same, but his back is very sore. He has not any appetite.

20th. He has not yet had a stool. His back is very sore. The ulcers in the mouth have increased. His appetite is better. The gold ring was polished, and given him again in a bit of meat.

22nd. He purged this morning. In other respects he is the same.

23d. He has had loose stools, which contain blood. The ulcers in the mouth are better. He is very thirsty, and has a bad appetite.

24th. He has not had a stool since yesterday morning. He has no appetite.

25th. He has purged a little, but the ring has not been found. The ulcers in the mouth are nearly well. He is very thirsty, and has not any appetite. He was hanged at twelve at noon.

Two drachms of ointment were used every day except on the twenty-first. Twenty minutes were generally occupied in rubbing it in; but when his back was very sore, two or three minutes only were employed. He was kept muzzled the whole time except when he was fed.

Examination.

This took place at two P. M.

All the ganglia of the grand sympathetic nerves were much inflamed, and especially the superior cervical. The brain and medulla spinalis and their membranes, were very vascular. The ganglia of the spinal nerves, and those formed by the fifth pair, were rather more vascular than natural. The other nerves had not any particular

redness. The inside of the skin on which the ointment was rubbed was very vascular. The thoracic viscera were sound. The whole of the abdominal viscera appeared very vascular. The liver was very dark-coloured. The villous coat of the stomach and small intestines was red, but not near so much so as in the third and eleventh experiments. The inside of the rectum was more red than natural, and in the same degree as the villous coat of the small intestines. The gold ring was found in the stomach near the pylorus; it was tarnished, but was not in the least affected by mercury. I again showed it to a silversmith, who assured me that no mercury had touched it.

I think the experiments I have related, most decidedly prove that mercury, in whatever way it is used, produces a specific influence on the grand sympathetic nerves. It does not appear to me in the least probable that, in the last experiments, it was absorbed and conveyed to the intestines, and that the irritation there produced by it

was secondarily conveyed to the ganglia of the grand sympathetic nerves. But to show that the inflammation of the ganglia was not merely a continuation of that of the intestines, I will relate the following circumstance: I dissected a dog which had laboured under the distemper for several weeks, and for the last two or three had frequent stools, which were chiefly bloody mucus. I found many patches of a whitish substance on the peritoneum, which I supposed to be the remains of previous inflammation. The villous coat of the intestines was in many places highly vascular; but there was not the least redness in any of the ganglia of the grand sympathetic nerves.

It may appear singular, that the nerves supplying the parts on which the mercurial ointment was rubbed, were not so much inflamed as the ganglia of the grand sympathetic nerves; but it is not more so than that various medicines should be taken into the stomach and produce a specific effect on particular parts of the body. Why the effect is such it would be as difficult to as-

certain as why various substances produce such different odours. The Belladonna produces no sensible effect on the part to which it is applied, but yet its influence is actually conveyed by this part to the Iris. Sir Astley Cooper, in his Surgical Lectures, relates the case of a boy who had tobacco juice applied to the head. Tenesmus was produced, and such a general weakness, that he died in a few hours. * "Tobacco beat well with vinegar or brandy into a mash, and applied in a linen rag on the stomach, occasions strong vomiting."

If the effects of tobacco and other substances can be conveyed by the nerves of the skin to those of the intestines, can we wonder that a similar operation should take place in the application of mercury?

It is a curious fact, that mercury affects chiefly all the parts concerned in digestion, and when we know that it exerts its greatest influence on the grand sympathetic nerves, we can readily understand how the intes-

* Edinburgh Medical Essays and Observations, vol. ii. p. 45.

tines, and the rest of the abdominal viscera are affected by it; but how it excites the action of the salivary glands and other parts about the mouth, may not be so easy of explanation. The manner in which it appears to me to do this is by means of the branches of the superior cervical ganglia of the grand sympathetic nerves. These accompany all the branches of the external carotid arteries, exactly as those of the semilunar ganglia do the arteries distributed to the abdominal viscera, and as far as I can judge, the branches of the grand sympathetic nerves are not distributed in the same manner along other arteries, as they are in those I have mentioned. Though other nerves are distributed to the salivary glands and the different parts of the mouth, still I conceive, the irritation communicated by the branches of the superior cervical ganglia, so excites the action of the arteries of those parts as to produce the increased flow of saliva, and the inflammation and ulceration. Why these parts are so differently affected in different people under a course of mercury, must depend not only on the degree of inflam-

mation existing in the ganglia, but on the peculiarity of their formation, and the different degrees of excitement from disease, or other causes, which they may have been previously subject to. We find a great variation in the size of the ganglia, and branches of the grand sympathetic nerves, and we may therefore fairly presume, that difference of function may depend on the peculiarity of structure.

In examining the accounts of the experiments, it will be seen that all the ganglia of the grand sympathetic nerves were not inflamed to the same extent in every expement. In several, the semilunar ganglion of the right side was not inflamed so much as that of the left, and this was the case in the fifth experiment, whilst there was very little redness in any of the intestines except the rectum. In this experiment there was a mercurial ulcer in the mouth, and the superior cervical ganglia were much inflamed. These facts, I think, go to corroborate the evidence in favour of the salivation being the effect of the irritation from the superior

cervical ganglia, and shew that mercury affects the grand sympathetic nerves chiefly, whilst in some subjects particular parts of them are affected rather than others.

In the experiments with mercurial friction, the mouth was always first affected, and when the use of the ointment was continued, it appeared to have lost the power of stimulating this part; and then other parts were excited by it. It would seem, therefore, to be the case with mercury as with many other things which operate upon the nerves, that when the nerves supplying the parts which receive its influence have become impressed to a certain extent, they lose in a great degree their capability of receiving farther impression from it.

When mercury is inhaled into the lungs in the form of vapour, it seems reasonable to suppose that it affects the system by its peculiar stimulus on this very sensitive membrane, which affords so extensive a surface for its application. And if, in opposition to this, it be said, that the effect is

here produced by absorption, inasmuch as we have evidence of the capability of this membrane for absorbing different vapours, as those of spirits of turpentine, and therefore it may fairly be presumed that it has the same power over those of mercury.

It may be sufficient to observe, in reply, that if mercury were absorbed from the lungs and taken into the circulation, there seems no reason why the mouth should be generally affected first, when it is inhaled, or the intestines when it is taken into the stomach, because, as soon as the absorption took place, it would become mixed with the blood, and conveyed away, in which case, it is most probable, every part would be equally affected by it.

As mercury, when taken into the body, appears to be a peculiar stimulus to the nervous system, it therefore becomes those who are using it, not to give it to an extent that will be likely to produce such effects when much inflammatory action is present,

especially in diseases of the liver, and other organs.

It is generally believed that when the stools are black, or have not the natural appearance, mercury will so alter the secretions of the viscera as to produce a healthy appearance of them; and though it has this desired effect when properly administered, yet it sometimes happens that, instead of the secretions becoming better, they are more and more discoloured, and in such cases it is supposed necessary to push on its use with redoubled diligence; but as, in some of these instances, the parts are already too irritable, the more this state is increased by the mercury, the more discoloured the evacuations become, whilst after some time, when it has been discontinued, and quieting medicines used, the irritation will cease, and the secretions become natural.

When mercury is given for the cure of an ulcer which depends upon an improper state of the digestive organs, a few doses will change the secretions of these organs

to a healthy state, and the sore will immediately begin to heal, but if the cure depends on a change to be produced on the ulcer by the mercury, it must be effected either through the system or some local application. If through the system, how is the change produced? Mercury is not in the system, but is applied to parts whose nerves are susceptible of its influence. Through these the whole nervous system is affected, and the change of action in the termination of the nerves produces a corresponding change in the minute arteries; as constitutions vary, so when this action is carried beyond a moderate degree in a weak or irritable one, the part is stimulated beyond its powers, and sloughing or death are produced.

When an ulcer, supposed to be syphilitic, has formed, and mercury is given for it, it so changes the ulcer as before described as to produce a healthy state. If the mercury is continued longer, the state of the ulcer becomes irritable from the continued action, and may frequently be cured by leaving off

the mercury, whilst, at the same time, medicines are given with a view of lessening irritation. When the ulcer has begun to heal, the restorative process often stops, or the ulcer spreads; the parts have become languid from the previous too great action, and then if mercury is given again, it again stimulates the nerves, and the parts again dispose for a time for healing; again, perhaps, they become too irritable and spread or do not mend, and then by leaving off mercury, and giving quieting medicines, the ulcer again begins to assume a healthier appearance; and this varied state continues to teaze the patient for a great length of time, till, at last, by the frequent use of mercury, the actions of the whole body become changed, and fresh symptoms show themselves, and in this manner I conceive diseases resembling syphilis are frequently produced.

Should what I have written appear probable, practitioners should never give mercury without reason, and when they do, should attend to the excellent directions of

Mr. Abernethy, in not giving it except in unirritating doses; and thus perhaps many complaints, and especially those attended with lowness of spirits, not improperly termed nervous, and which very frequently follow its employment, may be much diminished.

There is one more fact I wish to mention, and that is, the highly inflamed state of the rectum, which, it appears from the preceding experiments, is generally produced when mercury is used. This part is frequently liable to disease, and I therefore think it important to consider, whether mercury should be given whenever much irritation exists there. In diseases of the bladder, likewise, much caution may be required.

I have thus given an account of what appeared to me the probable mode of the action of mercury; and though the subject may require further consideration, yet I cannot help remarking that so many of the dogs which were the subjects of these experi-

ments, having died from no very considerable quantities of mercury given to them, if any deductions are to be made from these circumstances with respect to the effects of the same medicine on the human body, it will, in my opinion, be a sufficient reason for the discontinuance of that free use of it, which is too often made without either thought or caution. I do not here mean to state that it is to be abandoned altogether; on the contrary, I consider it one of the most valuable medicines in the materia medica; but what I would say is this, that practitioners should well consider before they hazard a patient's comfort for the rest of life: and if it behoves practitioners to be careful in using so hazardous a remedy, how much more does it become mothers to be so, who are ever giving it to their children, and ladies who are frequently administering it to the poor around them, in their laudable attempts to alleviate human misery.

As I wished to ascertain whether arsenic affected the nerves, the following experiments were made:

EXPERIMENT XIX.

April 11th, 1823, at seven A. M. two grains of the sublimed oxyd of arsenic, mixed in an ounce of cold water, were injected into the left jugular vein of a large dog. He immediately breathed with difficulty, and appeared as if he would die. He soon, however, recovered from this state. Half an hour after he breathed again with difficulty. At four P. M. he ailed very little. At six he breathed with difficulty, and this affection was much increased by nine.

12th. His breathing is not altogether free. He is in good spirits, and has a good appetite.

13th. He appears quite well.

14th. At half past seven A. M. four grains of the sublimed oxyd of arsenic were mixed in an ounce of hot water, and, when cold, were injected into the right jugular vein. He very soon after vomited. At ten he

breathed with difficulty, and appeared much exhausted. He vomited and purged several times. He died at twelve at noon.

Examination.

The ganglia of the grand sympathetic nerves had an increased vascularity. There was not any decided deviation from the healthy appearance in the other nerves. The brain and the ganglia formed by the fifth pair of nerves were more vascular than natural. The lungs, more especially on the right side, were purple, and much inflamed. There was some fluid in each cavity of the chest. There was not any appearance of disease in the heart. The villous coat of the stomach was red; that of the small intestines, especially at its superior part, was very highly inflamed. The inside of the rectum was much more red than natural.

EXPERIMENT XX.

April 15th, 1823, at seven A. M. I introduced into a wound, on the back of a dog,

some sublimed oxyd of arsenic in powder. Before nine he had vomited a quantity of mucus. He died at one P. M.

Examination.

The ganglia of the grand sympathetic nerves were inflamed, more so than in the last experiment. The par vagum, where it communicates with the superior cervical ganglion of the grand sympathetic nerve, was inflamed. The brain and medulla spinalis, and their membranes, were vascular. The ganglia of the spinal nerves were too vascular. The axillary plexus of nerves was much more vascular than natural, but this was not the case with the sciatic nerves. The heart was not affected. The lungs were a little inflamed, but by no means equally so as in the preceding experiment, and there were some purple spots on that of the left side. The villous coat of the stomach was inflamed, but not near so much so as the superior part of the small intestines, which was red in the greatest degree, and ulcerated in several places. The re-

maining portion of the villous coat of the small intestines, and the inside of the rectum, were inflamed. Inflammation appeared to extend over all the rest of the abdominal viscera.

THE END.

LONDON :
Printed by A. & R. Spottiswoode,
New-Street-Square.

By the same Author.

A DISSERTATION on the TREATMENT of MORBID LOCAL AFFECTIONS of NERVES, to which the Jacksonian Prize was adjudged by the Royal College of Surgeons.

An ACCOUNT of a New Method of making DRIED ANATOMICAL PREPARATIONS; exhibiting the various structures of animal bodies, so as to present the same appearances as a fresh subject when first dissected; and by preventing every offensive smell, and the usual destructive effects of heat, damp, and insects, affording the opportunity of keeping them unaltered for any number of years; and as putrefaction can be stopped by the same process, enabling the anatomist to dissect a putrid body in any place, and at any season of the year, without the least inconvenience.

Second Edition, considerably enlarged.

OBSERVATIONS on some points relating to the ANATOMY, PHYSIOLOGY, and PATHOLOGY of the NERVOUS SYSTEM.