house to proceed home, he playfully caught his friend round the waist, and fell backward with the man on his lap. The patient immediately felt great pain about the abdomen, and was unable to get up; a desire to pass water was also felt, as he had not micturated for some hours. He was carried home, put to bed, and attended by a surgeon, till his admission into the hospital.

Mr. Lloyd ordered ether, ammonia, and laudanum, in camphor mixture; a poultice was placed on the abdomen, and brandy given at intervals. A catheter was passed, and eight ounces of urine, mixed with blood, drawn off; the bowels were also relieved, the evacuations being plentiful, dark-coloured, and slimy. The patient had great desire to pass urine whilst at stool, and thought that he had evacuated a little. On the next day he was no better; the tension of the abdomen and the pain had increased; he had had a restless night, and was altogether in a feebler state than when he was admitted. The sickness had, however, been stayed. The same medicines were continued, and Mr. Lloyd ordered, besides, small doses of mercury with chalk and Dover's powder every fourth hour. On using the catheter again, an ounce and a half of somewhat clearer urine was drawn off. But during this day the patient became gradually worse, and died late in the night, three days after the accident.

Autopsy fourteen hours after death. No external marks of injury. On opening the abdomen, a quantity of sanious fluid, similar to that drawn off by the catheter, escaped. The great omentum was of a greyish colour, and firmly adherent to the peritonæum, lining the abdominal parietes and the fundus of the bladder. The intestines were glued together by recent lymph, which latter was easily broken down. A catheter, introduced into the urethra, passed into the cavity of the abdomen through an aperture on the left side of the fundus of the bladder, an inch in extent, and surrounded by coagulated blood. The viscus itself was much contracted, and could have held only an ounce of urine; some clots of blood were lying at the orifice of the urethra. About three pints of fluid were contained in the abdominal cavity; the portion which was collected in the pelvis was thicker, and contained coagulated blood, with soft lymph, apparently passing into pus. The rest of the viscera were healthy.

Though rupture of the bladder had been diagnosed in this case, there existed, however, a circumstance well calculated to deceive—viz., the withdrawal of eight ounces of urine from the viscus, or rather from the abdomen, for the catheter must have passed through the rent, and given exit to a portion of the urinous fluid, which was constantly escaping into the abdominal cavity. It will thus be seen that the evacuation of urine is not a sure sign of the integrity of the bladder.

CASE OF POISONING BY LAUDANUM IN INFANCY,

SUCCESSFULLY TREATED BY KEEPING UP ARTIFICIAL RESPIRATION BY MEANS OF THE GALVANIC BATTERY.

By WILLIAM BIRD HERAPATH, M.D.

MRS. B— was confined by me, on Jan. 26, 1852, with the subject of the present case; therefore the age is correctly stated at thirty-nine days.

March 5, 1852.—This infant having a slight cough, his mother administered to him a small teaspoonful of what she considered at the time to be a cough medicine; but almost immediately afterwards she discovered that the bottle contained laudanum, and that she had therefore committed a serious error. This occurred shortly before one P.M. A very small portion of the laudanum was spilt, the child swallowing the remainder. When I saw it, at five P.M., the infant was almost *in articulo mortis*, cold and pulseless, and the skin of the face and extremities blue; dyspnoea excessive; respiration taking place only by irregular, convulsive catches; pupils contracted to a mere point; the eyes rotated upwards under the brows; the child lay still and motionless, and, but for the occasional respiratory gasp, to all appearance dead.

As all the laudanum had been retained, and four hours had elapsed since its administration, I did not, from the appearance of the little patient, anticipate anything but a speedy death; but in order that the best chance might be given to it, strong mustard cataplasms were immediately applied along the spine, and an infusion of coffee administered, containing a little compound spirit of ammonia. This could only be given by a teaspoonful at a time; and even then it was swallowed with considerable difficulty. Whilst these remedies were being pre-

pared, the nurse was directed to keep the child in constant agitation, and to rouse it as much as possible. After a time, some little evidence of returning animation appeared: it occasionally moved a limb, and attempted to open its eyes; the respiration was a little less embarrassed; and he became more able to swallow the coffee. This was steadily given until between one and two ounces were administered. The mustard plaster by this time began to take effect; and so much counter-irritation was produced, that I decided upon its removal for a time, lest vesication should be produced, which would wholly prevent the application of another. The child had now become somewhat uneasy, and its respirations were performed with more facility and regularity in consequence; but of course little consciousness showed itself. At six P.M., the case was relapsing again into its former condition. Another sinapism was applied to the chest and abdomen. Of course the child was not allowed to remain still during a single moment.

As it was clear that all the poison must have already passed into the circulation, it was useless to give an emetic: if administered, it would have probably failed; and if it had succeeded, it would only have caused the ejection of the antidotes—namely, the coffee and ammonia: and as it was evident that the treatment of the case would last many hours, if successful, but would fail if at all slackened for an instant, I determined upon bringing electricity to our aid. Whilst arranging the battery, my pupils were directed to administer electric shocks from a small Leyden jar, along the neck to the diaphragm; but the child did not appear to respond to this stimulus in the slightest degree. Having now got Horne, Thornthwaite, and Wood's little maintaining and multiplying battery ready, I began, at half-past six P.M., to pass a constant stream of electricity through the little patient.

After numerous trials, it was found that, by placing the zinc or positive wire on the mucous membrane of the mouth, and the negative or copper wire just below the ensiform process, the respiratory movements were carried on with considerably more regularity and ease than by any other method. It was evident that the stream of electricity, entering by the fifth nerve, was conducted by it to that portion of the spinal marrow (the medulla oblongata) which presides over the function of respiration, and which, being stimulated to action, its influence was sent through the phrenic and external respiratory and spinal nerves to the diaphragm, the intercostal and other accessory muscles of the respiratory process.

The fifth nerve is known to be a natural afferent or excitor nerve of the respiratory movements. We only, therefore, called its physiological action into play, and it cheerfully obeyed the call. Respiration proceeded steadily and regularly as long as the stream continued to be applied in this manner; but if the zinc or positive wire slipped from the cheek to the tongue, the movements became more gasping and convulsive; spasm of the glottis appeared to ensue, and if it had been persevered in, possibly asphyxia would have resulted; as another nervous arc was probably then employed, the gustatory branch of the fifth appearing to act as an excitor (through the medulla oblongata) of the superior laryngeal, thus closing the glottis, and probably inducing an act of deglutition at the same time.

The stream of electricity was maintained, with only an occasional intermission, during several hours. As long as the battery kept in action, all went well; the child breathed steadily, regularly, and almost as if nothing were the matter. At times the stream would get weaker, in consequence of more acid being required, or from the vibrating spring for making and breaking the contact getting out of order; at these times the little patient would experience a serious relapse. At eleven P.M. it had a very narrow escape; the only sign of life left was derived from auscultation; the heart was still found to beat, "tap, tap," about thirty times in a minute, faintly and just audibly. The battery at this nick of time was restored to action, and the aspect of the case again improved. From this period until two A.M. it was constantly maintained in action. At this period the electricity was slightly discontinued, as consciousness began to manifest itself; the little resuscitated patient appeared restless, uneasy, and in pain from the repeated sinapisms; it even attempted a feeble cry. In about ten minutes there were symptoms threatening relapse. The battery was again used for a few minutes, and a stimulating enema of one drachm of spirits of turpentine, six drachms of castor-oil, in about four ounces of strong infusion of coffee, was used, whilst some coffee, with a little brandy, was administered by the mouth. This was swallowed with difficulty; some of it got into the larynx, and produced a fit of dyspnoea, but there was not sufficient nervous energy to induce a cough.

Half-past three A.M.: He was so much recovered that he no longer required the stimulus of the battery; he had continued to breathe with tolerable ease during the last half-hour without its assistance. I left it at four A.M. in charge of my pupil, Mr. Phelps, who watched it carefully until I came down, at eight A.M. During the whole of this time the battery had been employed three times for short periods only; the last application was at seven A.M. during ten minutes. I found it breathing naturally and with tolerable regularity; it would occasionally seem to catch in its breathing, as if a slight spasm of the glottis occurred; but by blowing in its face or shaking it, the inspiratory act would be induced, and all would again go on smoothly for some time, when a repetition of the spasm would call for similar treatment.

At one P.M., March 6th, it was sufficiently recovered to be left in the charge of its anxious parents, and to be removed from my house, where it had been all night. It was, however, still highly comatose, with the respiration occasionally stertorous. The bowels had not acted; some little of the enema had returned at the time of its administration, otherwise the greater part had been retained. At four P.M. I visited it: all was going on well; the child appeared to be slowly rallying from its stupor; it could not yet take the breast, but it swallowed small quantities of milk-and-water given by the spoon with more ease; respiration was going on better; the spasms continued to recur, though at longer intervals, and to become slighter in their intensity. The skin began to assume a more natural, healthy tint; it had lost the deadly, sallow hue it formerly had. The temperature of the surface was more natural; there was not that necessity for artificial heat which existed previously; it could now dispense with the fire and the blanket, and was lying in its cot; the sleep was deep, but the breathing had lost its stertor. Eight P.M.: The little patient continued to do well, but had not yet been able to take the breast; I advised them to watch it well during the night; in fact, to remain up with it.

7th.—One P.M.: Everything progressing very favourably; the child had awakened from its lethargy; it had taken the breast and cried lustily during the night. All danger therefore appeared gone. A dose of castor-oil was ordered, and I prescribed a slight antimonial mixture for the cough, which appeared to trouble it.

8th.—Improving in all respects; ceased attendance.

Remarks.—The treatment of this case is most satisfactory; it shows in an eminent degree that perseverance aided by science will accomplish wonders. An infant of tender age, only thirty-nine days old, has nearly three grains of fluid opium administered to it—a decidedly fatal dose; the whole is retained and absorbed, as four hours elapse before the slightest effort is made in its behalf. It is true the nurse had wisely endeavoured to keep it awake all the time by continued agitation, but these efforts failing, it was sent to my surgery: fortunately I arrived about ten minutes afterwards, or in a few moments all would have been over. I never undertook a case with less hope to stimulate me, and soundly reprimanded the most interested parties for the unwarrantable delay which had been allowed to occur before rendering any efficient assistance to a case of such imminent danger. Slight improvement resulted from the ordinary mode of treatment; our only hope was derived from this amendment. The battery was the sheet-anchor; the other means only paved the way for its use, and gave us hope that perseverance would surmount the difficulty. Unfortunately, from its having been out of order, and no opportunity occurring to repair it, except in a temporary manner, it could not render that assistance it ought to have done, and a condition of asphyxia results, so nearly approaching to death, that the heart alone, of all the living wheels, continues to act, and even this goes but poorly—30 times in a minute instead of 120. How near the grave! Yet the “sacred fire” is applied—the life-giving stream circulates with lightning rapidity through the whole spinal system, and the patient sucks in the breath of life—mechanically, it is true, but as if endowed with sense and consciousness; slowly, but surely, the function of respiration becomes re-established; the vital air not only gives new vigour to the feeble frame, but it burns away the waters of Lethe, and enables the nervous system to throw off that incubus which oppresses it to death. During eight long, tedious hours was the stream constantly employed; not a moment could be suffered to elapse without the attention being directed both to the apparatus and to the patient, or the results of all the previous care were lost, and the case endangered. But at length came the reward for all our toil: the patient could do without our aid; it could by its own energy inspire the breath of life—the universal spirit of

ancient days, being, as it is, both the creating and destroying agent of mundane organization.

P.S.—Since writing the remarks on the above case, I have seen, in THE LANCET of March 20, the account of the death of Mr. Lloyd’s patient from chloroform, in which instance galvanism temporarily roused the subject, even after the functions of respiration and circulation had apparently ceased for ever. “The circulation appeared to return after the employment of artificial respiration and galvanism; then respiratory movements ensued without manual aid.” Three times was the patient roused by the same means, yet at last relapsed irrecoverably. It would be interesting to the profession to know by what means galvanism was employed, and also through what nervous arc the current traversed the spinal system; in fact, at what parts of the body the positive and negative wires were applied. Perhaps Mr. Lloyd will have the kindness to explain these points fully in the next LANCET.

With respect to chloroform, permit me to say, that I have had considerable experience with it, in the practice of midwifery, and also in surgical operations; and having never met with a case in which serious symptoms developed themselves, I ascribe the cause to the precautions invariably used by me to avoid them. My rules are—1st. Never to administer it to any patient with a full stomach. 2ndly. To take particular care that the vapour is diluted with plenty of atmospheric air; and I invariably employ a cupped sponge, with large holes, applying but a small quantity of the liquid at one time. 3rdly. Never to proceed to stertorous respiration, if it can be avoided. As soon as the patient becomes insensible to sound, or the pupils dilate, to intermit the application of the chloroform, and operate at once, if necessary applying the sponge again and again, for short periods, in order to keep up the anæsthetic effect. It is never necessary to make the patient lie like a breathing log, as I have frequently known to occur in the practice of other parties. Death from chloroform takes place in consequence of the density of the air mixed with the heavy vapour of the chloroform being nearly equal to or greater than that of the carbonic acid to be expelled from the blood: thus, the density of carbonic acid gas at 60° is one and a half that of atmospheric air; consequently, oxygen and nitrogen endosmose through the membranes of the pulmonary air-cells and capillaries, whilst carbonic acid exosmoses through the same membranes, according to the known laws regulating endosmosis of gases—namely, “in inverse proportions to the square roots of their densities.” Now, increase the density of the inspired air by adding the vapour of chloroform to it, and of course carbonic acid accumulates in the circulating fluids; it does not exosmose through the membranes at the same rate. The nearer the two densities correspond, the less carbonic acid escapes from the blood, and the function of respiration no longer goes on. An inspection of the accompanying table of the specific gravities of the following gases and vapours may contribute to the perfect comprehension of this argument:—

	Specific Gravity.
Atmospheric air at mean temperature and pressure	1·000
Carbonic acid	1·523
Nitrous oxide (laughing gas)	1·520
Ethereal vapour	2·586
Chloroform vapour	4·200

Now, it follows that it is possible to respire a mixture of one volume of the vapour of ether, if it be diluted with two volumes of atmospheric air, the specific gravity of the mixture being $1·517$, for $(1·000 \times 2) + (1 \times 2·586) = 1·517$, and one

volume of the vapour of chloroform, to be at all respirable, must be diluted with more than five volumes of atmospheric air, as the specific gravity of such a mixture would be $1·533$ higher than carbonic acid, for $(1·000 \times 5) + (1 \times 4·2) = 1·533$,

whilst nitrous oxide having a specific gravity of $1·520$, may be respired perfectly pure during a certain time, after which, the access of oxygen gas is absolutely necessary to keep up vitality.

There is another circumstance worthy of attention. Atmospheric air at 60°, saturated with the vapour of chloroform, has a specific gravity of $1·355$, and is therefore perfectly respirable; but increase the temperature of the air to 70°, and it will take up a much larger quantity of the vapour, by which means the specific gravity will be increased to $1·533$. It is, therefore, necessary to pay attention to this point also, or danger will ensue. This is more especially requisite where

inhalers are employed; a good cupped sponge, moistened with cold water, has numerous advantages over every variety of inhaler I have seen, the chief being, in my opinion, that the rapid evaporation of the chloroform diminishes the temperature of the air as it passes through the interstices of the sponge, thus decreasing the specific gravity of the mixed gases for respiration, and consequently adding to the safety of the patient.

There are other causes why chloroform impedes and destroys the powers of life. The local anæsthetic effect of the vapour upon the ramusculi of the pneumogastric nerves, distributed on the air-cells, destroys their excitability; they no longer carry that excito-motory power to the medulla oblongata, so necessary to produce the mechanical movements of the respiratory phenomena; consequently, the motor nerves no longer stimulate the respiratory muscles to action. Again, the blood, highly charged with chloroform and carbonic acid, and deficient in oxygen, may act centrally on the medulla oblongata, destroying its nervous energy and paralyzing its functions. The most practical difficulty is that which the difference in density occasions. We have that fairly under control. The physiological difficulties may also be met by not giving the Lethatic fluid too rapidly and in too great a quantity. The respiration of the vapour of chloroform may be kept up for a considerable length of time provided it be not suffered to accumulate in the air-cells of the lungs, or in the circulating fluid, the occasional respiration of atmospheric air being permitted from time to time.

In resuscitating from an over-dose of chloroform, galvanism is the only chance. Keep up a current of electricity through the fifth nerve, medulla oblongata, phrenic nerves, and diaphragm, as long as respiratory movements can be produced, and let the patient have plenty of fresh air or oxygen gas, and the case must do well, for the blood will remain fluid for a long time, and circulation will go on as long as respiration continues to be carried on artificially. The blood and the air-cells throw off their load, and in proportion as the pneumogastric, medulla oblongata, and motor nerves, slowly resume their functions, so respiration begins to assume a less artificial character; at length the cerebrum aids us, and respiratory movements, both voluntary and involuntary, keep up the functions of life unaided.

It is my opinion, that if the stream of electricity had been employed in Mr. Lloyd's case, in the manner in which I used it with Mrs. B——'s infant—namely, by applying the positive electrode to the mucous membrane of the mouth, and the negative over the diaphragm, and so stimulating the branches and trunk of the fifth nerve, and sending the current to it by the medulla oblongata, and taking advantage of its physiological excito-motory function to induce motor phenomena through the medulla oblongata, phrenic, intercostal, and external respiratory nerves, and thus compelling the whole respiratory system to enter into a combined effort to maintain the function in its natural and physiological action,—it would have terminated as successfully as my own, provided the artificial respiration had been kept up long enough to unload the system of the toxic and Lethiferous vapour oppressing it, as the opium did in my patient.

Old Market-street, Bristol, March, 1852.

THE POLICY AND PATHOLOGY OF INSANITY.

By JOSHUA BURGESS, M.D. &c., London.

(Continued from p. 193.)

PHYSIOLOGISTS are agreed, that the seat of the mind is in the brain; that the *sensorium commune* is seated in the anterior cerebral hemispheres; that the "source of power" is in the "vesicular neurine" of the grey ganglia, (*cineritious*;) and that the "conductor of power," or what might be termed the nervous or potential current, is in the "tubular neurine" of the medullary matter. Solly says,—"If there is one point in the physiology of the brain more unequivocally demonstrated than another, it is, that these ganglia," the cineritious, (*vesicular neurine*), "are the instruments of the mind; the portion of the brain in which sensations are converted into perceptions, and give rise to ideas: and comparative anatomy; developmental anatomy; experiments on living animals; observations on its size and form, as indicated by the size and form of the skull; and last, but not least, pathology—all afford a mass of overwhelming evidence, that this portion of the brain, and this only, is the cerebral organ of intellectual power." Again,—*"It is evident.....that they, the cerebral hemispheres in*

man, are the seat of the mental functions: that in them, the sensorial impressions are not only perceived, but are connected with ideas, and that in them resides the power of directing the mind to particular sensorial impressions."*

Müller says—"For consciousness, imagination, thought, volition, will, and passion, the brain is absolutely necessary."† To these may be added understanding and ideas, as constituting the elaborations of the mind.

The functions, or operations of the brain, are produced in a different manner, and governed by different laws, to other functions in the animal economy. The brain, having the function of consciousness, derives intelligence both from, and independent of, external objects, since it derives ideas, thoughts, and imaginations, from its own internal impressions, and can communicate them through other functions; and direct and guide its own elaborations; and can compare and reflect upon both internal and external impressions *at the command of the will*.

The *Medulla oblongata* is ancillary and essential to the performance of the function of the brain, (*sensorium commune*;) it being "the seat of the faculty of sensation;" it concentrates the senses for the use of the brain, and becomes *co-ordinate* with the functions of the cerebral hemispheres. The *Medulla oblongata* is also the seat of volition.

Defective control of the will induces insanity; the *domination of will* is necessary to a healthful and sound state of volition in man and the higher animals.

Will and volition, in relation to Insanity.—Will is an operation of the mind which includes consciousness, perception, memory, thought, and understanding.

Volition is properly an animal function; but in man and the higher order of animals, to insure the correct performance of its function, volition is governed by the will, and under the control of the mind; and in their conjoined and healthful action, *although volition is co-ordinate, yet consciousness of will, and of the mental object, only exists*; and the animal or corporeal act is subjective, involuntary, and consecutive; what the will demands, volition performs, amongst rational animals, without consciousness of it. But volition becomes less subjective to the will as we descend in the scale of intelligent organization; or if the mind in man be small, diseased, or depraved; till at length the animal function of volition exists, without any government of will whatsoever.

Will and volition, although essentially different, are used synonymously by Dr. Abercrombie‡ and others. Will is mental and intellectual; volition is an animal and physical function, *dependent upon the will in man, and the higher animals*; but becomes organic and instinctive in lower animals, and in vegetable life where there exists no will.

In insanity, volition is not under government of the will, and the opposite state exists—volition acts without the will, the will is dormant.

PHYSIOLOGICAL TESTS.—The physiological signs which test insanity are, errors of will, perception, consciousness, memory, and understanding.

ÆSTHETICAL TESTS OF INSANITY, are emotional signs—namely, delusions, delirium, mania, anger, rage, and fury.

In the attempt to discriminate crime from insanity, æsthetical tests prove of no value. In the investigation of civil and criminal lunacy, the medical profession and the bar will find every case of insanity capable of being included within the three physiological tests above given. We will suppose a case, in which ignorance of the knowledge of right and wrong, good and evil, is combined, with loss of control of the will, over the function of volition: decided insanity and irresponsibility must be the consequence. The same would as certainly attend a loss of memory, accompanied with ignorance of right and wrong, good and evil. Or if, with either loss of memory, or loss of control over the will, delusions should exist, irresponsibility before the law is irrefragably established. A sane condition of the will cannot exist without memory; the faculty of memory is so nearly allied to that of the will, that the first can only be practised by the exercise of the latter, and their mutual integrity is necessary to a healthful state of mind.

"A man not of sound memory, is explained by Lord Littleton to be *non compos mentis*—*amens*—*demens*—*furiosus lunaticus*—*fatuus*—*stultus*—or the like: *non compos mentis*, is the most sure and legal."§ "Sound memory" is held by Blackstone|| to be evidence of a sane mind. Memory, will, and understanding,

* The Human Brain, pp. 335, 336.

† Müller's Physiology, (Baly's Translation,) p. 818, vol. i.

‡ The Philosophy of the Moral Feelings, pp. 35 and 102, edit. 1843, New York.

§ Highmore on the Law of Lunacy, p. 1.

|| Blackstone's Commentaries, p. 24.