Marshall Hall's discovery of the reflex function gave a new stimulus to think on the great importance of Bell's discovery, from which it had taken its origin. This doctrine of the reflex action of the nervous system can only be compared to the discovery of the blood-circulation. It gave an idea of the manner in which the nervous action is kept on day and night, one reflex action following the other. Trying to understand this action, I was led to assume a second principle, which is intimately blended with reflex action. I found that immoderate reflex action in muscles, or muscular organs, was generally combined with painful feelings, sometimes in the neighbourhood, sometimes remote from the seat of spasm. As a similar train of combined sensations must take place during healthy action of muscles or muscular organs, I guessed that the action of the muscular system was necessary to maintain the nervous energy.

Sir Benjamin Brodie, in his work on local nervous affections, opposes the popular use of the name of spasm for painful feelings. This is the case in Germany. People make no difference between *Krampf*, spasm, cramp, and *Schmerz*, pain. There is some reason for it; where there is spasm, there used to be pain, but often in remote parts. Instead of pain, spasm is often combined with altered sensibility, partial or general. The German name for hysteria is *Mutterkrampf*, mother cramps. The uterus being a muscular organ, it may well be that hysteria partially consists in habitual spasm of the uterus, as a reflex action from the ovaries, or from other parts of the system. This idea was well known in England in former times. You can find it in Shakespeare's *King Lear*, who is made to say, "How this mother swells up towards my heart."

One of the most striking examples of pain originating in spasm, is that of the glans penis, from contractions of the bladder around a stone in it. Another well-known example is pain in the knee, arising from reflex spasm of the flexor muscles of the hip-joint, from inflammation of its bones, sometimes from other causes.

In a particular case, where there was no inflamed hip-joint, I succeeded in doing away with the knee-pain by dividing the rectus and pectineus muscles. I have pointed out sensations, combined with muscular action, in all the organs of sense and in many cases of disease. I have written on my theory of combined motor and sensitive nervous energy, first, in Hanover, 1837, in the *Göttinger Gelehrten Anzeigen*, an article which I reproduced in Latin, after having become Professor of Surgery in Erlangen. I have followed up this subject no farther, because it would have cost me the exertion of a whole life to carry it to a degree of perfection equivalent to a clear demonstration by physical evidence. But the fact that every pain, which evidently does not depend upon local alteration of texture, depends on spasmodic action of some muscular organ, has been of great use to me in practice, and I can advise you to put this question to yourself in every case of that description, Where is the seat of spasm? Remember that it is as well in the voluntary muscles, as in the involuntary ones, that spasms can take place. Perhaps you little suspect that the liver is an organ whose muscular energy is of great importance. But if you had felt the pain in passing a biliary calculus, you would think otherwise. I have felt it myself, and took six grains of opium in one night for it.

Pains in remote parts of the body are very frequent in liver-complaints, in the shoulder, in the head, or in other parts. I could tell a great number of cases in which local nervous affection of an extremity proceeded from the liver, others from the accumulation of hard faeces in the large intestines, keeping up spastic action for their expulsion. It is very easy to cure them, after having found the real cause, without any topical application whatever to the affected limb. After having spoken of such a variety of things and for such a length of time already, let me bid you farewell now, gentlemen, and thank you heartily for the kind attention with which you have been listening to me. I wish you may remember your studies in London with the same feelings of gratitude and satisfaction as I do after forty-four years of practical life.

ON DEATH FROM CHLOROFORM: ITS PREVENTION BY GALVANISM.

By THOMAS GREEN, F.R.C.S., M.D. Edin.,

Consulting Surgeon and late Senior Surgeon to the Bristol Royal Infirmary.

DEATH from chloroform is now an announcement unhappily appearing so often in the medical journals, that it becomes the duty of those who have seen much of its use to lay the results of their experience before the profession; the more so, if they know, or think they know, one remedy more than another likely to arrest the mortality from that drug.

Ether, chloroform, and other anesthetics, have been in constant use at the Bristol Royal Infirmary since their first introduction into

notice. Three deaths from their use have occurred at that institution during this period.

CASE I.—The first occurred in the practice of my colleague Mr. Harrison, then senior surgeon to the Infirmary. Chloroform was administered to an elderly woman in the ward, before bringing her into the theatre for operation. A second drachm of chloroform was being inhaled, when, after a few stertorous respirations, the pulse and breathing suddenly ceased. Mr. Hore, the house-surgeon, immediately employed the usual means. The surgeons were sent for; and, when they saw the patient, she appeared dead. Galvanism was then tried; it "produced some convulsive efforts of the respiratory muscles," but animation was not restored. (ASSOCIATION MEDICAL JOURNAL, 1851, p. 109.)

CASE II.—The second case occurred in the practice of my colleague Mr. Prichard. Chloroform was given to an elderly man on the table in the theatre. After a short inhalation from the first drachm, a few convulsive respirations were followed by the sudden stoppage of the heart's action and of breathing. We were all in the room at the time. Galvanism, artificial respiration, etc., were at once tried: the first caused strong contractions of the face and trunk, but had not the slightest effect on the heart; the latter was kept up for nearly half an hour through an opening in the trachea, but without any effect on the heart. In this case, paralysis of that organ was so complete that all means failed to excite its contractions, and death was the result. Those who have not seen a spectacle of this kind can hardly realise what a painful and depressing thing it is to look upon. On examination after death, the "external surface of the heart was found covered with fat;" and "the muscular structure generally was pale, and contained much fat, deposited in rows among the fibrillæ." (BRITISH MEDICAL JOURNAL, 1858, p. 207.)

The third case occurred in the out-patient room of the Infirmary, and is reported by Dr. Ludlow, the house-surgeon. The first two cases I witnessed; but I saw nothing of the last. Since the second case, no death has happened in the operation-room. I have now to mention some cases where recovery took place, under circumstances quite as bad as those before related.

CASE III.—The following case occurred at the Infirmary. I had operated on a boy for stone, under chloroform. The operation was over; the boy was untied, and about to be taken to his ward; all present had left the room, except Mr. Webster (then a pupil), myself, and the nurses. Seeing everything safe and well, I left the table, and was going into the consultation-room, when Mr. Webster called after me to say that the pulse had stopped. On turning round, I found the boy deadly pale and pulseless, and his breathing stopped. The galvanic battery was in the theatre ready for use, and it was instantly applied. After a few seconds, both pulse and breathing returned, and the patient entirely recovered. It is impossible to imagine anything more decided than the effect of galvanism in this case; and it is the more remarkable, as the pulse ceased to beat some time after chloroform had been discontinued.

CASE IV.—An elderly man was brought into the theatre for operation by Mr. Prichard. A small quantity only of chloroform had been given, when the pulse suddenly stopped, and the man appeared dead. The galvanic apparatus was near, and was instantly used. A deep and rapid inspiration, succeeded by a strong noisy expiration, like a loud groan, was the immediate result; and at the same time he started up into the sitting posture. The circulation was at once restored, and he entirely recovered. All these things occurred in little more time than it takes to describe them; one thing followed another so rapidly.

CASE V.—The next case occurred in the practice of my much regretted colleague, the late Mr. Ralph Bernard. An elderly woman was placed on the table to have the trachea opened for disease of the larynx. The veins of the neck were large and numerous, and a good deal of blood escaped; hence Mr. Bernard was obliged to proceed slowly in exposing the trachea. Perhaps half an hour was occupied in this way; when the pulse suddenly stopped, and to all around she appeared dead. Galvanism was instantly applied, with the same result as in the last case. Circulation and respiration were instantly restored. The trachea was then opened in the usual way.

CASE VI.—The next case occurred to myself. A boy was on the table for operation. A small quantity of chloroform was given, when suddenly the pulse became hardly perceptible, but did not stop entirely. Galvanism was at once used by Mr. Crisp of Swallowfield, then house-surgeon; and in an instant recovery was the result.

CASE VII.—The next case was that of a girl placed on the table for amputation of the leg by Mr. Bernard. Chloroform was being given, when suddenly the pulse stopped. Galvanism was at once used, and instant restoration was the result. She was taken back to the ward. The next day, half a tumbler of brandy was given her. She was

brought into the theatre, the tourniquet slightly screwed; and the leg was taken off by Mr. Bernard. When again in her ward, she did not know that her leg had been removed.

The last death from chloroform occurred in 1858. Since that time, no fatal case has happened in the operating theatre. The third death took place in the out-patient room.

From so many fatal and nearly fatal cases happening in one institution, it may be thought that the agent was not properly administered—perhaps not sufficiently diluted. Chloroform has been generally given by the house-surgeon: a drachm placed on a sponge held over the mouth and nose, and taken off from time to time to allow fresh air to enter; the finger being kept constantly on the pulse. No accident has now happened for some years, so that it may be inferred that this method of administration is safe. The last five cases here related can leave no doubt as to the fact that galvanism saved life in each of them; that the pulsations of the heart stopped in an instant, and were as instantly restored by this agent. In all the recorded cases which I have met with, there are not to be found five successive cases similar to those mentioned—that is, where restoration was instantaneous. Cases are recorded where the pulse and breathing suddenly stopped, and were restored by artificial respiration. The most recent is related by my friend Mr. Clover; and, from his experience in the administration of anæsthetics, there cannot be found a more accurate authority than he is. Mr. Clover relates a case where, after chloroform had been used, the pulse and breathing suddenly stopped, and were restored by carrying on artificial respiration for about a minute (BRITISH MEDICAL JOURNAL, 1871, vol. ii, p. 33). I would, however, suggest to Mr. Clover that the minute thus spent might make the difference between life and death. One of the best cases I know, where artificial respiration succeeded in instantly restoring the action of the heart after it had suddenly ceased, occurred in the practice of Sir William Ferguson. Dr. Snow was administering chloroform to a “tall thin elderly lady, with a small and feeble pulse” (a bad subject for chloroform, evidently having a very weak heart); suddenly the breathing ceased, and the pulse could not be felt. Sir William, with the promptness and readiness for every emergency which belongs to that accomplished surgeon, at once applied his mouth to that of the patient, and made a strong expiration, which expanded her chest fully, and immediately the heart began to beat (Snow on *Chloroform*, p. 260).

These cases show the value of artificial respiration; but it has failed so often in the fatal cases recorded, that we cannot place much reliance on it, even when air is blown in from the mouth of another. Amongst other reasons is this: the air goes, not into the lungs, but through the œsophagus into the stomach. This has happened in the attempts to restore animation after drowning. Dr. Marshall Hall's plan has succeeded in restoring patients narcotised by chloroform. The effect of artificial respiration is proved by a simple experiment. In an animal just killed, if air be at once forced through the trachea, the lungs immediately begin to act, and the heart to pulsate; if the ribs be cut at each side, and, with the sternum, thrown up, the entire process is brought into view. This experiment is instructive, can be easily performed, and is painless to the animal. Amongst other means, quickly slapping the face with a wet towel has been used, and will often succeed in less urgent cases where the pulse is becoming feeble, but it cannot be relied on when it has suddenly stopped. The same may be said of strong ammonia placed under the nose.

An important communication has been made by Mr. Brown, of Haverfordwest (BRITISH MEDICAL JOURNAL, 1871, vol. ii, p. 13). He agrees with most accurate observers that death from chloroform is caused by “paralysis of the heart;” restore motion to that organ, and the patient is safe. He has little faith in artificial respiration, and dragging out the tongue he truly describes as an “idle occupation.” Mr. Brown recommends that no time should be lost in either of these proceedings, but that the “brain should be roused by hanging down the head.” He reports five cases where, after chloroform, the heart suddenly ceased to pulsate; the head was immediately lowered to the level, or below the level, of the body; breathing and circulation were at once restored. In fact, if blood be sent to the brain, the heart is at once excited to action. This, we know, is successful in syncope from loss of blood, etc. Altogether Mr. Brown's paper is well worth attentive consideration from all who have to deal with anæsthetics. The consideration of the cases which have occurred at the Bristol Infirmary has left a strong impression on my own mind, and, I believe, on those who witnessed them, that galvanism is the most powerful agent which we possess to restore animation when suspended by chloroform or any other anæsthetic.

The heart suddenly stopped in seven cases; two died and five recovered. In the latter, its functions were instantly restored by galvanism. It may be said that galvanism was used in the two fatal cases; but in the

first other means were tried, and some time had elapsed before it was employed; in the second, it was used at once and failed. The state of the heart was, however, quite sufficient to explain its failure. Degeneration of that organ from fatty deposit was so extensive that, when its vital contractions ceased, no artificial stimulus could restore them. Galvanism will excite muscle to contract, but cannot impart motion to “rows of fat.” In the five latter cases here reported, the stoppage of all motion in the heart and lungs was so complete, and the restoration so instantaneous, that no doubt can remain as to the value of the agent employed.

Electricity is the most powerful agent with which we are acquainted for exciting muscular motion even after death. Dr. Ure's experiment is well known, when by electricity he brought on strong muscular contractions in a man who died by hanging an hour before the experiment. Death from chloroform is caused by the cessation of muscular action, by paralysis of the heart; if electricity be the most potent agent known to excite muscular motion, it follows not alone as a physiological fact, but a logical truth, that electricity in some form or other must be the most powerful agent known to restore animation when suspended by chloroform. Galvanism has often been used after those accidents, and is said to have failed. Seven cases in which it proved unsuccessful are reported in Dr. Snow's last edition of his work. The same story is to be found in all of them; other means were used, the apparatus was sent for, adjusted, and tried; of course it failed, it came too late; to be successful it must be ready for instant use—on that depends its success. Seconds or minutes make the difference between life and death. The truth of this is so strongly impressed on my own mind, that I have not for many years ventured to operate under chloroform, either at the infirmary or in private, without having the galvanic apparatus ready for instant use; and I must express the opinion that chloroform should never be administered without the same precautions being taken. Deaths from chloroform are now so frequent (it has been said one in a week), and we are told that many deaths from this cause are never reported at all, that the time is not far distant, when the public safety will demand some inquiry into the use of this deadly agent, more comprehensive than anything hitherto done in that way. This inquiry may be made by any competent tribunal—say, a joint committee of the Colleges of Physicians and Surgeons, and it could not be in better hands, assisted, if they wish it, by men who have given special attention to this subject—such as Mr. Clover, Dr. Richardson, etc.

The inquiry should embrace several matters; first, whether any and what precautions should be taken before the use of chloroform or any other anæsthetic; next, to ascertain the best and safest of them, and the best and safest means in which they can be administered; and, lastly, the best and surest means to prevent fatal accidents from their use.

None can say what the result of that inquiry will be, if ever made; but I must express the belief that it will prove it to be a mistake, to give chloroform to a person kept some hours without food, without some support to nerve-power, and brought to an operation under a dread of its consequences—it may be, shivering with cold—brought from a warm bed to a cold room. For several years I have always given a fair amount of fluid nutriment, and a full amount of stimulant, not long before any operation under chloroform. Next, it may prove that more precision must be used in its administration. Dr. Snow and Mr. Clover tell us that the proportion of chloroform to atmospheric air should not exceed five per cent. Mr. Clover's apparatus has been called cumbersome and inconvenient, but it attains a precision in this matter which no other contrivance has hitherto done; and I believe that no fatal case has occurred in the large number of operations in which it has been used by him, amounting to some thousands. Lastly, I feel some confidence that inquiry will prove galvanism to be the best and surest prevention against fatal accidents from chloroform, etc.

Before concluding this paper, I think it not right to let the opportunity pass without expressing the strongest dissent from the doctrines of Mr. Lister on the subject of these remarks. He has called the use of Mr. Clover's apparatus “a harmless luxury” (BRITISH MEDICAL JOURNAL, 1871, vol. ii, p. 117). Some might call his own strongly expressed advice, to draw out the tongue in cases of accident from chloroform, a “harmless” crocheting, or, as Mr. Brown calls it, an “idle occupation”; but when taken in conjunction with the following statement, deliberately written for the profession, it becomes a far more serious matter. He writes as follows: “The very prevalent opinion that the pulse is the most important symptom in the administration of chloroform is certainly a most serious mistake; as a general rule, the safety of the patients will be most promoted by *disregarding it altogether*, so that the attention may be devoted almost exclusively to the breathing.” From my own limited experience, and from the recorded opinions of nearly all the best authorities in this and other countries, that “Paralysis of the heart seems

to be the most frequent cause of death after chloroform" (*American Journal*, 1871, p. 437), I can come to no other conclusion than that Mr. Lister's teaching is more than a serious mistake; that in practice it will be found a fatal error.

Mr. Lister has also written as follows:—"When Mr. Clover virtually recommends medical men generally to follow him in abstaining from this practice (drawing out the tongue), he has given about as pernicious a piece of advice as can well be given with reference to the administration of chloroform." (*BRITISH MEDICAL JOURNAL*, 1871, vol. ii, p. 117.)

I know enough of Mr. Clover and his professional character to be able to assert with confidence, that there is not a surgeon in London who would endorse the statement that he ever has given, or could give, "pernicious advice" on the use of chloroform, or on any other subject.

The use of chloroform is a serious business, involving as it does the issues of life and death—how serious few can realise, except those who have seen one or more fatal cases; and sure am I that, when the heart suddenly ceases to beat after its administration, those who rely on pulling out the tongue to save life, will have to witness that sad sight where a person lies dead before them, who but a few minutes before was in full possession of life and strength.

P.S.—When galvanism is employed, the rotatory battery now in general use answers the purpose well; it is portable, always ready, and easily worked. One pole should be applied to the neck, and the other over the lower ribs at the left side.

MALINGERING DETECTED BY FARADISATION AND THE USE OF NITROUS OXIDE GAS.

By JULIUS ALTHAUS, M.D., M.R.C.P.,
Physician to the Infirmary for Epilepsy and Paralysis.

IN November last, I was consulted by the secretary of a working men's benefit society with regard to the case of one of the society's members, who professed to have lost the use of his left arm, in consequence of an accident which he had had three years previously. According to the society's rules, the sum of £100 is paid to members who are permanently incapacitated for work by disease or accident. The patient had had a fall from a considerable height, and asserted that ever since he had been unable to use his arm. He had been admitted into a provincial hospital, where he remained for three months, and where (to use his own words) "the surgeon tried as hard as he could to cure him," but failed. In course of time, the patient, who was known not to have done any work since the occurrence of the accident, applied to his society for the hundred pounds owing to him; and I was then requested to give an opinion whether the patient was permanently or only temporarily disabled.

The claimant was a tall, powerful man, of determined countenance, and evidently considerable force of will. He professed to be unable to undress himself, and had, therefore, to be assisted when the helpless limb was bared for examination. I found that the temperature and the bulk of the left arm were in all its parts quite equal to those of the right. The limb was held in full extension, and drawn to the body; while the fingers were somewhat tightly flexed. On endeavouring to flex the forearm and to supinate the hand, considerable resistance was encountered; and, when additional force was used for effecting this purpose, the patient called out with pain, and said he could not bear the manipulation.

Seeing this condition of the limb, only three pathological conditions could be suspected, viz., paralysis with contraction, ankylosis, or dislocation—provided always that the patient was sincere. In peripheral paralysis owing to injury of the motor nerves of the part, which is the only form of paralysis that could be thought of in this case, there is rarely any very great amount of contraction, since the paralysed limbs are mostly found flabby; and, if the case be of long standing, the muscles are wasted, and the temperature is considerably diminished. But as these clinical signs, although of value, are yet not invariably present, I employed a test which gives absolutely decisive results in such cases, and enables us at a glance to decide the presence or absence of peripheral paralysis—viz., faradisation. It has been shown by the concurrent testimony of all recent observers who have investigated this subject, that, in peripheral paralysis caused by injury to the motor nerves, the muscles animated by those nerves completely lose their

faradic excitability, while their galvanic excitability may be preserved, or, under certain circumstances, even increased. If, therefore, in the present case, the deltoid, triceps, biceps, and the other muscles of the useless limb, could be made to respond by contraction to the faradic current, it would be rendered evident that there was no paralysis owing to injury of the brachial plexus or any of its branches.

On using faradisation, I found that all the muscles of the arm and hand responded readily to the current by contraction of their fibres; yet, curiously enough, the arm of the patient did not execute those movements which are generally produced by such an application. Something evidently resisted the displacement of the bones; and, when I looked at the powerful determination visibly expressed in every feature of the patient's face, his hard stare, his contracted brow and lips, I could not help feeling suspicious that this something might be the patient's own volition. The influence of faradisation being irresistible if a sufficiently strong current be used, I increased the power with which I acted, in order to overcome any possible resistance on the part of the patient; but the latter called out so lustily, saying that he could not bear the pain, that I was obliged to desist. Enough, however, had been ascertained for enabling me to eliminate one of the three pathological conditions which could give rise to the complaint of the patient.

I now informed the secretary that, although I had satisfied myself that there was no paralysis, yet it was impossible for me to give a certificate concerning the exact nature of the affection from which the patient suffered, unless he were previously placed under the influence of an anæsthetic. All parties having consented that this should be done, I procured the assistance of Mr. Clover, who on the following day administered nitrous oxide gas to the patient. The latter was rapidly rendered insensible; and I could now freely move the arm in all directions, there being neither dislocation nor ankylosis. As soon as this was ascertained, the influence of the anæsthetic was withdrawn; and the patient, who recovered himself in a few moments, was informed that his case was not nearly so bad as he had imagined, and that he would certainly recover the use of the arm under proper treatment. I gave a certificate to the effect that the patient suffered from a painful affection of the shoulder-joint, which would yield rapidly to subcutaneous injections of morphia or a judicious use of galvanism; and that there was neither paralysis, nor dislocation, nor ankylosis, seriously to interfere with the use of the extremity. The claim was therefore not allowed.

RECURRENT DISCHARGE OF FLUID FROM THE UTERUS DURING PREGNANCY.

By D. DYCE BROWN, M.A., M.D., Aberdeen.

THE following case is offered as an addition to the interesting cases and observations that have of late been published in this and other journals on the above subject. The case is interesting from the diseased condition having recurred in three consecutive pregnancies, and also from the abundance and long continuance of the discharge in the first pregnancy.

A lady, pregnant about four months, after rather more exertion in walking than usual, was awakened in the middle of the night from a sound sleep by feeling a gush of fluid from the vagina, which, on inspection, seemed the liquor amnii just tinged with blood. After this gush, there was nothing more in the way of discharge that night, and only a slight feeling of uneasiness in the uterine region. I kept her in bed by way of precaution, but nothing further occurred till that day week, when the same discharge returned, and in the same manner. After another week, it again returned, as before, and with the same reddish tinge. Before each discharge there was a feeling of fullness and distension in the uterine region, followed by a feeling of uneasiness, which soon disappeared. The movements of the fœtus were now distinctly felt; the os uteri was slightly open. After this time, the discharge came on every two, three, or four days, and increasing in quantity. When she was about five months advanced, along with the usual discharge of clear fluid, there came an alarming quantity of blood in the middle of the night. The blood likewise came in a gush; so that after what might be supposed to have lodged in the vagina had come away, there was no further hæmorrhage. Nothing else was felt by the patient than the usual temporary uneasiness. For the next month, the watery discharge came nearly every night, in such quantity as frequently to soak a couple of towels. At the time of the hæmorrhage, there was no alteration in the os, and no evidence of partial attachment of the placenta on the os. At this stage, I consulted Sir J. Y. Simpson by letter, at the request of the friends of the patient. Sir James wrote as follows: "I have seen a