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EDITED BY

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ARCHIVES

OF

ELECTROLOGY AND NEUROLOGY.

VOL. II. MAY, 1875. No. 1.

ORIGINAL COMMUNICATIONS.

I.—*On Hysterical Symptoms in Organic Nervous Affections.* By E. C. SEGUIN, M.D., Clinical Professor of Diseases of the Nervous System, at the College of Physicians and Surgeons, New York.*

I PURPOSE, in this paper, calling attention to some points in the semeiology of diseases of the nervous system which have as yet been little studied—perhaps not at all in this country. While I do not know that any author has written upon this subject, I wish to say that I was first led to observe the emotional state of paralytics through a remark of Prof. Charcot, of Paris, made either at the *Société de Biologie*, or in his wards in the Salpêtrière Hospital, during the winter of 1869-70. I have since that time frequently spoken of hysteroid symptoms as occurring in certain paralytics, in lectures, and have called the attention of the resident staff at the Epileptic and Paralytic Hospital on Blackwell's Island, New York, to the matter. I am also aware that Dr. Brown-Séquard has observed and studied such symptoms in private practice. I should also say that a recent writer on the pathological physiology of the cerebrum,† has ably writ-

* This paper was read before the N. Y. Society of Neurology and Electrology at the meeting for June, 1874.

† De Fleury; Du dynamisme comparé des hémisphères cérébraux. Paris, 1873.

ten of symptoms closely akin to those I shall describe, and has (after Brown-Séquard) pointed out how different are the symptoms produced by lesions of either cerebral hemisphere. I ought not to omit a reference to a remarkable paper, written a good while ago,* in which pointed attention is paid to the emotional state of hemiplegic patients, whose intellectual condition is criticised by the author, Dr. B. W. McCready.

The term "hysterical symptoms" is one which seems useful for purposes of clinical study and classification, and one, consequently, to be retained until we shall have exactly analyzed and re-classified the signs which, together, go to form the classical hysterical state, or hysteria.

Philosophically considered there is nothing specific in hysterical symptoms; they are functional disturbances of various organs, due to a morbid dynamical state of the nervous system. With this understanding, it is not difficult to conceive of the very large number of symptoms which may receive, and justly in a certain sense, the qualification hysterical. The term hysteria, and the adjective derived from it, I shall make use of without having much respect for it; it was imposed upon nosologists by the dominant theory of olden time respecting the pathological physiology of the morbid state in question; a theory holding that the uterus and its appendages were the seat of the morbid process. With the various theories of hysteria, their rise and fall, and rehabilitation, I have only this to do: to state that most physicians to-day believe that the central nervous system is at fault, dynamically, in hysteria. Some writers teach that the spinal cord is most disordered in this condition; others, that the organ whose badly performed functions are exhibited by "hysterical symptoms" is the cerebrum.

Before proceeding to relate the cases which form the basis of this essay, I may be pardoned for presenting in tabular form an analysis of the chief hysterical symptoms. (See p. 3.)

The following cases are offered as illustrations of the proposition that hysterical symptoms will present themselves in persons suffering from organic disease of the nervous system. A natural division of the cases is adopted, into cases of disease of the brain,

* To what degree are the Intellectual Faculties affected in cases of Apoplexy and Hemiplegia? N. Y. Journal of Medicine, iii., p. 203, (1857.)

and cases of disease of the spinal cord. Cases observed by myself are marked by a prefixed asterisk.

HYSTERICAL SYMPTOMS.

- Intellectual.
  - Simple eccentricity of conduct.
  - Impairment of logical capacity.
  - General ideational disorder (mania).
  - Concentration of attention upon idea or sensation (ecstasy).
- Emotional.
  - Psychic pain.
  - Crying, Laughter } with co-incident spasms and secretions.
  - Morbid impulses.
- Sensorial.
  - Hyperæsthesia.
    - Special senses.
    - Ovary (left).
    - Infra-mammary region (left).
    - Vertebral groove (left).
    - Whole surface of body.
  - Anæsthesia.
    - Special senses (hemiopia, amaurosis, deafness).
    - Skin. Hemiplegic (left). Paraplegic. Universal.
    - Deep parts. Loss of muscular sense. Retention of excretions.
  - Dysæsthesia.
    - Pain. Side of head (left) (clavus). Left breast. Various neuralgiæ.
    - Ovarian aura.
    - Globus hystericus.
    - Numbness.
    - Sense of heat or cold.
    - Hallucinations.
- Motorial.
  - Hyperkinesis.
    - Tetanoid seizures.
    - Hystero-epilepsy.
    - Local contractures.
    - Postural spasms.
    - Catalepsy.
    - Cough and vomiting.
  - Akinesis.
    - Paraplegia.
    - Hemiplegia (left) (not facial).
    - Retention of excretions ; incontinence.
- Secretory.
  - Excess of tears.
  - " " urine.
  - " " intestinal gas.
  - Suppression of urine.
  - Local congestion and ischæmia.
- Imitation of various organic diseases, (arthritis, etc.)

CLASS A.

Cases of Disease of the Spinal Cord.

*I.—Female, E. E., 36 years, born in New York. Left hemiplegia, with paresis of right limbs—well marked hysterical

symptoms; suppuration of left elbow joint; death, extensive central myelitis, with formation of cavities in cord.

This patient was admitted to Epileptic and Paralytic Hospital, Sept. 17th, 1868. Five years before had sudden right hemiplegia, cured in three months. About three years ago, while under strong depressing emotion, sat out of doors three days and two nights, when palsy of left lower limb was found. Two months before admission had pins-and-needles feeling in left arm, and gradually lost use of it. On reception, patient *nervous;* has left hemiplegia, (paresis of arm,) with contractured leg in flexion; palsied parts are seat of prickings, and are cooler than right limbs; cannot retain urine; speech (articulation) impaired. August 23d, 1871: has double rotatory nystagamus; no diplopia, pupils normal; no facial palsy; left hemiplegia with contracture of fingers (slight), of knee and foot. Complete anæsthesia of left arm, slight, (with numbness,) of lower limb; right arm only weak; incontinence of urine.

This patient exhibited almost constantly, during the several months I observed her, well-marked hysterical symptoms. She had a squeaky, tremulous voice, which changed easily into a natural tone when she was chided. Often she began to cry, flush, and shed tears on speaking to me, but if I passed on she would control herself. I may state that the larynx was normal. I often hesitated in my diagnosis because of the coincidence of these emotional symptoms with left hemiplegia. She died on February 16th, 1873, in consequence of exhaustion from the elbow-joint lesion, and a sacral bed-sore. The spinal lesion has been spoken of, and it remains only to add that no lesion was found in the cerebral hemispheres.

*II.—Female, æt. 32; single. Admitted to Presbyterian Hospital November 16th, 1872. Attacks of gastric pain and vomiting; fulgurating pains in extremities; palsy of left 3d nerve; locomotor ataxia. Sudden death; cerebellar hæmorrhage; sclerosis of posterior columns of spinal cord.

Many details of this case are interesting for the student of locomotor ataxia, but need not be reproduced here. Suffice it to say that this patient was remarkably emotional and hysterical in manner, so much so that hysteria was thought to be her only disease, manifesting itself in emotion, vomiting, numbness of left arm, and neuralgia. The nurses and the resident staff could not be fully persuaded that the patient had organic disease. Upon examining her on taking the service, January 4th, 1873, I became

convinced, from the coexistence of fulgurating pains, ataxia in upper and lower extremities, and left 3d nerve palsy, that the case was one of sclerosis of the posterior columns, complicated by hysteria. Her death took place as follows, according to the hospital case-book : "April 6th, again hysterical ; complains of left arm. April 14th, was taken with severe hysterical (?) convulsions at 3.30 P.M., which were quite continuous and lasted about an hour. There was no vomiting, and nothing to show pure hysteria, such as she had had before. When the convulsions ceased patient fell into a sleep, as was generally the case after the attacks of hysteria. In this sleep there was nothing remarkable, and about 7 P. M. the nurse, having her attention called to her by hearing a loud sigh, found her in apparent syncope. On the arrival of the resident physician the patient was dead."

*III.—Female, æt. 23 ; single. Sclerosis of cord ; hysterical symptoms. Seen October 20th, 1873. A nervous girl, with occasional irregularity of menstruation, but no dysmenorrhœa : at times hysterical laughter or tears ; never convulsive attack. In July, 1871, while out walking, after having climbed a number of walls, felt weak and awkward in right leg ; thought she had sprained her knee. There is not enough evidence to support this statement. Ever since she has had weak right leg, without anæsthesia or numbness ; at times more use of leg than at others ; almost cured once or twice ; of late has required help of crutch or friend's arm in walking. When I examined Miss De P. I found paresis of the right leg, the loss of power being marked at ankle and toes ; there was doubtful weakness of the right hand ; I could not make out that the knee-joint was affected. The muscles of the right leg showed a slight diminution of reaction to Faradic current, and this agent also showed that sensibility to pain was a little dull in leg and foot. In view of the history of the case, the capricious development of the palsy, the absence of reliable signs of central disease, the presence of a strong neurotic element in the family, and the fact that strong emotions had been acting upon her, I concluded that the patient had a functional palsy of an hysterical nature. Strychnia was given her and Faradism used. The specific effects of strychnia appeared, and the patient was decidedly tetanized for a while ; this passed off, and when I last saw the patient, on December 11th, she was in about the same state as at the beginning of treatment. The unfavorable effects of the treatment led me then to believe that the patient had an obscure central lesion, probably sclerosis.

In March or April, 1874, patient rapidly grew worse, becoming paraplegic and her hands showing paresis. In July she was placed in an irregular water-cure house, where extensive bed-sores formed, in consequence of want of care and of cold applications to the palsied parts. (She had *continuous* applications for several days.) Exhaustion and pyæmia caused death, August 1st. The post-mortem examination showed disseminated sclerosis of the spinal cord. The brain not examined. I have the specimen in fluid, and will make a detailed report of the lesion. Dr. Chas. A. Leale of this city

treated the patient during July, after the bed-sores had formed, and I made the autopsy at his request and that of deputy coroner Dr. Shine.

IV.—Case by DUCHENNE. In a female who had true hysterical paraplegia, in Trousseau's service. Dr. Duchenne discovered that patient was suffering from the characteristic fulgurating pains of locomotor ataxia, and had noticed them five years. Dr. Duchenne diagnosed the coexistence of hysteria and locomotor ataxia, and foretold that after the cure of the paraplegia the ataxic movements would reappear. This did happen after the use of Faradization.

Electrisation localisée, p. 653, ed. 1872.

V.—Female æt., —. Hysteria and sclerosis of the lateral columns of the spinal cord. The patient, a female, began to have attacks of convulsive hysteria about the age of 14 years, and occasionally thereafter; at 34, after such an attack, had a left hemiplegic contracture, which lasted a fortnight and suddenly disappeared. The next year there was a second attack of contracture, at first hemiplegic, then bilateral. After two years patient improved so much as to be able to walk about; then a relapse occurred after an hysterical attack. Death by an intermittent disease. Post-mortem examination by Bouchard showed sclerosis of both lateral columns of the spinal cord from medulla downward. The early history of case was taken by Briquet in 1850, and completed by Charcot at the Salpétrière.

CHARCOT. Soc. méd. des hôpitaux, séance du 25 janvier, 1865; in Gaz. hebdom., 1865, p. 109.

VI.—Female, æt. 36. There were symptoms of sclerosis of various parts of the spinal cord and medulla oblongata; hysterical attack. At time of report patient still alive. She was the sister of two females affected with disseminated sclerosis of nervous centres. From an early period she had had attacks of convulsive hysteria, throwing herself about in bed, uttering monotonous cries; the respiration reduced; apathy and seeming unconsciousness closing the scene. These attacks were usaully brought on by emotional disturbances.

FRIEDRICH: Ueber degenerative Atrophie der spinalen Hinterstränge. Virchow's Archiv, 1863, Bd. xxvi., p. 291 et seq. Bd. xxvii., p. 1. (Case of Lisette Süss.)

In the above six cases of organic disease of the spinal cord the following hysterical symptoms were observed and noted.

Abnormal emotional tendency in all cases.

General nervousness in cases I., II., III.

Tears and sobs upon slight provocation in case I.

Tremulous variable phonation in case I.

Disordered sensibility on the left side in cases I., II.

Disordered sensibility in lower limbs in case IV.

Vomiting in case II.
Temporary paralysis in case IV.
Contracture of limbs in case V.
Convulsive attacks in cases II., V., VI.

The commingling of these hysterical symptoms with the signs of organic disease has caused each case to present a peculiar problem to the examining physician. Sometimes the organic disease was wholly overlooked. In Trousseau's and Duchenne's case (IV.) the diagnosis of hysterical paraplegia had been correctly made, and the sclerosis of the posterior columns of the cord not suspected by the former celebrated clinician. Charcot's case (V.) is still* referred to him as one of hysteria, in which a lesion was found—a view which I would suggest is the inversion of the correct one. As regards my own cases, in Nos. I. and II., there were times when I was in much doubt as to whether all the phenomena were not functional. It was not until alterations of nutrition appeared in Eagles (I.) that I became firm in my conviction that there was a spinal lesion. Her general appearance, manner, and speech, and the existence of many of her symptoms upon the left side, made up a more strongly marked picture of hysteria than I can give any idea of by words. In Miss L.'s case (II.) my faith in the significance of fulgurating pains and coexistent 3d nerve palsy kept me right. Even after I had made the diagnosis of sclerosis in this patient, the impression of the medical gentlemen who saw her was that she was simply hysterical. In the case which I have added since reading this essay, Miss De P. (III.) I made a grave mistake in diagnosis. I am glad to be able to publish this case as a guide for other physicians.

From a study of these few cases, in the present state of our knowledge of pathological physiology, it seems impossible to point out any close genetic relations between the lesions found and the hysterical symptoms observed. In support of the view that there was merely a coincidence in these six cases, I would adduce the following considerations: *a*. That the organic diseases were various. Two patients had sclerosis of the posterior col-

* Charcot: Leçons sur les maladies du système nerveux, Paris, 1872-3, p. 316-7.

umns of the cord; two (including case III. not yet minutely studied) disseminated sclerosis; one sclerosis of the lateral columns; and one extensive central myelitis. *b.* That the number of cases of disease of the spinal cord in the books and periodicals I have been reading in several years is quite large, and that these six cases form an insignificant minority. *c.* A certain number of cases of fatal hysteria have been examined after death, without any lesion of the central nervous system being discovered.*

After this conclusion of coincidence, I can only call the attention of this society to one question connected with these cases, viz., that of their bearing upon diagnosis. There are reasons for believing that hysterical persons are sometimes treated for organic diseases of the spinal cord, which exist only in the physician's mind; and the cases I have related show how possible the converse error is when the hysterical symptoms are so prominent as to prejudice the physician; and we may thus be led to attempt severe and unsuccessful treatment, and to make a false prognosis.

The only way in which we can hope to avoid these errors is by having a clear understanding of what symptoms are hysterical, either essentially so or by association in groups; and by being prepared to appreciate and firmly believe in the true meaning of cardinal symptoms of organic disease of the spinal cord; as the fulgurating pains and 3d nerve palsy of posterior spinal sclerosis, the paresis, ataxia, and peculiar speech of disseminated nodular sclerosis, the alterations of nutrition, and the abnormal muscular reactions to electricity in myelitis, etc. I believe that in minute and exact analysis of symptoms and symptom-groups lies our only safety.

CLASS B.

Cases of Disease of the Brain.

*I.—Mrs. R., 75. The subject of extensive arterial degeneration. On September 16th, 1873, a left hemiplegia was quickly developed without loss of C. There was complete anæsthesia also on left side of body. In course of three weeks there was no improvement in palsy, or anæsthesia, contracture appearing, and patient became very much depressed and careless of result;

* L. Meyer: Ueber acute tödliche Hysterie. Virchow's Archiv, 1856, p. 98.

this melancholy being in striking contrast with her previous condition. No improvement during winter. The general health remained remarkably good; the heart and arteries showing signs of progressing disease. No fever. The most striking symptoms were of an hysterical nature; the patient crying like a child for a moment, without any sufficient provocation. Upon the physician saying "Good morning," this lady would burst into convulsive crying, with enormous facial contortions—no tears, but moaning just like a child. Suddenly the fit would pass off, the face become natural in an instant, and the patient would exclaim, in a provoked way, "Oh, what an old fool I am!" During the short medical visit, in a few minutes, several such paroxysms would occur. Besides, in the last few months of life there were great physical restlessness, peevishness, loss of memory, hallucinations, (eye and ear,) and delusions. Death toward end of May, 1874; no autopsy allowed. It should be added that this lady had possessed remarkable intellectual power, and unusual force of will; that during the winter, often immediately after crying attacks, she made very witty remarks. This lady was a patient of Dr. Wm. H. Draper, with whom I saw her.

*II.—Midwife, æt. 46. Left hemiplegia. Some prodromata in the shape of vertigo last summer, and much headache. Sudden palsy of left side without loss of C. When examined at the Epileptic and Paralytic Hospital, Blackwell's Island, on January 30th, 1874: presents a complete left sided palsy, with marked anæsthesia of left face; great loss of sensibility in left arm and leg; does not know where arm lies; has beginning secondary contracture. The intercostal muscles on the left side are much palsied; the heart shows a faint apex systolic murmur; no gout or syphilis. In the middle of February marked hallucination of sight and hearing occur. Left (palsied) palm 3° Fahr. warmer than right. In March, April, May, and since, patient is often very emotional, though perfectly rational. Bursts into tears with much facial contortion, saying she does not know why. Some improvement in leg; none in arm, though sensibility is everywhere much better.

*III.—Male, æt. 28. Left hemiplegia, from probable embolism of a cerebral artery. Came to Clinic for Diseases of the Nervous System at the College of Physicians and Surgeons, where it was learned that eight weeks before, when going to bed, he had a slight vertigo, with tingling in the left side of tongue, and numbness, followed by loss of power in left limbs. No loss of C. Was in bed three weeks, because of inability to walk. Has since improved steadily. Examination shows a common left-sided hemiplegia, with involvment of face and tongue. There is a basal systolic heart-murmur. On June 13th, 1874, very much improvement is noted. During examination the patient flushes. He states that since attack he has been unduly emotional; when annoyed he has felt something rising from chest into throat, preventing speech; has even wept a few times.

*IV.—Female, 28 ; married. General paresis, hysterical symptoms. In June, 1873, began to complain of severe headache, universal, more severe on right side ; not nocturnal, occurring in non-periodic paroxysms. Pain down the spine. In July gradual failure of sight ; some loss of memory ; using wrong words. Generalized weakness first noticed by friends during December. No delirium. Since June occasional trembling of hands. From the first has had feeling of pins and needles in all her limbs at extremities. Has also had attacks of suffocation—something filling up her throat. Much constipation and nausea. In last two months less headache. Examination on November 11th, 1874 : Patient so weak as to be hardly able to stand; totters much and inclines a little to left side ; speaks loudly and complains of darkness of room. Speech clearly articulated and rational. Memory much impaired ; hands very weak ; no facial palsy, or muscular atrophy. Ophthalmoscope shows retinal vessels issuing from a uniformly red and velvety ground; choked discs. No anæsthesia. Very deaf on left side. Has been very emotional at times, and now presents a hysterical manner. Has been seen several times by Brown-Séquard, who thinks that she has a brain tumor.

*V.—Male, æt. 18. Left hemi-chorea with paresis, 3d pair palsy on right side ; probable lesion of right crus cerebri; hysterical laughter. This young man had paresis of left arm gradually developed from May, 1873. In July the choreic movements first appeared. On December 6th, left arm, leg and face are seat of rather ataxiform choreic movements ; no palsy of eye muscles. Toward middle of January, 1874, hebetude, greater chorea, slight ptosis on right side. During late winter and spring progress in paresis and 3d pair palsy ; hebetude, but no loss of memory. Often laughs without cause, and finds great difficulty in stopping the laughter : more correctly, patient has, involuntarily, the special spasm of full laughter very often, without the psychical elements. August, 1874, complete 3d pair palsy, with left hemiplegia and chorea; at times some spasm in right arm ; intelligence good. Patient died in September, but no autopsy could be obtained.

VI.—Male, æt. 43. Left hemiplegia. When twenty-two years of age had a chancre followed by secondary manifestations. Twelve years ago had an attack of hemiplegia, involving left side of face, and left limbs. The paralysis came on slowly ; soon after a mid-day dinner he noticed that the leg was weak. In the course of an hour this became entirely paralyzed, and the arm became enfeebled. At first, some improvement, none in last few years. Examination (spring of 1874) shows a left hemiplegia without contracture, except in face, where some muscles show some slight clonic spasms. Since a short time after attack, has been easily excited, either to laughter or tears; on which account he has been unable to go to church. Mind clear ; some impairment of memory. Has atrophy of right optic disc.

Observation by Dr. T. A. McBride, of New York.

VII.—Male, æt. 39. Hysteria; left hemiplegia; semi-coma; thrombosis of basilar artery. Patient had been weak and stupid for two years. A fortnight before admission had vertigo, and repeated attacks of a hysterical nature, with sobs, and bursts of laughter. Five days before death developed left hemiplegia, and passed into comatose state.

John W. Ogle, in Trans. of Path. Soc., of London, 1864, p. 14.

VIII.—Male, æt. 59. Left hemiplegia; speech preserved; much anæsthesia of palsied limbs; impairment of sight and hearing on left side. In three months some periodical delusions. Is at times given to laughing in an almost insane way; after which there supervenes a strong tendency to weep. Death in eleven months.

De Fleury: Du dynamisme comparé des hémisphères cérébraux. Paris, 1873. pp. 123-4.

IX.—Female, æt. 74. Left hemiplegia; speech preserved; various alterations of sensibility (anæsthesia of left limbs, ear, and eye.) When asked to perform movements patient cries and sheds tears. Later hallucinations and delusions. Death in nine months, with palsy of right side.

De Fleury: Op. cit., pp. 124-5, obs. xii.

X.—Male, æt. 42. Right hemiplegia, with aphasia. Subsequently frequent epileptic convulsions, which diminished in frequency later. Intellect remained clear; partial recovery of limbs. "In the early years of his infirmities crying fits would often occur, especially when meeting an old friend, and no one near him to interpret, or when he would see the promotion of a classmate, or on recovering from an epileptic attack, the tears would flow in torrents. . . . . On the other hand, a jest, an anecdote, or frolic of any kind would excite such convulsive laughter that I have again and again feared for his life, from the evident determination to his head. . . . . While engaged in any matter of interest his breathing becomes almost stertorous; his salivation is profuse." . . . . .

Dr. B. W. McCready: To what Degree are the Intellectual Faculties affected in cases of Apoplexy and Hemiplegia? N. Y. Journal of Medicine, III., Sept., 1857, p. 203.

XI.—Male, æt. 60; Right hemiplegia and aphasia; intellect good. 'The patient Wilcox weeps as often as the physician calls attention to his misfortune. His face becomes as much distorted as that of a weeping child, and his tears flow freely."

Dr. McCready: Op. cit., p. 221, and p. 246.

XII.—Male, æt. —. Double hemiplegia. Left side palsied first. While paralyzed in left side only, and still able to speak (on first day), he was as sound in mind as ever in his life; yet he wept frequently, with a child's distortion of face.

Case by Prof. A. Clark, in McCready: Op. cit., p. 236.

XIII.—Male, æt., 58. General paresis—greater on left side. Symptoms of organic brain disease, general paresis, epilepsy, speech much affected, writing scarcely legible, intellect clear. "He does not weep, but laughs immoderately on every trifling occasion. He scarcely smiles, but is seized with convulsive, hysterical laughter." . . . . . "He takes frequent and convulsive inspirations preparatory to uttering his words." No autopsy.

Prof. A. Clark, in op. cit., p. 246.

XIV.—Female, æt. 52. Partial left hemiplegia, right hemiplegia of twot years' standing ; palsied limbs, rigid ; absolute incapability of articulating sounds. "Every effort of the patient ends only in unintelligible stammering, interrupted by plentiful tears and sobs. Tears and sobs, such are the only means of expression in her power, and she uses them largely, for it is enough to feel her pulse or to speak to her to provoke an abundant flow of tears, a purple color of the face, and convulsive action of the muscles of respiration ; deglutition is embarrassed, and the patient makes us understand by gestures with her left hand, that the pharynx acts with difficulty." Intellect clear. Autopsy showed softening of the pons Varolii.

Cruveilhier, in Anat. pathol., liv. xxi., p. 3.

XV.—Female, æt., 55. Four attacks of left and right hemiplegia, with great difficulty of articulation ; understanding preserved. She weeps whenever questioned. The autopsy showed a clot in the left hemisphere and cicatrices in the right hemisphere and in the cerebellum.

Cruveilhier : Op. cit., liv. xxxviii., p. 1.

XVI.—Female, æt. 60. Left hemiplegia. An apoplectic attack in a subject of supra-orbital migraine. Although medical history is quite full, hysteria is not mentioned as having been present in earlier life. At beginning of attack had, with paresis of left limbs, "*une succession sans motifs de pleurs et de ris.*" Death in twelve days after beginning of palsy, which, at the last, involved also right limbs. Autopsy showed softening of corpora striata, and of centre of pons Varolii.

Cruveilhier, in Lallemand : Recherches sur l'encéphale, t. i., p. 101. Paris, 1824.

Of the above sixteen subjects :

Nine were males (III., V., VI., VII., VIII., X., XI., XII., XIII.)

Seven were females (I., II., IV., IX., XIV., XV., XVI.)

The paralysis was distributed as follows :

Right hemiplegia, two cases (X., XI.)

Left hemiplegia, nine cases (I., II., III., V., VI., VII., VIII., IX., XVI.)

Double hemiplegia, five cases (IV., XII., XIII., XIV., XV.)

Consequently fourteen out of sixteen patients had hemiplegia on the left side.

The hysterical symptoms present were not very various.

Undue emotions (tears and sobs) in fifteen cases.

Irrepressible laughter in five cases (V., VI., VII., VIII, X.)

Anæsthesia of left side of body in four cases (I., II., VIII., IX.)

Globus hystericus in two cases (III., IV.)

The lesions of the brain were determined by post-mortem examination only in a few instances.

The following table represents the pathological diagnosis :

Hæmorrhage in both hemispheres, one case (XV.)
Unknown " " two cases (XII., XIII.)
Probable embolism of right cerebral artery, one case (III.)
" thrombosis of " " one case (VI.)
Unknown, in left hemisphere, two cases (X., XI.)
" right " four cases (I., II., VIII., IX.)
Thrombosis of basilar artery, one case (VII.)
Softening of pons Varolii, one case (XIV.)
" pons and corpora striata, one case (XVI.)
Probable cerebral tumor, one case (IV.)
Disease of right crus cerebri, one case (V.)

Emotional symptoms were present in fourteen cases of left hemiplegia, and in two cases of right hemiplegia. This disproportion is enormous, considering that the records of many authors have been diligently searched for cases. I think that we may conclude that patients with right hemiplegia (who so often lose their speech), hardly ever lose control over their emotions ; while the subjects of left hemiplegia often do. Right hemiplegiacs are comparatively cheerful ; left hemiplegiacs are depressed and prone to weep. I am led by my recent experience to believe that this law will be brought into much greater prominence by future statistics.

The question of difficulty in diagnosis which occupied us while discussing the spinal cases, seems to me of minor importance in cerebral cases. Two of the sixteen cases are worthy of remark in this connection. In one instance (case XVI.) the paralytic attack was preceded by a well marked fit of hysterical weeping ; in another instance (case IV.) the exact diagnosis remained un-

certain until the existence of organic brain disease (tumor ?) was made sure by finding well-defined choked optic discs.

The thoughts which have arisen in my mind in connection with these relate to three points.

a. The possible parallelism between cases of hemiplegia from organic brain disease accompanied by hysterical symptoms, and typical hysteria.

b. The pathological physiology of some of the symptoms studied above, such as loss of control over the emotions, hemiplegia, and hemi-anæsthesia.

c. The new question of difference between the two cerebral hemispheres, in their functions and morbid susceptibility.

a. I have already, at the beginning of this essay, laid the foundations for comparing hysteria and the effects of certain brain diseases.

1. In typical hysteria the emotional symptoms are the most common, and according to many authors the most characteristic.

In all the cases of brain disease above related there were undue emotional manifestations, or emotional movements not duly controlled.

2. In typical hysteria many of the objective phenomena are almost always shown on the left side of the body; and we may consequently feel sure that in these cases the right hemisphere is disordered.

In nearly all of the above sixteen cases the right hemisphere was the seat of organic disease, and the symptoms were upon the left side of the body.

b. The genesis of symptoms in cases of organic disease and of functional hysteric disturbance. Adopting as I do, with some reservations, Brown-Séquard's new hypothesis, that brain lesions produce the symptoms which point out their existence, not by *destroying organs* in the brain, but by setting up irritations which *arrest* (inhibit) the functions of other parts of the encephalon, I find no difficulty in understanding why the same symptoms may exist without as well as with a brain lesion. In typical hysteria the functions of parts of the encephalon included in the right hemisphere, or in physiological relation with it, are inhibited by a peripheral irritation, starting from a diseased or disordered sexual apparatus, or other part; and, in case of organic brain disease,

the same inhibitory action is produced. In both kinds of cases we may have loss of rational control over the emotions, loss of voluntary power over one half of the body, and loss of sensibility in the same part.

In cases of hemi-anæsthesia due to lesions in the neighborhood of the thalami optici, (Türck,* Charcot,†) the explanation is, I think, the same—that a lesion in this particular locality is more likely to inhibit the functions of the (sub-cerebral?) centres for perception of sensitive impressions than lesions of any other part. I have long believed, with Brown-Séquard, that it is just so in the case of aphasia: We are forced by cases to deny the existence of an organ of speech in any convolution, yet are equally obliged by statistics to admit that a lesion of the posterior part of the left third frontal convolution, and immediately subjacent parts, is much more certain to inhibit the complex cerebral functions which co-operate to form articulate language, than any other cerebral lesion.

c. I may be pardoned for adding a short review of what seems well established concerning the different results of lesions of either cerebral hemisphere. After the great advance caused by the numerous publications upon aphasia, Brown-Séquard pursued the inquiry. In 1870‡ he communicated his conclusions to the Biological Society of Paris. He found that after lesions of either hemisphere the following symptoms predominated.

Left Hemisphere.	*Right Hemisphere.*
	Eschars.
	Œdema.
	Palsy of sphincters.
Aphasia.	More fever.
Palsy of organs of articulation.	Greater mortality.
	Pulmonary congestions.
	More frequent deviations of eyeballs in coma.
	Greater palsy.

* Sitzung der K. K. Akad. der Wissenschaften zu Wien, 1859.

† Op. cit., p. 271 et seq.

‡ C. R. de la Soc. de Biologie, 1870, pp. 27, 96, 116.

The last three characters of left hemiplegia were added to the list in 1871.* He and Charcot also noticed, but did not publish, that when the right hemisphere was injured there was more emotional disturbance, and that of a depressed kind.

Mr. Callender,† in his remarkable papers on brain shocks, noticed the difference in the effect of lesions of either hemisphere and expressed himself as follows in his second conclusion:

"2. The rapidly fatal results of bleeding into the right hemisphere outside the thalamus and corpus striatum, as compared with bleeding into the corresponding parts on the left side."

Recently, De Fleury‡ has pursued the same inquiry with similar and more striking results. He adds to the above table, that sensibility is more often and more deeply impaired when the right hemisphere is diseased.

To sum up: Lesions of the right hemisphere give us

More frequent and greater anæsthesia.

Greater palsy.

Greater alterations of nutrition.
- Optic neuritis (Jackson).
- Eschars.
- Œdema.
- Pulmonary congestion.
- Fever.

Palsy of sphincters.

Hysterical symptoms (emotional).

Lesions of the left hemisphere give us:

Less palsy and anæsthesia.

Aphasia.

Palsy of organs of articulation.

The general conclusions of this essay are:

First: I have brought forward facts to show that many hysterical symptoms may occur in diseases of the spinal cord and brain.

Second: that in diseases of the spinal cord these symptoms appear merely as a matter of coincidence.

Third: that in cases of cerebral disease the hysterical symp-

* C. R. de la Soc. de biologie, 1871, p. 96.

† Anatomy of Brain Shocks, in St. Bartholomew's Hospital Report, iii. p. 415; v., p. 3.

‡ Du dynamisme comparé des hémisphères cérébraux. Paris, 1873.

toms have a deeper significance, being in relation to the hemisphere injured.

NOTE.—*Nov. 1st*, 1874.—During the past summer and fall there have appeared in the *London Lancet* a series of excellent clinical lectures by H. Charlton Bastian, on the common forms of paralysis from brain disease. In Lecture V., part 2 (Lancet of Sept. 26, 1874, p.p. 440-441) the author refers at length to the subject of difference of symptoms when either cerebral hemisphere is injured.

E. C. S.

II.—*The Elements of Electro-Therapeutics.* A series of letters to Inquiring Practitioners. By GEORGE M. BEARD, M.D.

(Continued from Vol. I., No. 2, p. 166.)

LETTER V.—TO A SURGEON WHO INQUIRES THE BEST METHOD OF TREATING NÆVI BY ELECTRICITY.

THE method to be used in treating nævi depends on the size and situation of the tumor. Small and superficial nævi may be treated by inserting a needle connected with the positive pole directly into the tumor, while the negative sponge electrode is applied on some indifferent point near at hand. A few cells and a few moments only are necessary to produce sufficient electrolytic action. The color of the tumor is changed with the current, owing to decomposition and coagulation, and the remnant of the tumor, a dried and shrivelled mass, disappears in the course of a week or two, leaving but a slight scar if any at all.

If the tumor is large and elevated it must be treated more thoroughly, if it is expected to make the cure by a single operation—that is, a method approaching the method of electrolysis of the base that is employed for malignant tumors must be used. A short seance with a mild current will not answer the purpose; a limited decomposition may take place, and at the poles there

may be coagulation, but the body of the tumor will be unaffected. It is useless to attempt to cure these cases without causing something of scar. There may be destruction of tissue as well as coagulation, and this destruction of tissue may result in scarring, though very much less than after other methods of operating. Sloughing may follow, and cicatrization ; but if sufficient care be used, sloughing may be avoided entirely. An operation of this kind almost always requires full anæsthesia.

If the tumor be subcutaneous it should be treated much like an aneurism, that is, by insulated needles connected with both positive and negative poles. The object of the insulation is to keep the current from acting on the skin. A current of considerable strength may be used for this class of tumors, provided the insulation of the needles be satisfactory. If the needles be not properly insulated, or if the current used too strong or too long, action may take place around the needle in the skin to such an extent as to cause much subsequent sloughing. In the majority of cases, and especially in those tumors situated on the face and neck, or in exposed positions anywhere, sloughing is to be avoided, the great point being to obtain a cure with the least possible disfigurement. If the contents of the tumor are sufficiently coagulated by the electrolytic action, or if the circulation be obstructed, the tumor will at once become more or less hardened, and in the course of weeks absorption will gradually take place. Usually one operation is sufficient, but in cases of large tumors two operations or more may possibly be necessary. In some cases I make the first operation short and tentative, restricting the operation of the current to a limited portion of the tissues, reserving the principal part of the electrolysis for the second operation, which may take place after a week or two. Complete hardening of the whole tumor does not appear to be necessary, provided the circulation be pretty well interrupted. Operations of this kind almost always require a full anæsthetic, although a resolute patient may dispense with it. Large "mother's marks" can be successfully treated with little or no scarring, as I have recently shown, provided care is taken to avoid overdoing the operation.

LETTER VI.—TO A SURGEON WHO INQUIRES WHETHER IT WILL INJURE A YOUNG CHILD TO OPERATE WITH A STRONG CURRENT ON A TUMOR OF THE HEAD.

The notion that serious results may, for persons in average health, follow the use of strong currents applied to the head and neck, is being fast dispelled. We see, not infrequently, adults who are so sensitive to electricity that even mild interrupted currents in the region of the brain cause unpleasant sensations —dizziness, nausea, and headache ; but these symptoms are not serious, usually soon pass away, and if, in a very rare case, they persist, they lead to nothing worse. But children, very young children, bear electricity better than adults. I have shown, by recent experiments, that infants may be treated on the head or neck, or on any part of the body, with either galvanism or faradism, and with strong currents and long applications without any apparent injury.

There may be idiosyncrasies in children that will not tolerate electricity ; but they are, to say the least, rare. Children rally from electro-surgical operations around the head without any of the reactive effects that adults often experience. The alarm which parents feel in this particular may be appeased by the prompt and decided statement that electricity agrees with children, even those who are very young.

In relation with this fact we may suggest the fact recently demonstrated, (if the statements on the subject may be accepted,) that children have a great tolerance of hydrate of chloral. There are other remedies also that children bear better than adults.

It is also a fact of interest, first pointed out by West, I believe, that children are very much less liable to neuralgia than adults ; indeed it may be doubted whether very young children can have true neuralgia at all.

LETTER VII.—TO A SURGEON WHO INQUIRES WHETHER IT IS BETTER TO USE ONE OR BOTH POLES IN AN ANEURISM.

The question has been considerably disputed, and the reasons given for preferring one or the other course have not always

been sound. If the aneurism is small, one or more well insulated needles connected with the positive pole may be sufficient to produce coagulation, the connection being made on the surface, at some indifferent point, by a sponge electrode connected with the negative pole. If in this case the patient be anæsthetized, and strong currents are used, there is danger of making a blister under the negative pole; this can be avoided by occasionally moving the sponge. The action that takes place around the positive needles is feeble and the clot is slow in forming, but when formed the positive clot is blacker and harder than the clot at the negative pole.

For the majority of cases of aneurism it is, I think, much better to use both poles in the aneurism, especially if it be of large size, and to use a number of needles. The obvious advantage of this method is that it saves the enormous resistance of the body and thus concentrates all the force of the current where it is needed, inside of the aneurism; a mild current used in this way will do more work than a very strong current in the unipolar method.

Another advantage of having both poles in the aneurism is that both the negative and the positive clots are formed and found very near to each other, so as to unite and make one firm coagulum. It is well to reverse the current during the operation, so that at both poles there may be both the positive and the negative clots. The needles used in these operations should be well insulated over the portions that are in contact with the skin.

LETTER VIII.—TO ONE WHO WISHES TO KNOW WHETHER THE EFFECTS OF ELECTRICAL TREATMENT ARE AS PERMANENT AS THE SAME EFFECTS PRODUCED BY OTHER MEANS.

The general assertion that the effects of electrical treatment are as permanent as similar effects produced by other means is probably pretty near the truth; but in order to estimate the real value of this statement we must consider that many of the nervous and other diseases for which we use electricity are of a slippery and relapsing character, and however successfully they may be treated they are liable at some time to recur. This is

notably true of neuralgia and functional nervous diseases in general ; also of rheumatism, nervous exhaustion, and so forth. Now and then a case will be found where the symptoms disappear while the treatment is in progress, but recur soon after suspension of treatment, but this is not the usual history. More frequently indeed the improvement goes on for some time after the course of treatment, and the patient is better in six weeks or two months than while he was regularly visiting his physician.

But in most sub-acute and chronic nervous symptoms there is a possibility of relapse, or more correctly speaking of recurrence, months or years after absolute relief, and such recurrence does not count against the method of treatment employed. In certain diseases of the skin, as prurigo and chronic eczema, the results of central galvanization are surprising, and under continuous treatment these diseases may disappear, but they may and do recur, although the relief may last for weeks and months and very likely for years. There are some—indeed there are many —diseases that are reflected from some distant local disturbance, and can never be permanently cured until this local disturbance is removed. Diseases of this sort may be treated by electricity with temporary success that is most encouraging, but at once fall back as soon as the treatment is stopped. So long as the patient is under the continuous tonic action of the current, the symptoms may be kept down, but as soon as this tonic is taken away the local disturbance resumes its sway. I think I have seen cases of this kind. Diseases of the genital organs in both sexes are especially prone to excite distant reflex symptoms, which symptoms may possibly give way in a measure before electrical treatment, and so deceive the physician, who suspects nothing of the kind and makes no examination, and therefore is unable to account for the subsequent relapse. Cases of acne will sometimes improve quite rapidly under local electrization, but do not wholly disappear until the stomach or genital organs from which the acne proceeds are properly treated.

LETTER IX.—TO A SKEPTIC WHO RAISES THE INQUIRY WHETHER THE EFFECTS OF ELECTRICAL TREATMENT ARE NOT, IN PART AT LEAST, OF A PYSCHICAL CHARACTER.

The enormous influence of mind in the treatment of diseases

has long been recognized in a general way, and it is worthy of more consideration than it has yet received. The so-called "moral influence," which with greater strictness should be called mental influence, complicates all therapeutics and all hygiene as well. The benefit that follows new remedies or strange methods of treatment is partly due, in some cases certainly, to mental influence—the faith in the remedy and the hope it inspires. Hence the sanguine reports of first experimenters with any medicine or method of treatment are not always entirely fulfilled by subsequent experimenters. Hence also, the advantage of frequently changing medicines or changing the method of administration.

Electricity is to many a new and strange and mysterious remedy, and some of the methods of using it are but little familiar to patients, and when they begin a course of electrical treatment the emotions of faith and wonder and expectation help out the effects of the electricity. With a certain class of patients the co-operation of the mind of the patient with the electricity wonderfully reinforces it and makes the relief more certain, and perhaps brings a success where otherwise there would have been failure. But it does not follow that mind does the whole work any more than that where two horses are drawing a load all the work must be done by one.

That the effects of electrical treatment, and notably the sedative and tonic effects that are claimed in nervous exhaustion and allied conditions, are not wholly due to mental influence, but are real and appear independently of any mental influence, is proved by the following facts.

1. Persons who have no faith in electricity, who indeed at first doubt its value, are yet benefited by it.

2. Persons of cool, imaginative temperaments, who receive the treatment passively and indifferently, yet are improved thereby, though less rapidly than those who have opposite temperaments and strong faith in the remedy.

3. Young children, even infants, are very decidedly benefited by general and central electrization. The sedative and tonic effects of these methods of treatment are sometimes appreciated by nursing infants more rapidly than by adults.

4. Animals improve in nutrition under general electrical treat-

ment, galvanic and faradic. This has been proved by experiments.

In the case of animals and of young children there is no chance for psychic influence, and the results, if obtained in a sufficient number of cases to eliminate the possibility of accounting for them by mere coincidences, must be assigned to the effect of the electricity itself.

There is no doubt that in using electricity, as in using any other remedy, much depends on the temperament of the physician. He who uses this agent heartily and enthusiastically, inspires faith and hope in his patient, and obtains the very important co-operation of mental therapeutics with electro-therapeutics, and thus succeeds oftentimes where the coldly calculating observer utterly fails, although the latter may be as skillful in the use of the agent as the former. It is partly for this reason, in some cases at least, that the great successes of earnest pioneers in the use of any remedy are not fully confirmed by subsequent and skeptical observers, although the remedy itself may have a permanent and classical value.

II.—*Œsophageal Stricture Treated by Galvanism.* By F. F. Frank, M. D., Titusville, Pa.

Before entering upon the description of the treatment employed in this case, and the results obtained, I will give the history of the disease, as I obtained it from the patient.

Henry E. W., of this city, an engineer by profession and aged thirty-four years, after his recovery from lumbago, for which I had treated him with electricity in the fall of 1871, removed to Cleveland, O., the following spring. Shortly thereafter he became afflicted with catarrh, and sickness after eating, which was followed by a severe sore throat and great difficulty in deglutition. The latter increased despite all the medical efforts which up to that time had been employed to relieve it, and the patient was informed by his physician, Dr. Bigger, of Cleveland, O., that it was only a question of time as to its fatality.

In August of the same year he visited a water-cure in Wisconsin

from which he returned somewhat improved. His former difficulty however returned, and it became a great task for him to swallow, and large doses of opium were employed to this end. For nearly a year he had eaten little or no solid food.

In December, 1872, he visited Philadelphia, Pa., to consult Dr J. S. Cohen. The day after his arrival there, and while Dr. Cohen was endeavoring to explore the œsophagus, an ivory ball from the end of the exploring bougie became detached and remained in a strictured portion of the canal. All effort with stomach tubes to dislodge it proved unavailing, and the patient's situation became daily more critical; though at no time was he entirely deprived of the power to swallow small quantities of liquid, when strongly exerting himself.

This condition remained till June, 1873, when under convulsive action of the œsophagus the ball passed into the stomach, and the patient drank immediately thereafter a large quantity of milk with ease. In August of the same year Mr. W. returned to Titusville measurably improved.

The following September he had a fever, and while the disease was at its height, the power to swallow became completely restored. This improvement, however, was of short duration, and by December the difficulty was worse than ever. At this time Dr. C. O. Moody, of this city, attended Mr. W., and advised the use of electricity, and sent him to my office for treatment; where I obtained the above history of this interesting case.

He was extremely emaciated, and weighed but ninety pounds, while his usual weight was one hundred and thirty-five pounds. A narrowing in the œsophagus, near the cardiac orifice of the stomach, prevented the passage of bougies into the organ.

It being the desire of Dr. Moody, at this most discouraging period of the disease, to afford his patient some temporary relief, if no more could be done, he requested me to so influence the pneumogastric nerve and epigastric plexus by galvanism, as to produce relaxation of the stricture similar to that which happened spontaneously during patient's fever period, as heretofore mentioned.

With this view I operated in the usual manner by placing the positive pole from a zinc-carbon battery by the side of the sterno-cleido-mastoid muscle, near the base of the neck, while

the negative rested below the ensiform cartilage. The reduced condition of Mr. W. demanding the greatest caution during my applications, I employed the current with just intensity enough to assure myself that the resistance of the intercalated parts was overcome, at the same time avoiding unpleasant cardiac symptoms. This treatment really did produce an improvement, for a short time after each application, and I followed it at twenty-four hour intervals till Jan. 9, 1874. From that time, however, I could see no further benefit derived from my treatment, and deglutition became impossible. At this juncture I obtained the patient's consent to have an application made directly to the seat of stricture, and I operated in the following manner: An œsophageal electrode connected with the negative pole of my constant current battery being passed down the canal to the obstruction, about two inches from the cardiac orifice of the stomach, and placed in the hands of my assistant, I closed the circuit with the positive pole a little below the occiput, and carefully increased the battery tension till ten cells were in action, allowing the sitting to be continued during fifteen minutes.

The operation was painless with the exception of a sensation of slight heat produced by the metallic point of the negative electrode. The patient was now allowed to rest during forty-eight hours, and when I saw him again I found him cheerful and much encouraged by the results of my last treatment. He had been able at regular intervals to swallow some solid food.

I continued the local applications at three-days intervals till in all twelve had been made, when Mr. W. desired them to be discontinued, for a while at least, as he could now eat as well as ever, and was rapidly improving in general health: the constipation, with which he was seriously afflicted during the whole period of his illness, having given away to a perfectly normal constitution of the bowels.

It is now Sept. 18, 1874, about eight months since the last application, and no relapse in the patient's condition has occurred, and therefore I have found no occasion for further galvanic treatment. Mr. W. has followed his vocation during the spring and summer months with impunity, and though very much exposed to the inclemencies of the weather, has suffered no inconveniencies beyond an occasional cold. When I saw him, a few days since, he as

sured me that he has never enjoyed better health in his life, and that his weight is several pounds more than ever before.

A few questions arise in connection with the foregoing case to which I will draw the reader's attention before closing my report. Could an ivory ball three quarters of an inch in diameter be held by a strictured portion of the œsophagus from December, 1872, till June, 1873, and the patient still be able to swallow some liquid food, or had it passed unobserved into the stomach and the stricture closed spasmodically immediately thereafter?

When on the last named date the patient made a strenuous effort to swallow, did not the general relaxation and prostration produce the same result as happened during the fever period, when deglutition almost instantly became restored?

And was it not a deception on the part of Mr. W., when on that occasion he thought he felt the ball pass into the stomach?

It would certainly be matter of interest to receive views that clear up the doubts presented in connection with this case. I am myself convinced from circumstances that the ball had either passed unobserved into the stomach, or was pushed down during one of Dr. Cohen's efforts to dislodge it by stomach tubes, and that from the irritation so produced the stricture closed immediately after the ball's descent with great tenacity. Without question, the stricture must have been purely spasmodic.

IV.—*A Case of Eczema Capitis treated by Central Galvanization.*

By G. W. Murdock, M.D., of Cold Spring, N. Y.

A. McQ—, aged 10 months, a bright and otherwise healthy boy, and of healthy parentage, had been under my care several months for a severe and obstinate eczema capitis, from which he had suffered since he was three months old.

It now covered one cheek and the greater part of the scalp, and the itching was so great as to require the constant attention of one person to keep him from scratching. He slept but little, and even then was uneasy and restless. I had used many

kinds of treatment at different times but with little effect, and had finally told the parents that the disease would probably persist in spite of any remedies until he had finished teething.

My attention being directed to a case reported by Dr. Beard, of treatment by central galvanization, I began its use on May 28th, 1874, giving it three times a week. I should state that for the two or three preceding weeks, the child had been without any treatment whatever, although no change had taken place in his condition.

Upon June 1st, I note, "Have made two applications and there is already decided improvement. The eruption is perceptibly better and the child has slept through the past two nights with very little trouble, which it has not done for many months before."

From this date the improvement was steady and rapid. There was a little unavoidable irregularity about the applications, and the treatment extended over about six weeks. In all I gave the galvanization thirteen times, following uniformly the method recommended by Drs. Beard and Rockwell, and paying no attention to the local disease.

At the end of that time the eruption had almost entirely disappeared and has not since returned, seven months having elapsed.

No other treatment was used during this time and none has been required since.

Having had no very severe cases of this affection since that time, I have not had occasion to repeat the method.

I have tried central galvanization in but one other case of eczema of any form.

In this instance no benefit was perceived, but perhaps none could reasonably have been expected, as it was of long standing, and affecting a lady nearly eighty years of age.

V.—*The Relations of the Nervous System to Diseases of the Skin.*

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(Part II. Clinical.—Continued from ARCHIVES, No. 2, p. 268.)

HAVING studied the Relations of the Nervous System to Diseases of the Skin, from 1, Anatomical, 2, Physiological, and 3, Pathological stand-points,* we are now prepared to enter upon the more important practical parts of our subject, namely, 4, Clinical teachings; 5, Conclusions; and 6, Therapeutical considerations.

4. *Clinical Teachings.* In the preceding portion of this article I have already given a number of clinical illustrations relating to the physiological and pathological portions of the subject, and the present observations and cases pertain more particularly to what is commonly understood as clinical evidence, especially where either the features of the disease or concomitant phenomena point to neurotic elements.

I will first review the remarkable articles by Rendu,† which have appeared since my former article, and consider also the clinical article contributed by Dr. Clifford Allbutt,‡ to which reference was made in a note, as appearing too late for other mention, referring also to an article on this subject, partly clinical, which has since appeared by Dr. S. G. Webber, of Boston.§ Dr. Rendu conceived the idea of testing the skin in its several morbid states, in reference to three sensations: that of touch, changes of temperature, and pain; and he gives us quite a number of cases—over thirty—where these tests were made and recorded. Beginning with simple inflammation of the skin, as produced by a vesicatory, before any bullæ had appeared, he found

* Archives of Electrology and Neurology, November, 1874.

† Annales de Dermatologie et de Syphiligraphie, Vol. V., No. 5. Vol. VI., Nos. 1, 2, 3.

‡ The Practitioner, November, 1874, p. 319.

§ Bost. Med. and Surg. Jour., Dec. 17, 1874.

hyperæsthesia and hyperalgesia, (increase of the feeling of pain,) but a blunting of the perception of temperature. Almost the same was observed in eight cases of erysipelas. In a case of very pruriginous herpes iris he found slight tactile hyperæsthesia, and in a case of marginated erythema the tactile and thermal sensibility were normal, but a superficial analgesia (loss of the feeling of pain) existed. Ten cases of eczema were studied, and very generally gave a diminution of the tactile and thermal sensibility, while the sensitiveness to pain was either normal, increased, or diminished. Very much the same states were found in chronic lichen, while in a case of pityriasis rubra circinnata there was diminished tactile sensibility, and analgesia was very marked in the centre of the patches. Psoriasis yielded much the same results. He further found disordered sensibility very marked on the surface in the track of herpes zoster, there being exaggerated tactile sensibility to the extent that, while two points of the compass were distinguished on the diseased side at a distance of 13 millimetres, on the corresponding portion of the unaffected side of the body they were separated 7 centimetres before recognized, or more than five times the distance. Sensibility to pain was equally exaggerated, but very unequally distributed, as there were certain points of complete analgesia alongside of hyperalgesic spots. The hyperæsthetic zone extended for the distance of a line beyond the limit of the hyperæmic surfaces; seven cases of zona thus gave irregularities of sensation. He found also certain sensory disturbances around the eruption of purpura, and pemphigus likewise presented similar abnormalities. In many of these instances he found the normal sensations of the parts return as the eruption disappeared.

He draws certain conclusions from these researches which I will quote: it would be highly desirable to have them further proven and elaborated by others. The changes he has observed he has grouped into four classes, as follows:

"1. Diminution of tactile and thermal sensitiveness, that of pain being preserved intact. This is the most commonly observed (eczema, psoriasis, lichen).

"2. Exaltation of the sense of touch and of pain, the percep-

tion of temperature being blunted; this is the type of frank dermatitis, and pertains also to erysipelas, herpes, certain erythemas, and a good portion of the artificial eruptions.

"3. Preservation of the tactile and thermal sense, coinciding with more or less marked analgesia (certain forms of psoriasis, pityriasis, and leprosy).

"4. Finally, in certain cases the hyperæsthesia is associated with anæsthesia and analgesia, the sensitiveness to temperature remaining unchanged or diminished. This is observed in zona which forms a class by itself."

In the succeeding portions of the very interesting and able paper, Dr. Rendu goes over some of the points given in my former article, and makes strong claim for neural influence in producing very many of the diseases of the skin.

Coincidently Dr. Clifford Allbutt furnished a good clinical contribution to the subject, looking at it from yet another point of view. He gives the headings of eighteen cases, in each of which there were concomitant nervous ailments, and which demonstrate measurably the *neurotic relations*, at least, of several diseases of the skin. The list embraces ten patients with eczema, three with urticaria, two with psoriasis, one with lichen, one with itching pityriasis, and one with "a curious skin affection partaking of the characters of pemphigus and of rupia." The following are specimens of the evidence: "1. Mrs. A., a neurotic all her life, has suffered much from gastralgia and tic of the head and face. Has eczema behind both ears. 3. Mrs. B., wife of a medical man, had obstinate and severe gastralgia eight years ago, and now has extreme nervous depression and paræsthesia. Has severe lichen in head and neck. 7. Mrs. K., migraine from childhood, facial neuralgia frequent, one attack of cervico-brachial neuralgia, severe recurring gastralgia. Has had four attacks of eczema. All her affections were wonderfully relieved by arsenic. 12. Mr. L., a great sufferer from neuralgia; very subject also to eczema over arms, legs, and trunk."

The limits I had assigned to this article forbid further quotations, which could be multiplied, as periodical literature presents isolated examples of the influence of the nervous system in producing cutaneous alterations. I will give in brief some

cases which I have recently noted in private practice, which appear to weigh strongly in the direction of our subject. The cases which I shall allude to at the present time are thirty-five in number, as follows: Eczema, eleven; Acne, nine; Psoriasis, four; Erythema, two; Pruritus, two; Herpes gestationis, two; Lichen, one; Alopecia areata, one; Leucoderma, one; Morphœa, one; Elephantiasis Græcorum, one. The notes were taken at various times, without any reference to nerve relations—indeed many of them long before my attention was seriously directed to the subject. I will allude to them briefly in the above order.

1. *Eczema.*—Miss D., aged 53, is executive officer of a charitable institution. Tuesday's work of each week is very severe and trying, and the night often sleepless, and is always followed on Wednesday by either a fresh outburst of the eruption or by a great aggravation of that existing. This had been the case for some months before I saw her, and it was observed to occur several times during treatment. The eczematous eruption occupied the face and backs of hands. The nerve elements of itching and burning were very marked. She has always been subject to great headaches, which have ceased since the appearance of the eruption.

2. *Eczema.*—Rev. Dr. B., a prominent clergyman in a neighboring city, has had for many years an eczema of the head and face, which he finds to be always worse on Monday, after the Sabbath's mental work and strain, and which is particularly bad whenever extra work is called for, as the tax of preparation for and fulfillment of other public duties, to which he has frequent calls.

3. *Eczema.*—Mr. J., aged 39, has had pruritus of the anus for eight years, with eczema extending on to scrotum; this is largely developed from the continued scratching. He complains principally of the itching and burning about the end of the sacrum, deep in, which he describes as the most horrible torture. He feels the distress to be very largely due to the great mental overstrain to which he is subject, as he has charge of about three thousand operatives in a very large manufacturing community, superintending both their work and their dwelling-houses, and having charge as well of a Sabbath-school organized for them.

Extra work or anxiety will always aggravate the difficulty immensely, whereas absence from duty affords much relief to the pruritus. Remedies seem useless while he is occupied with his business, but moderate the itching and the eruption when in this city and away from home.

4. *Eczema.*—Mrs. V. T., aged 46, with eczema of the right hand, is of exceedingly nervous temperament. The affected hand trembles almost as if affected with paralysis agitans. She has also marked *globus hystericus* and gastralgia. The family history is remarkable for longevity; her father is living, at 75 years of age, grandmother died at 99, two aunts at 103 and 108 years. Under arsenic and phosphoric acid all the symptoms improved very greatly, and on neglect of treatment the nervousness returned and with it the eczema. The left hand trembled but slightly, and had only a trace of eczema on it. The itching feature in this case was marked.

5. *Eczema.*—Mr. B., aged 39, has had eczema on the legs every winter for the five years previous to being first seen. His brother has had eczema on hands and over body; his health also is much broken and he is incapable of brain work. The patient's father died at 59 years of age, with hemiplegia of the left side; his mother and one sister died of similar trouble; mother had also eczema. The patient is of a very nervous temperament. A railroad accident causing a slight contusion of the left forehead was followed by ptosis, strabismus and double vision of left eye; also pains in the right side, and anæsthesia.

6. *Eczema.*—Mr. S., aged 57, has been working very hard for few years past; has great financial interests and finds that his eruption, which occupies the lower legs, popliteal spaces, and scrotum, is aggravated by mental strain. His mother was subject to migraine. He is of a very bilious temperament, sluggish bowels, etc., but has himself noticed the nerve element in the case. The itching is a very serious feature; for some time the sleep has been very poor.

7. *Eczema.*—Miss T., aged 35, is a most perfect specimen of a neurotic female, having innumerable and indescribable nervous symptoms, among others great cutaneous hyperæsthesia, especially of the scalp. She has an oily seborrhœa of the scalp, and

eczema of the face and some portions of the head. Itching is quite a prominent feature, both of the diseased surfaces and of the whole body at times.

8. *Eczema.*—Miss C. T., aged 65, has eczema of the shoulders and about the nipples, following a protracted and distressing watching till death of a sick child. She has long had gastralgia, and itching is marked.

9. *Eczema.*—Mr. B., a clergyman, aged about 24, has eczema of the scrotum, of which the itching is the main symptom, which is always worse after mental strain.

10. *Eczema.*—Mr. G., aged 47, a busy manufacturer, has eczema of the scrotum, beginning solely as a pruritus. Had several attacks of asthma.

11. *Eczema and herpes zoster ophthalmicus.*—Mr. B., a very nervous and excitable gentleman, aged 56, a lawyer with great professional and financial interests; has had eczema on various parts of the body for some years. When first seen he was suffering from a frontal herpes zoster of the left side, which was accompanied by most severe neuralgic pains in other parts of the head as well. The neuralgia persisted distressingly for a long peried in spite of most patient and varied treatment, galvanism included. He had always had neuralgic headaches.

12. *Acne rosacea.*—Miss H., aged 22, has had more or less acne rosacea for several years. She presents all the phenomena of hysteria, with much of true nerve suffering. She has numbness in various parts of the body, severe gastralgia and intercostal neuralgia, neuralgic headaches, and hysterical dysuria, fainting spells, nausea and irregular chills.

13. *Acne rosacea.*—Miss B., aged 26, has had rosaceous acne for three or four years, from no known cause; tongue clean, appetite and digestion good, bowels and menses regular and normal. Her mother has *tic douloureux* of the right side very severely. The patient is very nervous, has cold hands and feet, and a very variable pulse. Her treatment consisted in quinine, iron, and nux vomica; after remedying an existing oxaluria with acetate of potassa, the disease disappeared entirely; soothing and slightly stimulating local measures being also used.

14. *Acne rosacea.*—Miss —, aged, 30 has suffered from the

effects of malarial influence for some years. Her sister is a martyr to neuralgia not amenable to any treatment. The patient has a cataract forming in the left eye, attended with much deep seated neuralgic pain. She was formerly subject to "rose cold." She is improving steadily under iron and strychnine, with the occasional use of acetate of potassa.

15. *Acne rosacea.*—Miss S., aged 21, has had nervous dyspepsia for several years, intense gastralgia, palpitation of heart, and restless sleep, dreaming. She experienced the most benefit to the face trouble from phosphoric acid, iron, quinine, and arsenic, guarding the stomach from dyspepsia.

16. *Acne rosacea.*—Mrs. V., aged 44, is a nervous lady, very subject to spasmodic asthma, which is inherited, her grandmother, uncle, and those of the immediate family having it. Her acne has been much benefited by phosphoric acid.

17. *Acne rosacea.*—Miss C., aged 28, has had rosaceous acne for about a year; the face has been subject, however, to red patches for several years. She is rather nervous, very active in charitable work, has from time to time had various nervous symptoms, dizziness, headache, etc. She has had also, while under my care, a well marked and obstinate attack of general urticaria. She has taken phosphoric acid, iron, and nux vomica, with great benefit to the acne, after regulating the bowels and digestive organs.

18. *Acne indurata.*—Miss C., aged 22, a most painful case of indurated acne; has had for several years intense neuralgia, abdominal and intercostal fainting spells, palpitation of the heart and irregularity of pulse, without any appreciable heart lesion.

19. *Acne indurata.*—Mr. R., aged 38, an overworked and harassed clerk; had a face very badly disfigured by acne indurata. He always noticed that business worry aggravated greatly his cutaneous difficulty. Iron and mineral acids have cured him completely, after a moderate course of blue mass, colocynth, and acetate of potassa.

20. *Acne simplex and indurata.*—Mr. L., aged 27, says that his acne is always much worse when he is mentally overtaxed.

21. *Psoriasis.*—Mrs. C., aged 34, has had psoriasis off and on for many years. She is a very nervous lady, although possessing

great self control, and is very largely occupied in home and benevolent duties. She is subject to neuralgia, nausea, restiveness, and sleeplessness.—When first seen the eruption itched fearfully, which has since been a marked feature.

22. *Psoriasis.*—Miss H., aged about 40; is very nervous and hysterical at times, subject to headache and gastralgia. She has had psoriasis very generally distributed over the body for many years, which disappeared entirely and remained absent for the longest period within her recollection, from the internal use of phosphorus. Arsenic has been of considerable service, but has lost power of late.

23. *Psoriasis.*—Mr. S., aged 33, a very intelligent gentleman, a dentist, has long noticed that when he gets nervous, worried, constipated, and dyspeptic, his psoriasis is sure to appear.

24. *Psoriasis.*—Mr. B., aged 55, has had psoriasis for 50 years. His father had it, also his oldest child, a son; his second child, likewise a son, has psoriasis and asthma, the asthma being better when the psoriasis is out; his third child, a son, died at the age of 22, feeble and idiotic, psoriasis developing just before death; the sixth and seventh children, both daughters, have psoriasis; the seventh, aged 15, being under my treatment. She is very nervous, and the eruption is very itchy and partakes more of the characters of eczema. The patient is a large man, of full habit, with a tendency to cerebral congestion.

25. *Erythema urticatum.*—Mrs. S., aged 45, has Graves' or Basedow's disease, as indicated by exophthalmos and goitre, with palpitation and irregularity of the heart; and for several months while under observation had most distressing general pruritus, accompanied with transient œdematous swellings of various parts of the body, sometimes distorting the face greatly, sometimes making the hands or portions of them of unnatural size, always with more or less erythema. She was very hysterical, and said that she never perspired. Treatment afforded her but very little relief; it was followed out, however, only three weeks.

26. *Erythema facei.*—Mrs. —, aged 36, is as nervous and hysterical a lady as is often seen, the subject of most intense burning neuralgia. She has erythema of the face, seated chiefly in the region where the neuralgia exists—that is, about the forehead and

at the root of the nose; also on the cheeks. The pain is sometimes deep seated, sometimes superficial.

27. *Pruritus.*—Mrs. L., aged 34, has on three occasions had intense pruritus occupying various parts of the body. On one occasion it was during pregnancy, and on its subsidence under treatment, a nervous hoarseness appeared, which ceased at once on delivery. This hoarseness occurred in a similar manner with a previous pregnancy. She is subject to neuralgia, is very nervous, and says that her mother was the same.

28. *Pruritus.*—Miss G., aged 35, has a pruritus ani which has resisted the most varied treatment from the hands of many physicians for at least two years. No cause can be made out; no lesions exist save those caused by scratching, and the disease must be reckoned a neurosis, but I have no other recorded symptoms as proof.

29. *Herpes gestationis.*—Mrs. E., aged 33, has three times, with pregnancy, had the disease develop which I have described with the above name in the Journal of Obstetrics for February, 1874, giving this case. In the intervals she has had attacks of urticaria; also neuralgia. The second and third attacks of the disease were greatly moderated and arrested by quinine, strychnine and arsenic. The disease was described and exists clearly in my mind as a reflex neurosis.

30. *Herpes gestationis.*—Mrs. C., aged 32, was another less marked case of the same disease, whom I saw but once in consultation.

31. *Lichen agrius.*—Mrs. M., aged 32, has for several years had a lichenous eruption on the right arm and shoulder, seemingly dependent upon the enormous nervous overstrain that the hand and arm has been subjected to in writing. She is a perfect type of a neurotic female, having had, as she says, general paralysis, and having insanity in her family. This case was referred to in the previous article, page 254.

32. *Alopecia areata.*—Mr. H., aged 24, is very nervous, wakeful at night, working very hard, and with a quick pulse, varying from 90 to 104. A small patch of perfectly smooth white skin has appeared quite recently on the right temple, just above the ear, with no vestiges of hairs. This is improving under the

local application of tincture of capsicum and glycerine, with strychnine, quinine, iron, and latterly arsenic, internally.

33. *Leucoderma.*—Mr. J., aged 29, presents a well marked example of this strange and rather rare disease. He is a great smoker, very nervous and restless, and has quite marked locomotor ataxia. His mother had chorea in childhood.

34. *Morphœa.*—Miss B., aged 10, is a very nervous child, restless at night and subject to nervous headaches. Her father is of a very nervous temperament and has neuralgia, as does also her mother. She has four or five spots of hardened white skin about waist and thighs, which have steadily increased in size, with the new formation of others, for more than a year. They appeared to be arrested for a time, with daily applications of a moderate faradic current of electricity.

35. *Elephantisis græcorum.*—Mr. O., aged 30, presented markedly the features of the macular form of anæsthetic leprosy. Nervous sensations of tickling, pain, and burning were very common.

It were possible to multiply the number of cases very largely, but these will be quite sufficient to illustrate this division of the subject.

5. *Conclusions.*—From what has been thus far stated in this and the preceding article, it may reasonably be concluded that the nervous system has much to do with the causation of skin diseases. But on the contrary, there has been much evidence given that the term neuroses of the skin, as heretofore used by writers, has been both too extended, embracing too many affections, and yet too limited, including too few. To be more explicit, it has been shown in the preceding paper that the cells of the rete Malpighii are intimately connected with the nerve terminations ; it has been shown that there are many physiological facts pointing in the direction of neuropathy in skin diseases; it has been shown that irritation of the nerves, as by injury or disease, will cause cutaneous lesions ; finally, it has been demonstrated that very many of the affections of the skin have varied and many neurotic associations.

But while these facts exist, it is likewise true that not every

nerve lesion will be followed by integumental disease, nor will every neurotic person suffer from these maladies. There are other factors in the case. While I have alluded to nearly a dozen cases of eczema, where mental and nervous connections seemed manifest, fifty times the number could more easily be cited where no such relations could be traced ; for each of the few cases of acne related as illustrating nerve influence, a hundred stand ready to prove negatively that such is not necessary, or at least cannot be shown in any proportion of the cases ; and so on for the other diseases quoted.

These facts go to show that the time has not yet come, when we can distinctly draw any line with certainty, and say that such and such diseases are neurotic, and these others are not. Cases are neurotic, but diseases of the skin cannot be as definitely stated to be such. Now, while I know full well, and have already mentioned in the previous paper, that most remarkable alterations have been discovered, *post-mortem*, in the nerves and ganglia of the territory occupied by an eruption of herpes zoster, and would, therefore, be inclined to make that a true neurosis, around which, perchance, we may as time rolls on be able to construct a class of neurotic affections of the skin, I cannot at present feel justified in separating the neuroses from other skin lesions without including eczema, whose neurotic elements of burning and itching are so painfully thrust upon our notice every day. The true nerve alterations connected with it have not yet been demonstrated, it is true, but do they not exist ?

When we attempt to construct the class of neuroses of the skin from a pathological standpoint, we are met with the fact already developed, that *many and varied* cutaneous affections have been actually observed to follow crushing and other injuries or disease of the nerve termini, trunks or centres. Thus, erythema, the glossy skin, nail alterations, eczema, herpes, urticaria, papillomatous growths, ulcerations, bullæ of various sizes, hyperæsthesia, analgesia, and anæsthesia, itching, burning and pain, hypertrophy, and alteration in perspiration and hair growth. Now all these have been actually observed by competent men, to follow and depend on nerve influence. Where can we draw the line without including all of them ?

The conclusion seems evident that the direct control of the cell elements of the skin, which result at one time in healthy, at another in morbid action, resides very clearly and definitely in the nerve elements distributed to and among them. Further, that, in proper subjects, an *irritation* of nerve tissue results in disease of the parts to which it is applied. It must be remembered, however, that in the laboratory physiologists have failed to obtain these lesions from artificial irritation and sections, and we must also believe that during our late war multitudes received nerve injuries that were never followed by skin lesions.

But still, again, the occurrence of these very same lesions, without any direct appreciable nerve influence, such as injury, etc., must lead us to enlarge our view and look at these affections not only from the neurologist's or dermatologist's standpoint, but with the far-embracing consideration of the thorough physician. Doing this I believe we will find two very important causes of skin diseases; first, *reflex nerve irritation;* second, *direct nerve irritation.* The first, *reflex influence*, is shown *inversely* in the occurrence of intestinal ulceration attending extensive cutaneous burns; *directly*, in the flushing and heat of the surface, or paleness and perspiration, caused by the presence of certain articles in the stomach, also by mental, or nervous states, as severe neuralgia; or this reflex influence is further shown in the pruritus and even urticaria following certain ingesta, the cutaneous symptoms being often relieved at once by an emetic. Likewise in the pruritus of pregnancy, or in the herpes gestationis, both of which cease on emptying the uterus.

The second method of production of skin lesions, direct nerve irritation, is less easily demonstrable. It includes, among others, the skin lesions found in herpes zoster, leprosy and syphilis; also in gouty patients, or in those in whom the results of mal-assimilation are less strongly marked than in gout, the subjects of oxaluria, lithæmia, etc. With these may be placed those where ingesta produce an eruption some time after taken, as, in certain subjects, strawberries, pineapples, shell-fish, etc., always excite an eruption, likewise iodide of potassium, chloral and other medicinal agents.

Now, tar, iodide of potassium, buckwheat and other substances

will produce acne; but so also will a tumor or displacement or ulceration of the uterus, all acting through the nervous system, the former *directly*, as far as we can at present tell, by the circulation through the blood vessels of irritating matter; the latter, by the constant irritation of the uterus being *reflected* to the skin. So of urticaria, so of eczema. Inflammation of the spinal ganglia, we may grant for argument, causes the formation of a cluster of bullæ, which we call herpes zoster, but almost the same effect may be produced by an agent acting locally, excessive heat, irritants, as cantharides, etc.; or finally, certain substances taken internally can excite an eruption of bullæ, as iodide of potassium. Of the causation of the pemphigus we know but little, but it may be due to the syphilitic poison in certain cases; in the others is it a neurosis?

We know, further, that the circulation of certain effete products—as in lithæmia and jaundice—will engender pruritus of the integument, but we also know that the bite of the flea or mosquito, or the burrowing of the acarus, will do the same, as may also the impregnated or diseased uterus, or ascarides in the rectum. Lepra anæsthesia, perhaps the least contested of the nervous diseases of the skin, presents cutaneous and other phenomena which ofttimes resemble very closely those of syphilis; how do we know that these very lesions of syphilis have not for their ultimate cause alterations of nerve structure or function. These and many other points afford fertile fields for study and research, and until much more is known on the subject, especially in the way of pathological changes in nerves and ganglia supplying diseased skin, we are hardly prepared to isolate a few cutaneous diseases, whose nerve phenomena are perhaps more obvious than those of others, and call them neuroses.

6. *Therapeutical Considerations.*—Fortunately, however, this apparent uncertainty does not make the indications for treatment any less definite and sure, but on the contrary may often lead to more successful measures. I have endeavored in this and the preceding paper to show that all cutaneous affections, except certain ones manifestly local, as the parasitic, have much of nerve element, and our therapeusis will be followed by success in proportion as we pay attention to all the elements of a case. I

have elsewhere* shown the very great frequency of urinary derangements in skin diseases, as indicative of disordered blood-current. Our treatment, then, of skin diseases, as far as their nerve elements is concerned, resolves itself into three divisions: 1, remove irritating agencies; 2, employ such measures as soothe already excited nerves; 3, secure a proper vitality and tone of the nervous system. It were senseless to give arsenic or anything else internally, or employ emollient washes or ointments externally to relieve the itching or scabies while the insect was still left to burrow; quite as useless to expect relief of general or local pruritus by such measures while a cause such as lithæmia, jaundice, glycosuria, uterine disease or the like remains.

The first point then is to search for and remove the exciting and continuing cause, be it the flannel next to an easily inflamed skin, (causing eczema, urticaria, or pruritus,) or any external irritant, or assimilative, or other error irritating the nerves from within.

Second, soothe already excited nerves, it may be by alkaline baths, or quieting lotions, ointments or powders, or administer, if need be, internal remedies, as chloral, bromide of potassium, belladonna, etc. Chloral is often of great service, given in a tolerably full dose, half an hour before undressing, where there is much pruritus, to allay the great irritation from friction of the clothes and exposure to the air.

Third, the vitality and tone of the nervous system, and the proper performance of its functions, are to be obtained by all known means. If prolonged mental strain originates and keeps up an eruption, as in some of the instances cited, relief to the former must be had if we would help the latter. Cold baths especially of sea-water, change of scene, proper recreation and exercise, are well-nigh essential in many cases. In those cases of skin disease where there is functional nervous disorder, inherited or acquired, the medicines known as neurotics are most serviceable, and it is in these cases, as Dr. Allbutt remarks in his excellent article quoted, that arsenic is certainly and regularly efficacious. The great diversity of opinion as to the value of arsenic may thus

* Transactions of N. Y. State Medical Society for 1875.

be accounted for. But there are other remedies very efficacious in neurotic skin cases, and these are strychnine, quinine, iron, and phosphorus.

In conclusion, we shall, I think, obtain a much larger measure of success in treating skin cases, if, while we really discard the class of neuroses as separate and distinct from other affections of the skin, we still bear in mind the nerve elements of a large proportion of all diseases, including those of the integument, and regulate our therapeusis accordingly.

VI.—*Paralysis of the Muscles of the Eye.* By W. F. MITTENDORF, M. D., Assist. Surgeon to the New York Eye and Ear Infirmary, etc.,

I PRESENT the following interesting case of complete paralysis of all the muscles, supplied by the motor oculi and the abducens nerves, on account of the rapid and complete cure that followed the combined use of an antisyphiltic treatment and the faradic current.

Patient B. K., a Bohemian woman 32 years of age, who gives a pretty plain history of syphilitic symptoms, which she noticed about four years ago, a short time after she came to this country, had about six months ago very severe attacks of headache, which lasted for days, and were chiefly confined to the right side of the head, and the eye, and gradually she lost the use of all the muscles of the eye, and her sight failed rapidly. When she applied for treatment, which was about four or five months after she had the first attack, and which she had ascribed to a severe cold, she presented a very interesting picture of the effects of paralysis. The right eye was completely closed, and she was not able to open it at all; it was slightly prominent, probably due to the inability of the recti-muscles to draw it back and keep it in its place. On lifting the closed lid no inflammatory sign was visible, the pupil somewhat dilated, and quite immovable, and the eye itself was almost completely fixed, no movement being possible, except a slight oscillating movement, in a downward and outward direction.

This would indicate that all the muscles of the eye, except that supplied by the trochlearis nerve—the superior oblique muscles—were paralyzed, and it was very likely that this paralysis should be due to a syphilitic periostitis that affected the periostium of the bones forming the sphenoidal fissure, especially the lower part of it, which is formed by the great wing of the sphenoid bone. This is of course merely hypothetical; but as the fourth nerve, which passes through the upper and inner part of the sphenoidal fissure, was not affected at all, and as also the frontal and lachrymal divisions of the fifth nerve, which pass, together with the fourth nerve, through this part of the sphenoidal fissure, showed no alteration in the sensibility of the parts of their distribution, the cornea, conjunctiva, and the surrounding integument being quite normal in their sensitiveness, I feel authorized to say that this part of the fissure must have remained free from the process affecting the other nerves.

The sight of the right eye had greatly deteriorated, the accommodation being completely paralyzed. On lifting up the upper lid, she could count fingers in six feet. The other eye was emmetropic and her vision in it—20-xx.

The headache at this time was not quite so severe as it had been for several months; she had not been obliged to take to her bed on account of it for some time, and it appeared in greater intervals. A very offensive ozæna was also noticed.

Having made the diagnosis, an antisyphilitic treatment was at once commenced. At first she took 6 grains of iodide of potassium combined with the tinct. of gentian comp., three times a day, and had a pretty strong faradic current applied; the positive pole to the back part of the neck, and sometimes anterior to the ear, and the negative pole over the closed eyelids, When she was seen again, which was on the second day after the application of the electricity, and after she had taken six doses of iodide of potassium of six grains each, the eye began to show already very slight movements, and it appeared that especially the rectus internus exerted some influence on the movements of the eyeball. The ptosis, however, was as complete as ever. The dose of the iodide of potassium was now increased to 10 grains, to be taken three times a day, combined

with 1-32 grain of the bi-chloride of hydrargyrum. After the lapse of two weeks she improved under the combined treatment of anti-syphilitic remedies and electricity, which had been applied every other day, but the ptosis remained. For a week or two following she neglected to have the electricity applied, and although she had taken her medicine regularly, she had during this time hardly made any progress. By this time, however, a marked action of all the muscles of the eye could be noticed, with the exception of that of the levator palpebræ superioris and the rectus externus, which appeared still completely paralyzed. Her vision had also greatly improved. She was urged to have the electricity applied more regularly, at least twice a week, and to continue with the iodide of potassium 10 grains, three times a day, but without the hydrargyrum. Four weeks later the eye was moved very freely, except toward the outside, but even here slight attempts of the rectus externus to act again could be noticed. The ptosis was still nearly complete, but on lifting up the lid with the finger she was able to keep it elevated a little, but it soon would close the eye again completely.

The use of the iodide of potassium was now discontinued, as patient objected to take it any longer, but the electricity was applied twice, and sometimes three times a week, and the excursions of the globe seemed to improve from day to day. During all this time she suffered but very little headache, and her general condition had very much improved. She complained only about the annoyance of not being able to open her eye.

Dr. Van Bibber's (Baltimore) plan was tried now. The upper lid was lifted up by means of little straps of India rubber which were fastened near the edge of the lid by means of collodion, and the other end to the forehead, so as to produce enough traction upon the lid, that if the eye was opened it would remain nearly so, but it could be closed by her own efforts. The straps were renewed every other day. After this treatment had lasted for nearly two weeks, a decided change had taken place. Her acuity of vision had become almost normal. She could read Jæger II. in seven inches, and her vision was = 20-xxx, and all the muscles supplied by the motor oculi were acting again, the

slight degree of exophthalmus that had been noticed had completely disappeared, and all that remained was a slight weakness of the levator palpebræ and of the rectus externus. No other treatment was resorted to now, except the use of the electricity, and after six or eight applications, the action of the two last named muscles had so much improved, that it was hardly possible to discover any traces of the previous paralysis. At the present date she is doing very well; the headache did not make its appearance again, and only a very slight degree of ptosis is apparent.

In glancing over the case, I would like once more to call attention to the fact, that her improvement was steadily progressing with the exception of the two weeks during which time she did not present herself to have the electricity applied, although she continued to take her medicine all the time, and that as soon as the electricity was applied again her improvement was very marked.

About the same time another case of paralysis, but only of the two recti externi, presented itself at the class of Dr. R. H. Derby, to whom I am greatly indebted for these cases. Patient, a farmer, 32 years of age, a healthy and robust-looking man, denies all specific history, but ascribes the attack to exposure. Before he noticed anything unusual about his eyes, he had a very severe attack of headache, and found soon after that the mobility of his eyes as well as his sight was impaired. He consulted several physicians, but without obtaining relief. He came to the city to place himself under treatment. His vision was on the right eye, 20-lxx and on the left eye 20-c. He had the galvanic current applied to the back of the neck and to both temples alternately, and took 10 grs. of iodide of potassium three times a day. He improved but very slowly; the left rectus externus remained in statu quo, but the right rectus externus reassumed its functions several weeks after this combined treatment of electricity and iodide of potassium. His vision came soon up to 20-xl on right eye and 20-l on left eye. Patient had to resume work, and discontinued treatment. I will only add that in this case a decided improvement of the rectus externus of the right eye was noticed a few days after the commencement of the treatment. Another case, a robust farmer,

52 years of age, whose nervous system had been very low on account of severe misfortunes, had been exposed last winter a great deal, and had frequently wet feet; had a severe headache and noticed on the following day an abducens paralysis of the left eye, which interfered with his occupation so much that he came to the city to have it attended to. This case was a comparatively fresh one, only three weeks old, and after the application of the galvanic current and the use of 6 grs. of iodide of potassium three times a day, he showed such marked improvements that we were able to give him a good prognosis. In fact, I think, if a change takes place so soon after the application of electricity and the exhibition of iodide of potassium, we may safely expect to relieve the paralysis to a great extent. The patient, who has been married for 30 years, denies all specific troubles. He continued to improve steadily. I hope in the next number of this journal to be able to add to the list several cases that are under observation and treatment at present.

VII.—*Gleanings from Prof. Benedict's Clinical Lectures on Neuropathology and Electro therapeutics during the winter session*, 1873–'74. By I. I. Friedrich, M. D., New York City.

As I believe that we are yet very far from having a physiological basis for electric treatment—even in the most important questions of localization of the current and galvanization of the sympathetic, etc., being vague and unsettled, I am convinced that the only guide for practitioners can be cautious and unprejudiced clinical observation—the more so, as they can expect very little aid from the hands of physiologists, since many of them, instead of attempting to solve therapeutical difficulties, only ridicule the efforts of practitioners to explain the effects of the electric current. Physiologists seem to claim electricity as belonging entirely to their domain.

While I attended the clinical lectures of Prof. Benedict, I took careful notes on all cases, and followed up their history; in this manner I was best enabled to find out in what class of disease electricity had a positive and reliable result. In this

paper I shall refer only to those diseases where the use of electricity was still in dispute; nobody being now-a-days in doubt of the beneficial results of our agent in all forms of paralysis, whether central or peripheric, idiopathic or consecutive.

At the same time I wish to state that Prof. Benedict is far from relying entirely on electricity as the only remedial agent for nervous diseases; it is a great improvement of the second edition of his treatise on nervous diseases, that an appropriate chapter is devoted to hydrotherapeutics, gymnastics, diet, etc. If the professor has more success than other specialists, it may be chiefly attributed to his experienced and careful clinical examination of cases, to his great ability of finding out the marking points of the history of the case and to his unrelenting zeal and hard study.

In his clinic he uses Siemens & Halske's constant cabinet battery, consisting of sixty elements, with all the auxiliary apparatuses furnished by that firm; a galvanometer being interposed within the current.

TINNITUS AURIUM.

This disorder is best cured by the galvanization of the great sympathetic in the neck, and the so-called external application of the galvanic current, *i. e.*, one electrode is applied to the ear, the other on a wet compress, put around the forearm of the corresponding side. Frequent inversions of the direction of the current are useful.

As Dr. Rumbold, of St. Louis, has already indorsed the aid of electricity in this affection, in the first number of these ARCHIVES, I shall only refer to one case where the above menioned treatment was of excellent result.

M. Dr. med. of Russia, æt. 29; married, admitted on January 27, 1874.

History.—Was deaf mute up to his eighth year, when he began to stammer, which he is still doing in a slight degree. Four years ago he was suddenly attacked at night time with violent tinnitus in the left ear, that has continued since with varying intensity. Patient is nervous and easily excited.

Stat. præs.—Otoscopic examination by Prof. Politzer.
Right ear.—Perfor. memb. tymp., and otorrhœa.
Left ear.—Normal.
Electro-otiatric examination (external application of electrodes.)

Right ear.—13 el. 5°	(dev. of galv. needle)		Ca	Cl. s. *
	"	"	An.	Dt s.
	"	"	Ca.	Op. s.
	"	"	An.	Cl. s.
	"	"	An.	Op. s.
Left ear.—12 el. 3°	(dev. of galv. needle)		Ca.	Cl. s.
	"	"	An.	Cl. s.
	"	"	An.	Op. s.
13 el. 3°	"	"		Same.

Patient being daily galvanized, the tinnitus was after three days already diminished, but still continuous; 13 el. were used, and the sitting lasted two minutes. After two weeks treatment the tinnitus had nearly disappeared when patient left.

CHOREA MINOR.

Electric treatment of this disease has been so successful in Prof. Benedict's clinic that hardly any notes are taken of patients' suffering from this disorder, a speedy cure being the general rule. The treatment consists in galvanization along the spinal column, and the application of spinal muscle or muscle currents to the affected voluntary muscle; it requires from fourteen to twenty sittings to complete a cure.

The electric examination with spinal muscle currents reveals ca. op. contraction; in the case of a girl, æt. 11, whioh ad the third relapse, it took 40 elements to obtain the pathological reaction; 25 to 30 elements having only given ca. cl. c.; an. op. c.; an. cl. c. The girl was cured after 14 sittings.

Short packings, and cold ablutions are also useful; symptomatic disorders have to be attended to. Prof. Benedict always advises his patients to practice handwriting in order to steady the hand; the writing giving at the same time an indication of the im-

* Of the above observations Ca. means cathode; An., anode; Cl., closing; Dt., duration; Op., opening; s., sound.

provement. During my stay in Vienna, over a dozen cases of chorea minor were treated as above mentioned, and all cured.

It may be interesting to know the methods of treatment of some other German neurologists. Professor Hitzig relies chiefly on iron and Fowler's solution. In Prof. Westphal's clinic at the Charité, Berlin, galvanization through the head is principally practiced, and good results are claimed. In France, strychnia is the favorite remedy.

With regard to acute chorea in adults, I want to mention one clinical fact, observed by Prof. Benedict, namely, the danger of administering hydrate of chloral; in this affection the professor knowing of two cases, one occurring in private practice, where chloral had been given contrary to his warning, and one in the wards of Prof. Bamberger; in both instances death was the result of that drug.

How uncertain the prognosis of acute chorea sometimes is, I had a very striking opportunity to observe in the wards of Prof. Bamberger; a young woman having been brought in suffering of acute chorea, in such a degree that the bed where she was lying had to be guarded by such contrivances as would prevent her from falling out of it. The prognosis was thought grave, a cerebral affection being suspected. After a fortnight the patient could be discharged, a spontaneous cure having taken place.

Cephalalgia.—Three cases were admitted, and all cured.

No. 1. Female, æt. 40.—Admitted, January 9, 1874; was treated by faradization through the head.

No. 2. Female, æt. 11.—Admitted January 26, 1874; patient had typhus fever in September of 1872. The recovery was very slow, and left great weakness, profuse sweats, and cephalalgia behind. There was slight paresis n. fac. s.

Treatment.—Ferr. c. quinia; galvanization of the sympathetic in the neck.

No. 3. Female, æt. 45.—Treatment consisted in faradization through the head, of the sympathetic in the neck, and the use of the electric hand.

Tic Douloureux.—Four cases were admitted, all of several years standing; the treatment consisted in every case in galvanization of the sympathetic and of the brain, through the process. mas-

toidei. Strong currents have to be obviated, a deviation of 8° in galvanometer being the maximum. The galvanic treatment alone requires a very long time, as many as five months having been required for the cure of one case. Relapses in the beginning of the treatment are frequent, but the pain is always alleviated; patients have to continue treatment long after the regular attacks have left them.

The application of leeches is sometimes of benefit; even ligature of the carotid of the corresponding side may be resorted to in very obstinate cases, when the carotid pulse does not become small during an attack.

Rheumatic Stenocardia.—Two cases admitted, and cured. Besides galvanization of the sympathetic in the neck and application of the galvanic current along the spine, Prof. Benedict finds the use of the faradic brush over the præcordial region beneficial. Cases of evident organic disease of the heart he refuses to treat.

Visceral Neuralgia.—Two cases admitted and cured.

Treatment consists in direct faradization of the abdominal muscles after Frommhold's method, in galvanization of the affected nerves, by placing one electrode upon the sternum, the other on the point of exit of the peripheral nerve branches. At the same time the use of opiates is indicated, either in the form hypodermic injections or suppositories.

On account of its interest, I shall give the full detail of one case.

L. B.; male, æt. 14; admitted February 3d, 1874.

History.—Is sick since July 19, 1873, when he had an attack of great pain in the chest, with dyspnœa, that left him unconscious for a few minutes. A short time after he suffered from cramps in the abdomen, that lasted at first about five minutes, and appeared three times a day, one day as often as fifteen times. At present the cramps take an intermittent form, appearing every other day, from 7 to 8 o'clock in the morning. During the cramps the feet are drawn upward, while the trunk of the body is forcibly bent forward. Patient suffered from worms four years ago.

Stat. præs.—Pressure on the abdomen is painful, but much

less so after repeating the same; the stools are painless and regular. Position on the right side causes pain in the left and *vice versa*. No worms are discharged at present.

Treatment.—Direct faradization of the abdominal muscles, suppositories of opium used at night time, and at 6 o'clock in the morning.

Patient had no more than one single attack; he remained four weeks under observation without having a relapse.

Slight erosions of the mucous membrane of the intestines are liable to cause visceral neurosis.

LOCOMOTOR ATAXIA AND FARADIC ANÆSTHESIA.

Tabetic patients are represented on rather a large scale in Prof. Benedict's clinic, every day from four to six being present; some old patients of his coming for months and years regularly in good and bad weather, a proof that the patients do well under electrical treatment. Even patients far advanced in the disease feel greatly benefited. Whenever they have to stay away for a longer interval, on account of the severity of the weather, or some illness, their gait is a great deal more staggering. There is scarcely any disease that proves as well as locomotor ataxia the power of electric treatment. In this disorder the galvanic current proves to be the greatest means of relief.

The treatment is yet the same as the one described in the first edition of Prof. Benedict's treatise on nervous diseases, i. e., galvanization along the spine, and the use of the spinal nerve and spinal muscle currents, with the only difference that the professor believes now local faradization to be often the only means of relieving the pain in the extremities of tabetic patients.

The use of the faradic current as a local anæsthetic was also plainly shown in the following case, admitted Dec. 16, 1873.

Male, complaining of difficulty in deglutition; slight disorder of speech; a viscid mucus gathers in the back part of his throat, which he expectorates with difficulty. Patient had suffered a long time from chronic diarrhœa, and had from time to time attacks of vertigo. On account of exophthalmus of the right eye, struma and palpitation of the heart had been diagnosticated.

BASEDOW'S DISEASE.

The laryngoscopic examination by Dr. Störk revealed fissure and spasm of the musculus transversus. Patient, after having been treated by several laryngoscopists of Vienna, who used local applications and inhalations, but without relieving him, suffered such a degree of hyperæsthesia of the mucous membrane of the pharynx and larynx, that the laryngoscopical examination became very difficult and at last impossible; any attempt to introduce the laryngoscope produced an effort of vomiting. Prof. Benedict applied now the faradic current to the pharynx, one electrode being placed outside the neck; with the other the different parts of the mucous membrane were touched, a weak current being first used, gradually increased until patient bore quite a strong current. Now the laryngoscope, the metallic stem of which had been attached by a wire to the induction coil, was introduced and slowly advanced, when a laryngoscopical inspection could easily be made. The local faradization of the pharynx being continued, patient improved daily; the difficulty in swallowing disappeared almost entirely, when patient left Vienna.

VIII.—*Muscular Reactions in Paralysis—Classification, Diagnosis, Prognosis.* By Dr. A. Tripier, of Paris.

It is not long since that the word paralyses was used only to denote a loss of mobility, without it being suspected that the production of this symptom could account for various lesions.

However, since then, the researches of the physiologist having furnished exact notions about the conditions of movements, we are no longer led to consider any loss of this power as a phenomenon always identically the same. But these researches do not always furnish the explanations, which at first we were induced to draw from them. The procedure of experimental analysis of the nervous phenomena mentally employed, and which

heretofore has been accompanied with the best results, consists indeed in the exploration of the changes produced by the destruction of those organs, that produced their accomplishment ; but these isolated destructions present very frequently difficulties that could not be overcome by experiments, difficulties which depend on the juxtaposition, and even confusion of the elements on which the scalpel of the operator must be brought to bear.

It has been settled, however, that the muscles are the immediate organs of motion, and the solicitation of their contraction is transmitted through a special kind of nerves, which it has been possible to observe isolated in the mixed fasciculus, by suppressing their intervention by means of a section of the anterior spinal roots or by means of intoxication by curare. The isolation of the motor nerves should include that of the sensitive nerves. We had, therefore, between the impressionable and the reacting periphery, between the cutaneous or mucous surface and the muscles, a functional series, the organs of which might have been studied separately and their mode of action determined. But between these two extreme points of the chain, between the sensitive and the motor nerves, there is a central substance, the cerebro-spinal centres, and the part which they play can be well appreciated in a general way; but the determination of their diverse aptitudes could scarcely rest except on rational deductions, always more or less conjectural.

When Marshall Hall brought to bear on the solution of the question of locating the nerve centres, contributions, which have too long been lost sight of by most authors, who have occupied themselves with the object since him, and especially by the practitioners, who ought to have taken advantage of these physiological teachings.

It being unnecessary here to consider the complications connected with most of the phenomena of such observations and experiments due to the intervention of the apparatus of the nerve ganglions, I shall confine myself to examining only those that might have something to do with the transmission to the cerebro-spinal apparatus, and which would influence and deter-

mine the clinical character—the role and importance of which it seems has been generally but insufficiently appreciated.*

I.

It is from the observation of the reflex movements that Marshall Hall set out in order to arrive at anatomic inductions, the discussion of which would perhaps be rich in instruction.

He concluded, from his observations, that transmissions of two classes take place from the surface acted upon to the muscles. The one, conscious or not, resulting in involuntary or unconscious movement; the other clearly conscious, leading to the voluntary movements. Marshall Hall admits that each of this kind of communication has its distinct organs, and he gives the names of spinal or diastaltic circle to the channel of reflex transmissions, and cerebral circle to the way for conscious and voluntary transmission.

Is the road of communication from the skin or mucous membrane to the muscles, double in the whole of its course or only part of the latter? The English physiologists seemed to admit that it was double throughout, when they made a distinction between the sensitive and the incidental, or *bisodic* nerves of the diastaltic system. But this is a very complicated theory, that is not at all necessary to explain these phenomena. It suffices indeed, that the organs retransmit doubly, whenever their function requires it. The same nerve fibre will do to conduct to the centres all impressions that emanate from the periphery, whether this impression should be perceived or be reflected independ ently of all perception. In the same manner, the same motor filament can transmit the excitation to the muscles, whether this be voluntary or simply conscious, or be it purely reflective.

It is under the reserve of this amendment that I present in my lectures the theory of Marshall Hall.

The first impression that is carried to the centres, cerebral as well as intra-spinal, by the sensitive nerve, finds in this centre two ways to pursue : the one transmits it directly to the origin

* Notes on the spinal system or of the series of reflex actions. Paris 1855.

of the motor nerve; this is the spinal or diastaltic way. The other sends it to the same origin of the motor nerve, *conscious ;* and, transformed by voluntary phenomena, this is the cerebral way.

I need not stop here to enter into the details of experiments, which are already almost classic, and which establish the correctness of this physiological topography: but it is important to dwell on some of the consequences resulting therefrom.

The first point is, that as the reflex transmission, being as active for the impressions affecting the cranial as the spinal nerves, a portion of the spinal centre must be intra-cranial.

On the other hand, the sensitive nerve terminating shortly after its entrance into the spinal marrow, a portion of the cerebral centre must be inter-spinal.

This consequence of his general views seems to have escaped Marshall Hall, who, dividing the cerebro-spinal nervous system into cerebral and spinal sub-systems, introduces into his cerebral system both the brain and the cerebellum. There is here an incongruity, to which must be attributed the misunderstanding which makes physicians reject ideas which disturb their habits of mind, and for the perception of which it leaves a rectification to be made.

Giving the name of *cerebral paralysis* to every form of paralysis *which withdraws the muscle from the influence of the cerebral circle*, and that of *spinal paralysis* to every form of paralysis in which the muscles are withdrawn from the influence of the spinal circle, Marshall Hall has aroused, on every side, contradictions. Even at the present day his conclusions are almost universally rejected, because we are accustomed to regard the terms *cerebral* and *encephalic*, *spinal* and *intra-spinal* as synonymns, and because he had neglected to show that the paralysis, which he regarded as cerebral, might very probably be the consequence of an intra-spinal lesion, whereas a spinal paralysis might be due to an encephalic lesion.

Among the distinctive characteristics of the various forms of paralysis, there is one which gives immediately the class, cerebral or spinal, to which they belong: this is the muscular con-

traction, ascertained by means of the electric currents obtained from the inductive apparatus.

Admitting the infallibility of this reactive agent of the contractibility, Marshall Hall had formed the following law : *Contractibility is lost in spinal paralysis, and preserved in cerebral paralysis.*

This formula is, however, incomplete ; and I shall have to present, a résumé of the researches which have induced me to modify it. But the modifications which I have thought it my duty to make in it are nothing but amendments, and such as it stands, the formula has been the means of our making a vast stride in the clinical study of the various forms of paralysis. It enables us very frequently to fix its nature ; it will lead us to determine approximately its location ; and the devolopments to be introduced into this law do not at all modify the general conclusions which have been drawn from a diagnostic point of view.

The separation of the cerebral and spinal elements, which is generally so difficult or almost impossible for the anatomist, is almost constantly effected in a very clear manner by the causes producing the paralysis ; and their classification has already been effected according to the consideration of these causes.

In this manner the persistence of the muscular properties has caused to be included under the head of CEREBRAL paralysis, all forms of paralysis from *tumors*, *hæmorrhage*, or *softening of the brain*, (Marshall Hall,) the *general paralysis of the insane* (Duchenne and Brierre de Boismont,) several rare forms of *general paralysis without insanity*, still badly defined clinically, paralysis of the limbs in alternating paralysis, (Duchenne,) the *glosso-labio-pharyngeal paralysis*, (Duchenne,) certain forms of paralysis produced by *compression of the spinal cord*, *diphtheritic* paralysis ; (Duchenne,) finally, all forms of *syphilitic* paralysis, which I have had occasion to observe, were forms of cerebral paralysis.

Among the forms of spinal paralysis recognizable by the loss of muscular contractility, we must include certain form of *progressive paralysis without insanity*, cases of paralysis by traumatism of the spinal cord or of the mixed nerves, (Marshall Hall,) the fatty atrophic paralysis of childhood, (Duchenne,) certain vari-

eties of *spinal paralysis* which are to be seen in the adult, and which we are inclined to connect with the preceding form, the paralysis *following on the poisoning by the oxide of carbon*, (A. Tripier), the *facial rheumatic hemiplegia* of *alternating paralysis*, (Ducheme,) the paralysis following on *prolonged and eruptive* fevers. (Duchenne.)

Lastly, contradictory reactions have been announced as having been obtained in cases of *rheumatic* and *hysterical* paralysis. That probably is due to the fact that different forms of paralysis have been studied under the same name. The muscular interrogations by the inductive currents will have the merit, in this case, of showing the insufficiency of descriptive study, or etiological conjectures.

To connect the given facts, furnished by muscular explorations with clinical characters, will help us to localize the lesions from which the paraylsis proceeds. This lesion, being exterior to the nerve centres, will affect the motor, or mixed, or the sensitive nerves. In the first case we will have the reactions of spinal paralysis, in the second that of the cerebral variety. As for the cause of the paralysis, primarily muscular, I have shown* that there do not exist any instances outside of certain cases of experimental intoxication, which produce, in the first instance, death by stoppage of the action of the heart, and therefore do not present any clinical interest.

It is especially clinical investigations that have led to the localization of central lesions. The interrogation of muscular reactions can, nevertheless, contribute to it.

The plan given above leads to connect with the cerebral arc the posterior spinal columns. The muscular contractibility remains indeed intact, in those forms of paralysis accompanying locomotor ataxia.

In the brain, the white substance belongs also truly to the cerebral arc. But does it belong entirely to it? This is the point to be decided hereafter, with the part played by the antero-lateral columns of the spinal cord. In regard to the ante-

* Annales de l'électrothérapie, April, 1873.

rior columns, it appears to me that these also ought to be considered as forming a part of the cerebral arc.

The question about the role of the gray substance becomes indeed more difficult to solve. It comprises evidently the diastaltic arc. But does it remain a stranger to the functions of the cerebral arc? This is a question that seems impossible to be solved until we shall have been able to observe the effects of the destruction of the gray substance, not compromising the integ-. rity of the initial cells of the motor fibres, which are situated in the anterior horn of the gray substance.

Anatomical observations have so far failed to solve the question whether, between the terminal cells of the sensitive fibres and the original cells of the motor fibres, the diastaltic channel is solely constituted by a continuity of figurative elements, or whether the communication is not realized by elements simply contiguous, or even distributed in an amorphous medium, that has the faculty of physiological conductibility.

These two hypotheses are at present permitted. If indeed we have seen, in transverse sections of the cord, something like fibres, establishing a direct communication between the cells of the posterior horns and those of the anterior horns, and the generalization by means of the gray substance of impressions received by a posterior cell, it makes the second theory appear quite plausible. It is not likely, indeed, that each cell of the posterior horns is in communication with ALL the cells of the anterior horns by a direct fibre, which would have to be the case if this communication was necessary.

Or is, perhaps, the gray substance a general conductor, transmitting evenly the impression to the motor cells of the spine, and to the motor centres, or to the cerebral co-ordinators?

The results of Ferrier, and those contradictory, of Carville and Duret, could perhaps, although they aim at another object, contribute to the beginning of the solution of the question that occupies our attention now.

It has to be admitted, from the observation of movements, that motor centres exist which preside over the association of co-ordinated movements.

Ferrier has localized them in the gray cortical substance of

the convolutions of the brain.* In order to establish these localizations, he had recourse to faradization, but the exactness of these conclusions has been contested on account of the unavoidable dispersion of the current, which he employed as irritating agent.

In the counter experiments made by Carville and Duret, in which they tried to avoid this cause of error, they arrived at the conclusion that the motor centres of Ferrier ought to be found not in the gray substance, but in the white matter underlying the gray substance of the convolutions on which Ferrier experimented. This opinion is at first sight the most likely, and the study of the experimental results is equally in its favor.

There exist, consequently, in the brain, centres of associated movements, presiding over the functions of the extremities, and everything seems to confirm that these cerebral centres (for they are not the centres of reflex action) are in the white substance.

But after peeling off of the encephalic mass, or after section of the cord in the cervical or dorsal region, we can observe, in the extremities separated from the brain, reflex movements, presenting a certain degree of co-ordination. It exists, therefore, perhaps independently of the cerebral motor centres, also spinal motor centres? It is extremely probable. And in this case where shall we seek for these latter? In the anterior columns of the spinal marrow? This is not very probable. In the antero-lateral columns? or in the gray intra-medullary substance? This is the more likely hypothesis; but experimental verification has to be made.

However, in destroying the cortical layers of Ferrier, might not Carville and Duret have destroyed distaltic centres of facial movements? They have not paid any attention to this point, seeking something else. Their experience, nevertheless, would be well calculated to elucidate this matter.

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* [These experiments were first made by Fritsch & Hitzig of Berlin, mild galvanic currents being used.—E. D]

II.

Let us return to the results of Marshall Hall.

The study of the reaction which he employs will allow us to appreciate certain shades of difference, which it was impossible to take into account just at first, and will lead us to complete a formula from which it will be possible to deduce more extended and more accurate conclusions.

The inductive currents, the only ones employed at first in diagnostic researches, present different effects according as we desire them, either from different kinds of apparatus, or from different circuits of the same apparatus. Duchenne, who was the first to call attention to this fact, had shown that the muscular contractions were, as a general thing, better excited by the extra-currents of the ordinary apparatus, while the reactions of sensibility were more lively under the influence of the excitations by the currents of the induced coil. Hence the very different indications which he has formularized with reference to the use of the currents, which he formerly incorrectly termed induced currents of first and second class, indications being clear, and which are perfectly justified in practice.

Let us note, *en passant*, that side by side with these experiments on the healthy subject, Duchenne made numerous observations on cases of paralytic patients. We shall presently see that these parallel observations were of a nature calculated to render more evident the phenomena, to the study of which the imperfection of the apparatus caused certain difficulties.

It is in order to arrive at the interpretation of the facts noted by Duchenne—muscular reactions more strongly marked under the influence of the extra-currents, reactions of the sensibility more lively under the influence of the induced currents—that I had my first volta-faradic apparatus constructed with a movable coil.* I showed that the difference between the action attributed to the extra currents, and to the induced currents was due not to the fact that the direction of the former was *constant*, while that of the latter was alternately reversed, but to the fact that the two

* Comptes rendus de l'Académie des Sciences, 1860.

circuits furnished in a double point of view different currents, both as regards quantity and tension. And I thought myself justified in concluding that the muscular contractibility, when interrogated by means of inductive apparatus, was aroused more by the *quantity of the currents* than by their *tension*, whereas the *nervous reactions*, *motor* as well as *sensitive*, were more *easily produced* by tension than by intensity.* A consequence of these indications, of which the importance will be seen presently, is that if instead of having recourse to faradization in making explorations of the contractibility we make use of interrupted galvanization, employing currents of less tension but greater quantity, we will better provoke muscular reactions, and less successfully nervous ones.

III.

Repeated experiments, and comparative trials of various apparatuses, are necessary when we are operating on the healthy human subject, to clearly demonstrate the preceding proposition. The nervous influence, in fact, being the most efficacious exciting agent of muscular contractibility, it is difficult in the localized faradization in the healthy subject, to distinguish accurately between the share of the quantity acting more directly on the muscles, and that of the tension acting on them specially through the intervention of the motor nerves. But the pathological condition modifying the normal relations of nerve and muscle will present an opportunity for experimental verifications which will be perfectly satisfactory.

Let us examine in the first instance what takes place in cases of spinal paralysis.

According to Marshall Hall, whose law is sufficiently exact to allow of our establishing a diagnostic summary, the characteristic feature of these cases of paralysis is the loss of contractibility, which is absolute when the paralysis is complete and has

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* In French the two terms, intensity and quantity, are synonyms; but in English the word intensity is employed where the French use the word tension. Should the usual terminology be the same in America as it is in England, I have to request the reader to make the corrections indicated in this note.

reached its culminating point ; not absolute when the paralysis is incomplete or in progress of reparation. When this loss of contractibility is absolute, the muscle is refractory to every kind of excitation ; when it is incomplete, it happens according to the progress of the affection and the stage of the disease, that muscular reactions are being unequally produced by the effects of tension and by the effects of quantity of the interrupted currents, whether these latter be supplied directly by the cells, or be drawn from apparatuses of induction.

IV.

There is no reason for supposing, in cases of spinal paralysis, the existence of an initial period in which the muscular affection would outstrip, in the rapidity of its pathological process, the march of the nervous lesion, and in which the contractibility would be better aroused by the currents of tension than by those of quantity. The progressive muscular atrophy presents an example of this class in its alterations ; but if the disturbance which it produces in the accomplishment of the movements would be sufficient to have it included among the forms of paralysis, it is in the class of cerebral paralysis that we would have to place it.

What has been seen is this, that muscles which reacted but slightly under the influence of apparatuses of induction of the usual kind, reacted better, or even very well under the influence of currents drawn directly from the cells ; in fact, that muscles absolutely refractory to the same currents of induction might sometimes contract very well when acted on by voltaic currents.

Let us recall here, to avoid any misunderstanding, that these contractions by currents of quantity that are generally derived from voltaic batteries, are also obtainable from apparatuses of induction when these last are mounted so as to produce them. In a case of lead paralysis, when the muscles in responding to the voltaic interrupted excitations remained inert to the action of an ordinary voltaic-faradic apparatus, presented contractions under the influence of a magneto-faradic apparatus of Gaiffe magnetized with a very thick wire.

The pathological genesis, and the kindred mechanism of the lead paralysis, are not sufficiently understood for us to take it as an example in the theoretic discussion that these facts invite.

It is the traumatic paralysis of the mixed nerves which we must take as our starting-point, since it has been studied experimentally.

A mixed nerve is cut. Its peripheric extremity will atrophy; then will unite by its sheath to the central end; presently will heal on the side of the muscle. There will be during the atrophy of the peripheric end of *the nerve* an atrophied alteration, of which the nature and progress have not been sufficiently investigated; then nutritive restoration; after a time, return of the contractibility; finally, reëstablishment of the physiological relations with the nerve.

These anatomo-physiological conditions, which are to-day well understood, if not studied in all their details, correspond from the clinical point of view as well as from the standpoint of reactions furnished by the application of excitants with four distinct periods.

The first stage corresponds with the progressive atrophy of the peripheric extremity of the nerve. During this period, the contractibility when interrogated by the currents of tension gives a rapid loss of power. A comparison with the effects of the currents of quantity has yet to be made; we may presume, however, that the inducted currents, which are more efficacious in the first instance in producing contractions, will rapidly lose their superiority, and that the currents of quantity will assume for some time the upper hand; but the progress of the muscular alteration, consequent on nervous traumatism, has been less fully investigated than the nervous degeneration, and being ignorant as to its rapidity, which as yet we have only reason to regard as being variable, we must wait before promising an opinion as to its effects until the subject has been more thoroughly studied.

The second stage will soon be reached in which we will not obtain contractions, whether by currents of quantity or tension.

After this second stage, the longest, the stage of anatomical restoration, will ensue, during which the contractibility will dis-

play itself more and more easily excitable to the currents of quantity without the currents of tension making any appreciable gain.

Lastly will come the fourth stage, the phase of physiological restoration, during which the currents of quantity will lose their superiority, whereas the currents of tension will become more and more efficacious in producing contractions.

Clinical observation has but rarely been directed to the progress of the first stage: the weakening of the reactions indicated by the currents of tension has alone been shown. These observations will have to be resumed while making a parallel study of the influence of the currents of quantity. The absence of reactions during the second stage has been sufficiently shown by numerous observations. As to the reactions during the two last stages, I have observed them together in the same subject, who, struck on the edge of the iliac crest by a bullet which had deviated backward and must then have slipped downward, presents an incomplete paralysis of the lower left limb, the paralysis affecting the extensors and abductors almost exclusively. The affection, which dated some three years back, was in course of reparation; but all the movements did not return equally quick. The group of the *perinei* muscles, after having presented reactions of the third period more excitable to the currents of twenty-four *pairs of cells* than to that of the coil of thick wire of my inductive apparatus, presented, two months later, reactions of the fourth stage, and showed itself much more sensitive to the currents of induction than to those of the cells.

But whereas the group of the *peronei* had reached this point of recovery, the anterior muscles were still only at the stage of anatomical restoration, very strong induced currents were necessary in order to obtain contractions which were sensibly weaker than those obtained by the currents of the pile.

An inverse series of these phenomena should be met with in cases of cerebral paralysis; and I have met them when theoretical indications have led me to seek for them.

During their reparatory stage we see the contractibility, easily aroused at first by the induced currents, grow weak gradually under their stimulation, whereas the interrupted gal-

vanization, without any appreciable effect at first on the muscles, ends by making them contract. In a case of syphilitic hemiplegia of a patient who did not follow his physical or pharmaceutical course of treatment very regularly, I could perceive alternations of electrical reactions which might have sufficed to point out the condition of the patient, with which they coincided in the most accurate manner.

I am of opinion, therefore, that Marshall Hall's law should be modified as follows :

The motor faculties, *muscular* as well as *nervous*, *preserved in cases of cerebral paralysis, are there clearly shown by the currents of tension ; whereas the degree of persistence of the muscular aptitudes in cases of spinal paralysis is chiefly revealed by the application of the currents of quantity.**

Is even this law quite definitive and beyond the reach of amendments? I do not think so. I am of opinion that new considerations will have to be taken into account. As to the terms in which it is stated, I believe I can vouch for their accuracy. But there is one element which it does not include : the duration of the passage of the currents—duration extremely brief for the currents of a volta-faradic apparatus, but very sensible for the voltaic currents.

Is the influence of the duration of the same order as that of the quantity, and does it ally itself to it? Probably so ! and the experiments in which magneto-faradic apparatuses have seemed superior to the volta-faradic in exciting contractions in certain cases cases of spinal paralysis would lead us to think so. This is a point which, however, I hope to clear up by experiments devoted to this special object.

However that may be with regard to this point, which we hold in reserve, the insufficiency of the induced currents in producing certain muscular contractions cannot depend solely on their instantaneous nature ; their want of (deficiency) in quantity would suffice to explain it.

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* Des réactions musculaires dans les paralysies cérébrales et dans les paralysies spinales. (Comptes rendus de l'Acad. de sciences. Octobre, 1871.)

Since the immediate voltaic applications have come into general use, the majority of the German authors have published this opinion from the observation of certain pathological cases, *that in certain forms of paralysis, the muscular contractibility being no longer aroused by the induced currents is effectively executed by currents furnished directly from the pole.*

The examples furnished in support of this proposition, which several authors did not hesitate to generalize, were taken from certain cases of traumatic, lead, and facial rheumatic paralysis. After the details into which I have already entered, when treating of the electro currents regarded as muscular reactive agents, it will be sufficient for me to state the conclusion of the discussion to which I submit the interpretation of the noted facts.

The examples given were all taken from cases of spinal paralysis. All the cases of spinal paralysis ought, when observed at the proper moment, to furnish the same reactions.

The inverse observation, that is to say the inertia of currents of quantity vis à vis of the motor reactions produced by the influence of currents of tension, observations which it would appear have not been made by the authors I discussed, might be made in all cases of cerebral paralysis.

In the preceding pages I have left aside the question of therapeutics ; and I dwell on this voluntary omission in order to banish the conclusions of this class, which have been, and still might be wrongly drawn from considerations which have no interest except in a diagnostic and prognostic point of view.

So far, when treating of the preservation of the contractibility in cases of spinal paralysis, which has been clearly shown by interrupted galvanization, we have spoken of them as of cases of easy demonstration which are more generally observed. But the persistence of the contractibility presents itself sometimes under conditions which lend it a paradoxical appearance. There are certain instances in fact, in which, while a paralyzed part shows itself refractory to the action of the induced current, we see it obey, not only the voltaic excitations, but even *react under the influence of these excitations, more energeticlly than the healthy symmetrical member.*

This exaltation of the physiological functions is not an iso-

lated fact; it showed itself at each moment in the pathological condition, whether as the dominant expression, or whether as a morbid element of lesser importance; and its singularity is due entirely to the contrast with the paralysis, to the fact that this physiological exaltation has precisely for its seat a region of which the apparent functional aptitudes are abolished.

Marshall Hall has already shown the exaltation of the spinal properties, motor and reflex action, in the parts situated below a transverse section of the spinal marrow.

Brown Séquard has frequently repeated *the same experiment with like results*, which we often find ready to our hand under certain pathological conditions of the order of cerebral paralysis. Having inversely shown an augmentation of the cerebral functions, characterized by want of sleep, following a vertebral fracture in the cervical region, and again, as a consequence of some cases of poisoning by sulphate of quinia, I had concluded that the moderating action of the cerebral centre on the spinal centre was reciprocal.* Setting out from this hypothesis, I have advanced a theory of the anomalies of erection, which was published in the thesis of one of my pupils.† A theory which is based on the notion of this reciprocal influence of the cerebral and spinal centres, it affords an explanation of the phenomena of anaphrodisia, of satyriasis, and of priapism, in accordance with the varieties which clinical observation presents. Finally, connecting these phenomena to a law which seems to me to be well established by observations of various kinds, specially by those to which the cases of natural or induced somnambulism have given rise, I have thought myself justified in concluding in a general manner that: *In all cases where an organ is sufficiently healthy to have retained or (recovered) its physical properties, the infirmity of the organs, which in the normal functional conditions have as their role to put in play these properties, creates for it an*

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* Exaltation des phénomènes réflexes dans les paralysies cérébrales. Influence réciproque du centre spinal sur le centre cérébral. Courrier médical, 1870.

† Delouline. De l'Electrothérapie dans les maladies des appareils genital et urinaire. Thèses de Paris, 1872.

autonomy in which its peculiar faculties, appear exaggerated to the observer, who interrogates them with suitable reactive agents.

In a case of cerebral paralysis, the motor nerve is intact ; the system, isolated by the disease, is then constituted by the motor nerve and the muscle. The autonomy commences at the motor nerve, of which the exaggerated functions become manifest both by its more lively reaction when interrogated by currents of tension, which are the best reactive agents, and by *a more powerful influence exercised over the muscle*, which it holds in a closer dependence of its proper functions, withdrawing it, *in an equivalent measure from the action of the excitants which would have exercised over it a special influence* in this case, from the action of the excitants of contractibility, that is to say from the action of the currents of quantity.

In the case of spinal paralysis, the motor nerve is injured, at least in its origin. The autonomic system is reduced to the muscle. The latter, but very slightly sensitive in this case to the action of the reactive agents which used to make it contract by means of the intervention of the motor nerve to the action of the excitants of mobility, that is to say of the currents of tension, becomes much more easily excited by the currents of quantity, which being more special excitants of contractibility, address themselves directly to it.

Consequently, at the very outset of the progressive and the retrograde stages of a case of spinal paralysis, the muscle being still sufficiently healthy or sufficiently restored to react, but independent of a diseased nerve, will react fully, or normally, or even in an exaggerated manner, according to its degree of integrity, under the influence of the currents of quantity. But in proportion as the cure progresses, in proportion as the relations of this muscle with its nerve becomes renewed, it will cease to be affected exclusively by its own proper excitants : the currents of quantity will exercise less and less influence over it, the nerve more and more ; and through the intervention of the nerve, the most efficacious of all artificial excitants of mobility, the currents of high tension.

IX.—*Remarkable Case of Morphia Habit.* By JOHN VAN BIBBER, M. D., Baltimore, Md.*

A GENTLEMAN, age 37, sent for me last spring, to relieve him of constant and persistent vomiting, and, as he expressed it, "an uneasy feeling in his head." Every therapeutic means that could be thought of, failed to affect in the least the distressing condition of his stomach. The following history furnished ample cause for his singular condition. When 31 years of age, shortly after marriage, he suffered from an attack of acute articular rheumatism, and being unable to bear the agony it caused him, he was given morphia sulph., by hypodermic injection. The morphia was then carried to no excess, and he recovered sufficiently to return home. He then commenced to take morphia again, first at night, then in the morning, and afterward during the day. This was in August, 1866, and before Christmas of the same year he had increased his daily dose to 15 grs. hypodermically. This was gradually increased to twenty (20) grs. in 24 hours, and for three years he managed to be satisfied with this allowance. In 1869 he was much alarmed to find that the drug was losing its effect upon him, and in order not to increase the already large amount he was taking, he conceived the unfortunate idea that alcohol might aid its narcotic action. He showed the same tendency to excess in the use of this article, and was soon upon the generous allowance of one pint of whiskey per diem. Contrary to his expectations, he found that he was unable to be contented with his usual dose of the opiate, and was soon obliged to double the daily allowance of morphia. He also increased in his already liberal use of alcohol. He then became irregular in his daily doses, and took at times a quantity of both these drugs, which would seem incredible. His nurse assures me he has taken for 8 or 10 days consecutively, over three pints of the best whiskey, and not less than sixty (60) grs. morphia subcutaneously, with the addition of 8 or 10 strong cigars. He would remain in bed

* The following case has once appeared in print in the form of an appendix to a paper of Dr. Joseph Parrish, on Inebriety.

during this time, and about the 8th or 10th day these excesses would culminate in "*an attack*," or condition similar to that which I have already briefly described.

When he took the morphia, it was noted down in a little book, the time, and quantity; but this habit, which has been adhered to for the past seven years, was often overlooked in these excesses, and his attendant thinks he has sometimes taken as much as *eighty* (80) grs. in 24 hours. But as his interesting memoranda shows a maximum of sixty grs., it would probably be safer to accept this as the highest dose. He makes his own solution of morphia, and has 1 gr. to each syringeful. The writer was present three times when he took his (at that time) regular dose, nine syringes full = 9 grs.

Sometimes in inserting the needle, it would seem to enter a small vein, for soon after emptying the syringe he was seized with a sinking feeling, grew dizzy and faint, and would vomit for some time. This did not occur very frequently, nor did it cause him to reduce the quantity for that day. When I first saw him, he was suffering from "an attack" as he called it, which seemed to be a culmination in the effect of these immense doses of morphia and whiskey. The alcohol was, however, more potent in its effect upon him, as his various symptoms very conclusively showed. His pupil was widely dilated, except for a short time after a dose of morphia, when it would be contracted. He imagined he saw various things and people that were not in the room, was entirely unable to sleep, and his mind was in that restless, suspicious condition, always so marked in alcohol delirium.

The case presented a totally unphysiological patient; and it was difficult to determine the doses of the various narcotics which were tried in order to produce sleep. It may be stated that immense doses of camphoræ mono-bromat, conia, and atropia sulph., were given with no appreciable effect. The only remedy, used with care, was chloroform, which was given quite freely when symptoms of convulsion arose. Chloral hydrate and potassium bromide were not used on account of their bulk, and the irritable condition of the patient's stomach. After six days and nights of entire sleeplessness, unceasing movement and de-

lirium, the following treatment seemed to be successful in producing sleep.

A constant current of 16 zinc and carbon cells was applied for 5 minutes at short intervals to the region of the cervical sympathetic. After three applications an evident change was apparent. The eye lost its peculiar expression, the pupil was less dilated, and the excessive movements were greatly calmed. A strong ointment of British extract of conia was used freely on large blistered surfaces at the base of the neck, and in a half hour he fell into a quiet sleep which lasted 3 hours. He then awoke, and after taking some nourishment slept for 2 hours more.

He had now been 72 hours without morphia, but during this time he had been unconscious. As long as he could speak, he called for it, and was much excited by contradiction. Fearing his excitement would bring on convulsions, he was allowed to have it, though in much smaller and decreasing doses. Having slept 5 hours with but one interruption, he awoke conscious, but with no remembrance whatever of time or events. He thought he had been back to Paris, &c., &c. He soon demanded a dose of morphia, and became very much excited when it was refused.

It was advised that now, if ever, was the time to stop entirely this dreadful habit which had so enslaved him. He gradually worked himself into a state of wild excitement, and threatened to kill himself. As his family were unwilling that he should be removed to an institution, and as it was thought to be impossible to restrain him in his own house, he was allowed enough to pacify him.

He gradually got better and stronger, taking no alcohol, and about 20 grains of morphia per diem. When he had improved much physically, he was induced by moral treatment to decrease the morphia, and by a gradual reduction he has reduced it to 6 grains per day.

He considers his condition as better than it has been for seven years, but cannot believe it possible that he can live without morphia. The patient is highly educated, and a man of quite extraordinary literary ability. He is delicate and feminine in appearance, and does not, in the color of his skin, or the nutrition of his body, present the slightest evidence of opium cachexia.

A very interesting question is, what became of all the morphia that was taken into his system?

The mode of administration in this case insured its very intimate and thorough mingling with the circulation. If any of it was passed off by the rectum or kidneys, it would be only after passing more or less completely through the whole system. Did it go to form tissue, and if not, under what form was it passed from the body? Could it be that his skin, hardened and changed by frequent process of cicatrization, failed to absorb the salt, and some of it at least was thrown out, as a product of inflammation in the various abcesses with which he was at times troubled? The morphia was gradually becoming more and more tardy in its action, and only when the needle was accidentally inserted into a small vein, and he had the sinking sensation already alluded to, was it at all speedy in its effect. Fully a half hour generally elapsed before he would feel, as he says, "the pleasant effect of the morphia."

IX.—*Case of Excessive Hemorrhages from Fungoid Degeneration of Mucous Membrane of the Uterus.—Complete Recovery under Local and General Faradization.* By A. D. Rockwell, M.D., Electro-Therapeutist of the Woman's Hospital of the State of New York.

The following case is of interest, on account both of the persistency and severity of its symptoms and its uninterrupted progress towards complete recovery under the treatment adopted.

Powerfully illustrative as it would seem of the efficiency of the electrical treatment in certain hemorrhages, it would not commend itself so favorably, to my own mind at least, if isolated and unsupported by more extended clinical observation, and without the rationale of the effects of the method was susceptible of explanation. Not only uterine, but other forms of hemorrhages, and especially from the rectum—have I, in quite a number of instances, seen modified and checked by this form of treatment.

The causes of menorrhagia are so diverse that it is manifestly impossible to intelligently prognosticate its behavior under any method of treatment without some knowledgs of the origin.

Now it is well recognized that, whenever we have a case of this kind, it either depends on some cause seated in the constitution generally, or some local sexual disorder. An excessive flow at the menstrual period may be associated with granular degeneration of the kidneys. We find in this condition an altered state of the blood; it becomes attenuated and readily escapes from engorged vessels.

Under these circumstances, there can of course be no indications for the use of electricity. When, however, an excessive flow occurs (as it does not unfrequently, and especially towards the decline of sexual activity), in consequence of inactivity of the liver and constipation of the bowels, associated with a degree of nervous exhaustion, the indications are self-evident, and are often times excellently met by the powerful constitutional tonic effects of general faradization. From such local causes of menorrhagia, as misplacements, intra uterine morbid growths, and certain affections of the ovaries, electrical applications are ordinarily of doubtful efficacy; but if, as in the following case, the loss of blood be due to a flacid relaxed condition of the uterine tissues, local and general faradization, through their well known effects, answer better probably than most other remedies:

Mrs. B., aged 46, consulted me June 22d, 1874, in consequence of severe hemorrhage to which she was periodically subjected. Five years prior she first observed some slight increase in the menstrual flow. By degrees it became increasingly excessive, until in the course of a year the loss of blood at each menstrual epoch was frightful. For the first day or two only was the flow thus alarmingly copious, but its immediate effects were to render her completely colorless, and almost pulseless. The flow would now rapidly become less, but for two or three weeks there was a very slight but constant discharge of bright arterial blood. The catemenia did not appear with normal regularity—an interval of six weeks to two months ordinarily occurring. It is quite evident that if menstruation had occurred every four weeks the patient could hardly have survived for so long a time her repeated depletions, and as it was she was just enabled, by the aid of a good appetite and vigorous digestion, to regain a measure of strength and color before the recurrence of her trouble. I began treatment in the decline of one of these hemorrhages, and for the relief of the persistent insomnia, resulting from her anemic condition and the pains in her legs,

general faradization was administered on alternate days. It aided very greatly in inducing sleep and relieving pain, and markedly hastened returning strength. Shortly after these tentative applications were begun, I met, at the house of the patient, Dr. W. G. Alling, of New Haven, under whose care she had been a short time before, and from whom she had received continued and judicious treatment, both constitutional and local, but without decided relief. His examinations had found the uterus to be three and one half inches in depth and slightly retroverted. When the probe was carried into the cavity, at the first examination, slight hemorrhage followed its withdrawal, and a small fungoid mass came away. Further examination revealed considerable fungoid degeneration of the mucous membrane. I proposed alternating the general treatment with intra vaginal and mild intra uterine applications. This method of procedure was continued until April 13th—the patient in the meanwhile having regained, with far more than ordinary rapidity, her color and strength—when menstruation again appeared. The flow was considerably more profuse than normal, but not to be compared in severity with those that had previously occurred.

In ten days the flow ceased and treatment was resumed and continued until June 13th, when the patient left for the country, with the feeling that her recovery was assured if not an accomplished fact. A year has elapsed since all treatment was discontinued; at no time has there been a flow in quantity greater than normal, and moreover the patient is in the enjoyment of robust health.

XI.—*Subcutaneous Erectile Tumor successfully treated by Electrolysis.* By W. F. Hutchinson, M.D., of Providence, R. I. (Reported by A. G. Browning, M.D.)

Miss L. O. W., of scrofulous habit and nervous temperament, was directed to us by Dr. C. W. Fabryan, of this city, came under treatment October 20th, 1874. From early childhood has been affected with venous dilatations in various parts of her body. The most prominent, and the one that most annoyed and disfigured her, was an aneurismal varix of the right supra-orbital region, which extended from the inner angle vertically two and a half inches, in

breadth an inch and a half, and in depth about an inch. It was supplied by the supra-orbital artery. There was distinct pulsation. At the time she presented herself for treatment the tumor, according to her statement and that of her attending physician and friends, was steadily increasing in size. There was marked anemia, with loss of appetite and a generally depraved condition of the system. She was immediately put upon tonic and supporting treatment, which was continued for two weeks. During the interval that elapsed between her first examination and the day of the operation, she was frequently seen by us, and it was apparent that the walls of the sack were growing thinner and threatening to burst, which condition had been greatly aggravated by compression, which had been continued for a year. Fearing an accident of this kind, an immediate operation was decided upon November 4th, with the assistance of Dr. Fabryan, and in the presence of a number of the leading physicians and surgeons of Providence and vicinity, the tumor was electrolyzed.

The patient was placed under the full influence of ether, and one gold needle, insulated to within half an inch of the point and attached to the negative pole, was introduced into the lower portion of the tumor, and four non-insulated steel needles were thrust into different parts of the tumor at right angles to the negative and connected to the positive pole of the battery. The current from eight cells of a good patent portable zinc-carbon battery, of the Galvanic Faradic Company's manufacture, was allowed to run for ten minutes, at the end of which time a firm, hard clot was formed. On withdrawing the needles there was slight hemorrhage from the puncture made by the negative needle, which continued but a few minutes. The tumor was subsequently dressed with a weak solution of equal parts of tinct. arnica and tinct. opium, half an ounce to a glass of water, which was continuously applied for three or four days. The patient suffered none from shock, and in half an hour after recovering from the effects of the anæsthetic was able to ride to her home, two miles distant. Absorption commenced about the third day, the clot continuing firm and solid. Five days after the operation there was slight sloughing around the point of entrance of the negative needle; the residuum now having free exit soon passed of. The edges of the sloughing wound were brought accurately together and confined by a single suture; rapid healing followed, and in two weeks from the time of operating the clot had

entirely disappeared and the wound healed. The patient's general health soon began to improve, and at present is in the enjoyment of better health than at any time within the last ten years. At present there is no disfigurement, with the exception of a slight scar at the point of entrance of the negative needle. There is no elevation above the surface of the forehead. The tumor has totally disappeared, and is pronounced by all physicians who have seen it to be an entire success.

From the records of various plans of treatment hitherto employed for the cure of varices, aneurismal or otherwise, it would seem that the average of success is not more than fifty per centum. Such accidents as hemorrhage from rupture of coats, entrance of air into veins, or pyæmia, having usually caused fatal consequences. With electrolysis neither of the above named accidents are liable to occur, save the last, and ordinary surgical care will suffice to prevent that where there is no nerve shock, no depression of vital powers, and no confinement to the room following the operation. It is, therefore, evident that the electrical operation is preferable to any other surgical procedure, and that it should be generally adopted. Indeed, when the patient is a nervous, delicate woman, as I have frequently observed, and is given her choice between electro-surgery and the knife in any case, it is singular how unanimous the vote is in favor of the battery; and in New England, women cast their suffrage understandingly, having previously had the *pros* and *cons* fully explained, so that mere prejudice or love for novelty cannot be said alone to sway them.

XII.—*Large Mother's Marks treated by Electrolysis.* By Geo. M. Beard, M.D.

The treatment of superficial nævi of moderate size, by electrolysis, has now been pretty thoroughly tested, and there is little question, I believe, among those who have had large opportunities for studying this method, that it is an excellent method of treatment provided it be properly used.

Large mother's marks (cutaneous nævi), covering a wide extent of surface, have not, so far as I know, been treated in this way.

During the past year I have treated two cases by electrolysis, and with most gratifying results. The details of the cases will be published at a later date. It is sufficient here to call attention to the general fact that mother's marks of large surface have been successfully treated by electrolysis, with but little scarring or none at all, or, at least, with a scarring that is far preferable to the original deformity.

In mother's marks, as every one knows, there is not always any elevation of the skin, there is simply a bright redness, caused by the enlarged blood-vessels, and this redness may temporarily disappear on pressure. The deformity caused by these is horrible, and if they can be destroyed with but little or no scarring, and without incurring any risk to the patient, it will be a fact of much interest.

This is one of the questions that can be determined by a limited number of cases, since there is not, as in the treatment of nervous diseases by electricity, any source of error from the elements of time and mental influences. Mother's marks do not get well spontaneously, and they do not often, if ever, disappear under mental impressions. When once obliterated they do not recur, and it is not necessary to watch them for months and years, as in the case of malignant tumors that have been removed by electrolysis of the base.

The great point in the treatment, as I judge from the cases thus far treated, is to use just sufficient current, for a sufficiently long time, to obliterate the enlarged blood-vessels without decomposing the skin to any great extent. The cases that I have treated have been young children, but there is no question that the large mother's marks of adults, that are so frequently seen, could also be treated in the same way and with good results. If any scar is made on a young child, there is time to outgrow it somewhat, or to have it contract before maturity.

In one of the cases that I have under treatment a third of the forehead was disfigured; in another there was a red mark in the middle of the forehead, one inch long and one half inch broad. In the latter case the treatment left scarcely any scar, and the deformity is removed altogether, to the great delight of the parents.

XIII.—*The Nature and Phenomena of Trance.* By Geo. M. Beard, M.D.

Trance is derived (according to Webster) from the Latin *transire*, to pass over, giving the idea of a *passing out* of one state to another. A definition of trance, at once accurate, concise, and complete, would be very difficult to find. There is, indeed, much the same trouble as in attempting to define insanity, or other terms that are used to cover various and complex phenomena. Like insanity, trance is a state of degrees: the range between its lightest and most decided forms is very wide. As the very earliest symptoms of insanity are subtle and difficult of detection, so are the milder phases of trance.

The following description, though not free from objections, may assist somewhat in attaining a clear and correct notion of what trance is, and of its relations to other and allied conditions with which it is associated:

Trance is a passive state, conscious or unconscious, either physiological or pathological, in which the mind passes from the control of the will, and in the milder and conscious state acts through the senses in obedience to some prominent idea or external suggestion, with various mental and physical manifestations, and in the rarer and most advanced stages goes on to protracted suspension of the active vital functions.

The definite meaning of the various clauses in this description will be made more clear by comparing trance with other terms with which it is often used interchangeably. In ordinary sleep there is passivity and unconsciousness, and the will has no influence, but the body does not act in obedience to any dominant idea or external suggestion. In dreams, the imagination is active as in trance, the will inactive, but the senses are also inactive; while in trance the senses may be not only active but exalted.

Trance differs from ordinary sleep in these five general features as well as various special features to be hereafter noted under symptoms:

1. The trance subject acts out his dream, while in sleep the dream does not cause any corresponding coherent physical phenomena.

2. The performances of the trance are logical, coherent, and consistent; while dreams are filled with extravagance and obsurdities which to the sleeper seem entirely proper.

3. In trance, some of the senses are perfectly sealed. The loudest noises are not heard, the most fragrant odors are not observed, and there is no power of taste. While some of the senses are thus utterly closed others may be greatly exalted. On the other hand, the soundest sleepers are awakened by loud noises, or by sufficiently irritating the sensitive nerves.

4. Trance subjects are capable of responding to suggestions offered by a second party, or from any external source, and become consciously obedient to those suggestions. Sleepers present no such peculiarity; if they respond to external suggestions addressed to the senses, it is automatically and not consciously or coherently.

5. In some forms of trance there may be divided or double consciousness. The subject, on coming out of the trance, has no recollection of his experience while in it. On again entering the trance he resumes the experience of the previous attack where it left off, as though no active life had intervened. If he have a habit of entering into the trance at certain times, he really leads two quite distinct lives. In sleep there is no such continuity of existence, from one nap to another.

In strictness, trance is not sleep at all; it is rather another form of waking life, over which the will has little or no influence. It does not rest one, rather it is exhausting, at least in some of its phases, and with reason, for the mental and physical functions are oftentimes exalted.

Where a person asleep "acts his dream," and walks in his sleep, he may be said to pass from the state of sleep into the state of trance. Somnambulism is indeed a phase of trance, and answers to the description above given. The mind is passive—all the movements are automatic—the will having no influence; the senses, some of them at least, are active, and in some cases prodigiously exalted, and the subject acts in obedience to the idea of his dream or to external suggestions made through his senses, with most surprising phenomena.

When one rises from ordinary sleep, and walks without awaking, we call the act somnambulism; but somnambulism may also be exerted by any other influence that causes any other phase of trance.

Catalepsy and ecstasy are both forms of trance, the peculiarity in

both being that there is fixity of position, and that is no response to or but little response to external suggestion.

In what is called mesmerism, or hypnotism, such as is induced by the methods of Mesmer or Braid, the response to external suggestion is a marked feature. The senses are active and absolute, and the patient does whatever is suggested to him by a second party.

It will be observed that the term trance is here used in a generic sense, indicating a state rather than a symptom or a disease, and a symptom neither distinctively physiological or pathological, but common to health and disease.

This generic term trance includes the special manifestations of it known as catalepsy, ecstasy, natural and artificial somnambulism, and some of the phases of hysterical insanity.

Hysteria is not necessarily trance, but frequently leads to it. The symptoms of hysteria are infinite, and but a few of them are distinctly trance symptoms. Similarly, the disease of the brain, that gives rise to the different varieties of insanity, may also excite the trance state; in other words, insanity is one of the many doors that open into the trance: it is not itself the trance any more than the vestibule is the temple.

Symptoms of Trance.—The special symptoms of trance are various, and they vary with the individual, with the conditions under which the trance is developed.

The leading symptoms—mental and physical—as they are liable to appear in the different stages of the trance condition, may be thus classified:

First.—Closing of the eyes and fixity of position, with gradual loss of volitional power.

Fixity of position—sitting or standing—is, as we shall see, one condition, though not an essential condition to going into trance, and it is retained for some time after the first symptoms of trance have appeared. The subject may remain for a long time standing or sitting, and well nigh motionless.

In the mesmeric form of trance, to be hereafter described, the operator ascertains that the subject is entering into the trance by his inability to open his eyes when he is told that he cannot do so. The operator presses his finger on the forehead of the subject, between the eye lines, saying to him, "You can't open your eyes." If the subject is really entranced, he will struggle to open them,

but will not succeed. If the subject is farther along in the trance state, the operator will tell him that he cannot flex his extended arm or rise from his chair, and he cannot perform these acts; the connection between the will and the muscles is severed. The subject is no longer himself—he is a conscious automaton.

A mesmerized subject is in the condition of one in nightmare—trying to run away from some horrid animal, it may be, yet unable to stir—but with this difference, that with the nightmare subject the suggestion is purely subjective from his own brain, and the accompanying phenomena are purely mental; while with the trance subject the suggestion is objective and external, accompanied by physical manifestations.

The appearance and position of the eyes in full trance are peculiar. They are generally fixed, and turned somewhat inward and upward, and when open present a characteristic stare. The face sometimes assumes a glow, or shining aspect, that is characteristic of certain forms and stages of trance in some persons; but this is far from being uniform or even common. The voice also may change so far as to be unrecognizable.

Secondly.—Flushing of the face and eyes, with sensible and cold perspiration, and coldness of extremities. These symptoms, which come on quite early, are soonest observed in those of very sensitive organizations.

These symptoms are very far from being constant. I have seen them in self-induced trance, and they may occur in the mesmeric form. The hands and feet are covered with a cold perspiration, and at the touch they feel just as they do in cases of cerebral congestion and exhaustion. This symptom may come at the same time with the preceding symptoms; it is indeed a part and associate of the other symptoms, being a resultant of the unequal circulation.

Thirdly.—Sighing respiration and rapid pulse, with evidences of oppression and pain. When sighing respiration appears we may know that the subject is beginning to be well entranced. According to the temperament of the subject, and the condition under which the trance is developed, these symptoms may arise speedily and attain their full power in a few moments.

In some cases the pulse is not at all affected, or but a very little, and the sense of oppression is, I believe, the exception more than the rule. Sighing respiration is observed in self-induced and mesmeric trance, and sometimes in other forms.

During this stage the subject may sigh and groan, as if in great pain, as patients often do when under the influence of an anæsthetic. On coming out of the trance there may be no recollection of any suffering.

In twenty-seven cases of mesmerized subjects, observed by Dr. J. K. Mitchell,* the average of the pulse before sleep was 81.7; in sleep 105. The average of respiration before sleep was 19.04; in sleep 19.68. In all of the cases the pulse was accelerated, the least being 8 beats, the greatest 48, and the average difference 23.3.

Out of twenty-five cases the respiration was unchanged in nine, increased in nine, and in seven diminished. The average result was that the respiration was but slightly affected either way.

The preceding symptoms, which do not always appear—certainly not in their logical order—belong, most of them, to the early stage of trance before the subject loses entire control of his acts. They indicate what may be called *semi-trance*, or the conscious stage. In this stage there may be flushing of the face and involuntary muscular movement, or simply drowsiness, and the operator may have a feeble and imperfect control over the subject, such as preventing him from opening his eyes or from bending his extended arm, and yet be powerless to influence him in any other respect. Many subjects can never be forced beyond this stage. In this stage also the subject is conscious, more or less, and, at the suggestion of a second party, he does the most absurd things.

Fourthly.—Mild or violent involuntary muscular motions. These may begin with a spasmodic motion of the arms or feet, or of both, with various jerkings and twistings of the head and body, and may go on to furious contortions, violence, and continuous running, leaping, jumping, rolling, and all manner of absurdities, which may be protracted for hours and days. To this class of symptoms belong the dancing epidemics of the middle ages, the leaping, jumping, and jerking manias of Sweden and Scotland and Kentucky, and the convulsionaires of St. Medard.

Slight convulsive movements are sometimes the earliest evidences that a subject is going into the trance; they may appear before any flushing of the face or eyes, or any apparent change in the quality of the respiration.

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* Essay on Animal Magnetism, in Five Essays, p. 168.

Fifthly.—Involuntary mental action, with exaltation or depression of the senses and of the mental and muscular powers.

The activity in the trance—mental and muscular—is oftentimes surprisingly great, far surpassing that of the voluntary life, but it is ill-directed; there is no reason or judgment, for the will that directs the reason and judgment is dethroned. A person in a trance can perform mental and muscular feats which, in their voluntary state, are impossible; and besides, the functions of the nerves of general and special sense may be enormously exalted. There may be such an exaltation of the sense of hearing that a faint whisper in a distant room may be distinctly heard; of the sense of touch, so that when the hand of a second person is brought near to the subject its presence will be felt before it touches the body, by the increase of warmth.

Men in trance have been known to lift over their heads weights which, in voluntary state, they could not raise from the ground. Comparatively feeble women will, while in this state, dance furiously for hours and days with little fatigue, or without nourishment or rest walk consecutively for many hours each day. A young lady who was but a moderate singer, has been known, when in the trance, to sing with great effect; and many a poor talker goes off into a fluent though senseless speech. The co-ordinating power becomes so exalted in the trance that the subject climbs giddy heights, crosses narrow beams, and appears in all sorts of perilous places, without falling or even slipping. The so-called trance speaking illustrates the mental symptoms of this state in a very interesting way. Persons who are profoundly ignorant, who have comparatively feeble gifts of thought or speech, do exhibit in the trance a mental activity and brilliancy that is oftentimes amazing. Those mental qualities that are needed in trance speaking—command of language, phrases, illustrations, and stock expressions of those with whom the speaker is intimate—these faculties are some times very greatly exalted, so that the subject speaks with a celerity and freedom at which his friends are astonished. It is observed that trance speakers originate no great thoughts, and make no important contributions to literature; they simply repeat, in a glib and voluble manner, the thoughts and phrases already in their mind, and as the majority of professional trance speakers are of moderate or inferior ability, their sermons and speeches add nothing to the literary treasures of the world; relatively, some of these

trance speeches are interesting, as showing what an ignorant and stupid person can do in the exaltations that result from the temporary triumph of the involuntary life. We are amused with them as we are amused with precocious children, whose performances are far ahead of their years though of little absolute value.

But when men of real original genius become entranced, or partially so, they oftentimes do some of their best work. Great orators may, under high excitement, become so far entranced as to be but semi-conscious, and in this state they may utter their most eloquent passages. This involuntary and exalted activity of the mind is acpanied frequently by involuntary and exalted muscular activity of various kinds; when, therefore, one goes into a trance, while holding in the hand a pencil, or with both hands on planchette for example, he may write, to his infinite astonishment, words and phrases long forgotten, which are not recognized even when they appear before him. Experiences of early childhood, that have long since ceased to be a part of our conscious life; prayers that fell from mother's lips on unwilling ears; oaths and obscenity, heard or spoken in evil hours, and which we hoped had long been wiped from memory; the words of some other language, taught us by foreign nurses or teachers—all these, under passive state of the mind, when the will relaxes its grip on the brain, walk out of the cerebral cells in which they have been long imprisoned. The spirits are indeed upon us, but they come from our own brains—the jailer has gone and left the doors unlocked, and the prisoners escape.

The five senses are quite differently affected by the trance. The senses of taste and of smell are generally lost. Somnambulists are not usually affected by the strongest ammonia at the nose, and cannot distinguish one article from another by the taste; on the other hand, the senses of touch, hearing, and probably also sight, may be greatly exalted. In explanation of this difference of behavior of the senses in the trance, Dr. J. K. Mitchell suggests that sight, touch, and hearing are mechanical senses—sight and hearing being modification of touch, while smelling and tasting are chemical senses. In some cases, however, the sense of smell is certainly exalted. The sense of touch may be very greatly exalted, hence the feats of somnambulists, who go from room to room with closed eyes, avoiding whatever obstacles may come in their way with as much precision as in handling it, what it really is. If the operator who exhibits a subject in public be disposed to do so, he can avail him-

self of the exaltation of the sense of hearing to perform all kinds of trickery. Those who are familiar with the tricks of those who exhibit learned dogs, pigs, etc., that play cards and do all kinds of wonderful things, are aware that the master carries with him an instrument resembling a comb, one of the projections of which, on being touched, produces a very slight sound that the by-standers cannot hear, but which the learned animal hears with ease. It is to him an order to stop—the "whoa" for a horse—and as he stops he picks up the card, or number, or object near his mouth. When the master or trainer is out of sight and hearing the learned animals are very unlearned!

The exaltation of the sense of hearing enables operators to astonish audiences with mind-reading, clairvoyant, and second-sight performances of mesmerized subjects. Dr. J. K. Mitchell speaks of a patient who could hear, across two long parlors, a scratch of a pin against a door, though inaudible to the individual who applied it. That the retina is abnormally sensitive in some of these cases is evident from the fact that the light appears to be painful, even through the closed eyes, and when the eyes are opened there are all the symptoms of photophobia or intolerance of light.

Subjects who are in that state can probably read with a dimmer light than is needed by them in the ordinary state. Dr. J. K. Mitchell states that nervous patients are sometimes able to read in a room in which others could scarcely discern the largest object.

The exaltation of the sense of hearing—a condition also much observed in hysteria—may be so great that the feeblest whisper, not observed by those who stand near, is heard at a long distance. The popular delusions, that mesmerized subjects can read thoughts, see without eyes, or through firmly closed eyes, have only this basis, that the senses of touch and of hearing are so greatly intensified, as, in the case of the blind, to take the place of other senses. The somnambulist is asked the name of a certain article I hold in my hand. She is blindfolded thoroughly and does not see it, but her sense of hearing is so acute that she may distinguish by the slight sound made in taking it up. Dr. Mitchell proved this by experiment.

Analgesia, or loss of sense of pain, sometimes called the sixth sense, very frequently appears in trance, even when the sense of touch is greatly exalted. Thus, the subject can perceive the near approach of the hand of a second party, by the difference in temperature, and can distinguish the character of the object by touch

alone, but a needle thrust into the calf of the leg causes no pain. This same condition is observed in some diseases of the spinal cord, but there is not usually any exaltation of the sense of touch.

The whole of the body, or a part of the body, may be deprived of sensation of pain, and in the mesmeric form of trance this may be caused at the suggestion of the second person, or operator as he is generally called. This deprivation of sense may be transferred from one limb to another. Subjects in this state pounded, trod on, jumped on, give no sign of pain. The convulsionaires of the middle ages begged to be pounded, trodden under foot, and, in the extreme of their delirium, cried out for greater severity. The anæsthesia of the mesmeric form of the trance has been utilized in surgery. Jules Cloquet communicated to the French Academy of Medicine, April 16, 1829, particulars of a cancer of the breast, that was removed while the patient was in a trance, and no pain was experienced. The operation lasted from ten to twelve minutes, and the tumor was entirely removed. During all this time the patient conversed calmly with the operator, and gave no signs of pain by hand or motion. The pulse, the respiration, and the features were unaffected; there was no need of even the slightest restraint. For ten days following the operation the patient remained in the trance, and when awakened she remembered nothing of what had happened.

These anæsthetic effects are not uniform, and when an attempt is made to obtain them for surgical operations entire failure may result. Dr. J. K. Mitchell records a case where a patient being mesmerized a tooth was extracted without her knowledge or expectation. There was no evidence of pain in the face, or in any part of the body. In other cases, there were clear evidences of pain when the operation was performed, but there was no remembrance of the suffering after coming out of the mesmeric state. Dr. J. K. Mitchell estimates from his experiments, that about one in ten of those who are mesmerized are sufficiently anæsthetized to be operated upon without pain, and as only a certain proportion of people can be profoundly mesmerized—about one in ten—by an average operator, there is about one in a hundred on whom this method of anæsthetization could be used. Inasmuch as it is impossible to tell by the appearance of the patient, whether he can or cannot be mesmerized, or whether, when mesmerized, he will or will not be

sufficiently anæsthetized to be operated upon without feeling pain, it is clear that this form of producing anæsthesia could never have been of very great practical service, even if etherization and chloroformization had never been introduced. Those, however, who find by one operation that they are good subjects for this form of anæsthesia, are also good subjects for any subsequent operations.

Mark Twain has recently published in the *Atlantic Monthly* the following most remarkable case of exaltation of faculties in the somnambulic form of trance:

"There used to be an excellent pilot on the river—a Mr. X., who was a somnambulist. It was said that if his mind was troubled about a bad piece of river, he was pretty sure to get up and walk in his sleep and do strange things. He was once fellow-pilot, for a trip or two, with George E., on a great New Orleans passenger packet. During a considerable part of the first trip George was uneasy, but got over it by and by, as X. seemed content to stay in his bed when asleep. Late one night the boat was approaching Helena, Arkansas; the water was low, and the crossing above the town in a very blind and tangled condition. X. had seen the crossing since E. had, and as the night was particularly drizzly, sullen, and dark, E. was considering whether he had not better have X. called to assist in running the place, when the door opened and X. walked in. Now, on very dark nights light is a deadly enemy to piloting. You are aware that if you stand in a lighted room, on such a night, you cannot see things in the street to any purpose; but if you put out the lights, and stand in the gloom, you can make out objects in the street pretty well. So, on very dark nights pilots do not smoke; they allow no fire in the pilot-house stove if there is a crack which can allow the least ray to escape; they order the furnaces to be curtained with huge tarpaulins and the skylights to be closely blinded. Then no light whatever issues from the boat. The undefinable shape that now entered the pilot-house had Mr. X.'s voice. This said—

"'Let me take her, Mr. E.; I've seen this place since you have, and it is so crooked that I reckon I can run it myself easier than I could tell you how to do it.'

"'It is kind of you, and I swear I am willing. I haven't got another drop of perspiration left in me. I have been spinning around and around the wheel like a squirrel. It is so dark I can't

tell which way she is swinging till she is coming around like a whirlgig.'

"So E. took a seat on the bench, panting and breathless. The black phantom assumed the wheel without saying anything, steadied the waltzing steamer with a turn or two, and then stood at ease, coaxing her a little to this side and then to that, as gently and as sweetly as if the time had been noon-day. When E. observed this marvel of steering, he wished he had not confessed! He stared, and wondered, and finally said:

"'Well, I thought I knew how to steer a boat, but that was another mistake of mine.'

"X. said nothing, but went serenely on with his work. He rang for leads; he rang to slow down the steam; he worked the boat carefully and neatly into invisible marks, then stood at the center of the wheel and peered out blandly into the blackness, fore and aft, to verify his position; as the leads shoaled more and more, he stopped the engines entirely, and the dead silence and suspense of 'drifting' followed; when the shoalest water was struck he cracked on the steam, carried her handsomely over, and then began to work her warily into the next system of shoal marks; the same patient, heedful use of leads and engines followed, the boat slipped through without touching bottom, and entered upon the third and last intricacy of the crossing; imperceptibly she moved through the gloom, crept by inches into her marks, drifted tediously till the shoalest water was cried, and then, under a tremendous head of steam, went swinging over the reef and away into deep water and safety!

"E. let his long-pent breath pour out in a long, relieving sigh, and said:

"'That's the sweetest piece of piloting that was ever done on the Mississippi River! I wouldn't believed it could be done, if I hadn't seen it.'

"There was no reply, and he added:

"'Just hold her five minutes longer, partner, and let me run down and get a cup of coffee.'

"A minute later E. was biting into a pie down in the 'texas,' and comforting himself with coffee. Just then the night watchman happened in, and was about to happen out again, when he noticed E., and exclaimed:

"'Who is at the wheel, sir?'

"'X.'

"'Dart for the wheel-house quicker than lightning!'

"The next moment both men were flying up the pilot-house companion-way, three steps at a jump! Nobody there! The great steamer was whistling down the middle of the river at her own sweet will! The watchman shot out of the place again. E. seized the wheel, set an engine back with power, and held his breath while the boat reluctantly swung away from a 'towhead' which she was about to knock into the middle of the Gulf of Mexico!

"By and by the watchman came back and said:

"'Didn't that lunatic tell you he was asleep when he first came up here?'

"'No.'

"'Well, he was. I found him walking along on top of the railings, just as unconcerned as another man would walk a pavement, and I put him to bed; now, just this minute, there he was again, away astern, going through that sort of tight-rope deviltry the same as before.'

"'Well, I think I'll stay by next time he has one of those fits. But I hope he'll have them often. You just ought to have seen him take this boat through Helena crossing. *I* never saw anything so gaudy before. And if he can do such gold-leaf, kid-glove, diamond breast-pin piloting when he is sound asleep, what *couldn't* he do if he was dead.'"

Dr. Brown-Sequard gives this extraordinary case of balancing, while in a trance state. A young lady of Paris was every Sunday, at ten o'clock, seized with ecstacies. When this attack came on she would get upon a bed, put her toes on the edge, take an attitude of prayer, and begin to pray to the Virgin Mary. In this position she would stay for a long time, fixed like a statue, her chest moving, her heart beating, but her lips uttering sounds, and the rest of the body absolutely still. To stand on tip-toe, on level ground, even without shoes, is very difficult, and for any length of time impossible. Dr. Brown-Sequard investigated the matter, and was convinced that there was no deception.

I was consulted not long ago, and while I was preparing this very chapter, by a man who had been for a long time a sufferer from migraine, or sick head-ache. During the attack, even in spite of the pain, his mind is unwontedly active; he can, for example, improvise poetry, that in health would be impossible; in short, he is in

the exaltation of trance. He enters into the trance state through a pathological door, so to speak. The morbid state of the central nervous system, that gives rise to migraine, also gives rise to the state of trance.

The power of telling the time is one of the faculties that is sometimes exalted in a trance state. That such a power exists in the human mind, and that it varies with different individuals, there can be no question. It is also pretty clear that this faculty is active during sleep. There are many who can wake up at any hour they choose, and can trust themselves in this regard without apprehension. Others can only approximate the desired hour of waking; but all, by practice, exhibit this power in some degree. In trance, this power may be considerably exalted. It does not enable one to attain perfect accuracy, but to come moderately near the exact time. A medical friend of mine informs me, that during an attack of rheumatism he developed this faculty to a degree that surprised him. He could tell within a minute, or at least a very few minutes, the time by the clock in another room. He had never possessed this power, to any unusual degree, before his illness, and he did not retain it long after recovery. The very common blunder of supposing trance subjects can read the time, when the watch is held at the back of the head, is, in the light of this fact, easily explained; for, in a trance, the time-telling power may be exalted, and so they may astonish the by-standers by their accuracy; but the result is the same whether the watch is held at the back of the head or kept in the pocket of the owner. If the hands of the watch are turned backward or forward a few hours, unbeknown to the subject, and the watch is held at the back of the head, the subject will show at once that he does not see time by that watch, but will only guess approximately the real time of the day.

The explanation that I have to offer for the exaltation of functions in trance is this: Volitional activity costs more cerebral force than spontaneous, involuntary, automatic activity. It is necessary that the will should be constantly in use, especially in all the details of practical life, in order to give system judgment—in short, common sense to our lives. But common sense is purchased at an enormous sacrifice of absolute mental and muscular power. Supposing that the absolute amount of cerebral force that can be exerted in any special direction, as in raising a weight, or running or leaping, or walking a tight-rope, or making a speech, or singing a song, or

tipping a table, or listening to a delicate and distant sound, be represented by 100; then, if 75 be used up in willing to do the thing, there remain but 25 to be used in doing it. In the trance state no force is lost in willing to do anything, hence the entire 100 can be used in doing the thing itself. In the trance the subject seems to act with his whole nature in one or two or a few important directions, whereas, in the natural state, the forces are scattered. Between a subject out of trance and in trance there is the same difference that there is between a general scattering his forces in all directions, and a general concentrating, in succession, all his forces on one point.

Volitional activity is the costliest of all phases of cerebration. The will really interferes with the highest phases of cerebration; it acts as a check and restraint—a curb—and under certain conditions the mind moves much more brilliantly and effectively without it, just as the coach makes better time when the reins are loose, the driver thrown from his seat, and the horses have it all their own way. The mind, under the influence of the will, is like a balloon anchored to the earth. The mind, divorced from the will, is the balloon, after the the rope is cut, soaring upward in the sky. The practical details of daily life require not the higher but the medium range of mental force, and hence the need of the constant presence and activity of the will.

Sixthly.—Illusions and hallucinations of various kinds.

Hallucinations can appear in those who are not entranced, for they depend on a vast variety of cerebral conditions; but, of the different forms of trance, they are frequent accompaniments, and, in connection with other symptoms and the surrounding circumstances, help to make out the diagnosis.

In the mesmeric form of trance the subject can be made to see and hear anything that the operator suggests. A pillow may be transformed into a dog, a book into a baby, a lead pencil into a mouse, a bottle of ink into a cat running after it. The conclusions that Von Reichenbach derived from his researches seem utterly absurd, because he did not understand the nature and phenomena of trance. When sensitive subjects are shut up in dark rooms for a considerable time, with the expectation that some wonderful thing is to happen, they can be made to see fire and flames issuing from the end of wires or from magnets, or indeed almost anything that the

operator insists on, or that they expect to see. The difficulty with Reichenbach, as with nearly all who experiment in this department, was that he did eliminate the sources of error. He was one of a very large class who have been attracted to this branch of enquiry, who are ever learning and never able to come to the knowledge of the truth. Von Reichenbach was honest—he was not without ability—he was simply non-expert. An expert in these matters, Rev. J. M. Buckley, tells me that one time he had put a person into a trance and the imagination of the subject had become much exalted, and he fancied himself in heaven. The expert then said to him, "Do you see that kitten running out from under the throne of God?" At once the subject cried, "Yes," and began to run after the kitten, and tried to catch it.

Spiritual mediums in all ages have availed themselves of these phenomena of the trance to delude their victims. They partially or wholly entrance their poor, sensitive, credulous attendants on the seances by the combined influence of expectancy, awe, music, and darkness, and compel them to see and hear whatever they wish. Under these circumstances, hallucinations can be made to appear even to those who are but slightly entranced. They may be indeed the very first symptoms of the trance state, particularly in those cases where lights, flashes, flowers, and forms are expected to be seen.

Sensitive temperaments, who are liable to fall into the trance on slight provocation, frequently see full forms of the living or the dead, even when other marked symptoms of trance are not apparent; but usually an expert would detect that the subject was in the trance by other symptoms and without the confirmatory evidence of the hallucinations.

Seventhly.—Various hysterical symptoms.

Among these symptoms are tingling, feeling of pins and needles, numbness, heaviness, creeping, crawling, and allied sensations that are so common in hysteria. A very frequent symptom is an aura of some kind in some portion of the body, most frequently in the fingers, hands, arms, and head. This is variously described as a shock or thrill resembling that caused by electricity. That the subjects experience these sensations there can be no question, for the existence of such sensations, in sensitive states of the nervous system, is every day demonstrated, and they may come from either physical or psychical causes; these symptoms, or sensations, appear

frequently at the beginning of the semi-trance state. A man who has much experience in tipping tables, tells me that a sensation of this kind is almost always felt by him very soon after his hands are in position on the table. To those who have not looked into this matter, the ease with which sensations of this kind can be excited is incredible. This very day on which I am writing this paragraph, while I was treating a lady in my office with the galvanic current of electricity, another lady who sat three feet distant, declared she felt the electricity all over. She could feel it "tingle," she affirmed, and she persisted in experiencing that sensation in spite of my declarations that her body was not in the circuit, and she no more could get any of the electricity than if she were in the middle of Africa. This special result of the imagination I have seen very frequently. The friends of patients who witness the application persist in experiencing the same sensations as the patients always do experience. This cause is mental and not physical. In the trance there may be likewise dark spots or veils before the eyes, and sometimes, as Reichenbach has shown, various luminous appearances. Among these hysterical symptoms should be mentioned flatulence, with the distention of the bowels, so often observed during the trance epidemics of the middle ages. The involuntary jerkings and contortions, previously referred to as sometimes symptomatic of the early stages of trance, may be regarded as hysterical symptoms.

A marked feature of the earliest effects of mesmerism, as practiced by Mesmer himself in Paris, were convulsions. These convulsions were, in some cases, quite protracted, and were characterized by twitchings of the hypochondrium, tightness of the throat, glaring of the eyes, piercing shrieks, hic-cough and laughter. Some of the subjects were troubled by heats and perspirations, and violent fits, coughing and expectoration. These were common symptoms in the early experiments of Mesmer in Paris. Patients who developed these symptoms were said to be in a "crisis." It was regarded as an argument in favor of reinvestigating the subject by the French Academy, that the symptoms of the "crisis" that had been made so much of in Mesmer's early experiments, no longer appeared in the subjects that were then under observation. They did not understand that the epidemic of trance, then raging, was of a different type.

Eighthly.—Profound sleep with protracted suspension or diminution of active vital functions.

In the deeper stages of trance all or nearly all the active vital functions may be suspended for long periods; the subject is alive but he does not live. The remarkable case of Townsend is a familiar illustration. This man could at will throw himself into a condition of apparent death, in which state medical experts could find no pulse and no respiration, and feared that he was really dead. But in time the heart renewed its beating, and he was restored to his ordinary state. The heart was probably beating, but not audibly. It is said of the Fakirs, a religious sect of India, that they throw themselves into a perfect trance, and suffer themselves, while in this state, to be shut up in coffins and to be buried for days and weeks. The evidence on this subject, of the trance of the Fakirs, is not, to my mind, satisfactory. Sleep may occur early in a trance, and in many cases it never occurs; it is but one of the many evidences of the trance state, and is not essential to it. It may and often does follow the stage of violent muscular and mental activity. In some cases this sleep will continue for hours and days, unless the subject is awakened. Sleep is also an accompaniment of the previous symptoms, though when there is violent activity of mind and muscles there cannot of course be profound sleep.

In the deepest stages of trance, as illustrated in those who have come near being buried alive, the sense of hearing may be active, but the power of speech, or motion of any kind, is lost; the patient may take cognizance of the preparations going on around and yet be powerless to resist. The diagnosis of such cases may be made by the presence of electro-muscular contractility, which always disappears a few hours after death.

Rosenthal, of Vienna, records a case of trance in an hysterical woman. She was declared dead by her physician. When Rosenthal saw her, the skin was pale and cold, the pupils contracted and not sensitive to light, no pulse could be detected, and there was relaxation of the extremities. Melting sealing-wax, dropped on the surface, caused no reflex movements. When a mirror was held before the mouth no moisture appeared. It was not possible to hear any respiratory murmurs, but in the cardial region a feeble intermittent sound could be just detected on auscultation. The patient had been apparently dead for thirty-two hours. On examining the patient with

the faradic current of electricity, Rosenthal found that the muscles of the face and extremities contracted. After twelve hours of faradization, she recovered. Two years afterwards she was alive and well, and told Rosenthal that about the commencement of the attack she knew nothing, but that afterwards she heard people talk about her death but she was powerless to help herself.

Double or Divided Consciousness.—An interesting fact of the trance is the continuity of existence from one attack to another. At the beginning of an attack the subject may go on doing the same things as in the previous attack—may indeed begin just where he left off before, although the interval between the attacks may have been a very long one. The voluntary life is indeed ignored, and the involuntary life proceeds as though the individual led no other.

A very remarkable case of double consciousness is that of Miss Reynolds, the particulars of which were recorded in 1860, and accounts of which had previously appeared in various journals. This lady, who lived in Pennsylvania, was attacked at the age of eighteen by some form of convulsions. After one of her attacks she was found one morning in a deep sleep, from which she could not be aroused. When she awoke spontaneously after some hours, she had forgotten all about her former life; all her acquirements had passed from her. She knew not her father, mother, brother or sister. She had no consciousness of having previously existed. Five weeks she continued in this state, and then recovered her natural state and her memory returned, but no recollection of her long state of trance. She took up life where it was when she entered into the trance. She afterwards fell into the trance again, and in that state again forgot the experience of her natural state, and only remembered that little she had acquired in her previous trance. These alternations, from one state to another, continued until she was about thirty-five years of age when she fell permanently into the second state; she thus lived two separate lives. In her natural state she was quiet, sedate, sober, and pensive, almost to melancholy, with an intellect sound, though rather slow in the operations, and apparently singularly destitute of the imaginative faculty. In her second state she was gay and cheerful, extravagantly fond of society, of fun and practical joke, with a lively fancy and a strong propensity for versification and rhyming. Her handwriting in the one state differed wholly from that of the other. Darwin, author of Zoonomia, says:

"I was once concerned for a very elegant and ingenious young lady, who had a reverie on alternate days, which continued nearly the whole day, and in her days of disease she took up the same kind of ideas which she had conversed about on the alternate days before, and could recall nothing of them on her well days. She appeared to her friends to possess two minds." In a somnambulistic girl, that was studied by Dr. J. K. Mitchell, "it was curious to mark the sudden transition from one state of consciousness to another, and the unvaried character of each state, while there existed as little resemblance between the two as is found in the character of the most opposite persons. The ideas, sentiments, passions, form of expression and gesticulation, even the temperaments, were those of two contrasted individuals. She was slow, indolent, and querulous when awake; quick, energetic, and vivaciously witty when asleep."

An important fact in regard to trance is, that the first attack is usually the type of all the subsequent attacks, in general and special features. One who at first makes a trance speech will be likely to do the same in subsequent attacks; the same with one who moves tables by unconscious muscular motion. Similarly with the exaltation of special senses: one who is put into the trance by suggestion of a second party, acts in obedience to the suggestion of that party ever afterwards—succumbs more easily to the influence of that person than to a stranger.

In the trance, as in the voluntary life, practice makes perfect. He who has had much experience in entering the trance finds it easier and easier—less time is required to develop the earlier symptoms, and he goes further into the state. Hence, those who at first simply exhibit under the "mesmerizer" the feature of closing the eyes, with inability to open them, and of inability to close the hand or bend the arm, when the person with whom they are *en rapport* tells them that they cannot, and who are all the time more or less conscious, may go on to the profound stage—both mental and physical—where they are unable to resist the suggestion of the operator in any feature.

In regard to the stupendous claims that have been and are continually made, in connection with the trance, natural or artificial, that the subjects possess clairvoyant powers, and by virtue of that can see through the bodies of patients and diagnosticate diseases; predict the future, or describe the past history of those with whom they are *en rapport;* correctly narrate events of importance taking

place thousands of miles away; that if the different points on the surface of the head be touched by the finger of the operator, while the subject is in this state, emotions corresponding to the phrenological organs supposed to be beneath that region, will be exhibited by the subject; that the subject is at the mercy of the silent will of the operator, all these marvels of clairvoyance, prevision, lucidity, sympathy, prophesy, second-sight, and thought reading, as well as the very frequent claims of seeing with closed eyes, of reading through the pit of the stomach and with the ends of the fingers, or telling time through the back of the head, all these claims of the birth of a new sense or faculty in the trance, or the transference of senses or faculties in this state, as well as the general theory of animal magnetism, or of the existence of a magnetic fluid, or of a new force that passes from the operator to the subject, all of these claims have all the presumption against them, and, up to the present time, no experts have brought forward any evidence to overcome this presumption.

Human testimony, filling many volumes, can be fonnd in favor of the wildest of these claims; but on these, as in all other scientific themes, the average human testimony is worth nothing, except to illustrate human ignorance. Authorities in other branches of science even are worth nothing here. It has been shown over and over, that eminent chemists, astronomers, naturalists, and even physicians who have not specially studied the subject, make worse blunders in investigations of this kind than common laborers.

The testimony in favor of witchcraft is incomparably more imposing than that in favor of any of these claims. In all experiments, even on organic substances, there are numerous sources of error which must be guarded against if we would have the experiments of any value, and the conclusions from them accepted; indeed, the difference between experts and non-experts, in any realm of science, consists largely in the success with which they meet and overcome, and allow for errors in their experiments, and in their power of correct generalization from their experiments. In experimenting with dead or living animals, in the laboratory, the sources of error are far more numerous than in experimenting with inorganic substances; therefore it is, that in this department, the conclusions of the ablest experts are not accepted until they have been confirmed by many others. Hence the justice of the statement attributed to the late Prof. Jefferies Wyman, "in physi-

ology, a single experiment is worth nothing." In dealing with living human beings, who lay claim to occult and divine powers, the complications thicken, and sources of error multiply in geometrical proportion. Hence the almost absolute valuelessness of the literature of animal magnetism. From the days of Mesmer until now, not more than two or three experts in this department of inquiry have appeared.

Aside from general precautions, subjective and objective, that all experimental research demands, the special sources of error to be guarded against in investigations of claims of this sort, are the following: 1. Intentional deception on the part of subject. 2. Unintentional deception on the part of the subject. 3. Intentional collusion of confederates. 4. Unintentional collusion of by-standers. 5. Guess work and coincidences. 6. The phenomena of the involuntary life and of diseased states of the nervous system.

Any experiments with professed clairvoyants or mediums, in which all these sources of error are not avoided or allowed for, are of no value to science, and cannot be received. Even if all the errors that may arise from these six sources are provided for, the conclusions from these experiments, if contrary to presumption, cannot be accepted until they have been verified again and again by other experts. In all experimental enquiries, conclusions against presumptions of experts can only be received after full and repeated verification. In this department verification is all the more imperative, from the fact that the sources of error are more subtle. The best credential of an expert in this department is the ability to see, to avoid, or to allow for errors from all these sources. This is a credential that scarcely any of the authors on this subject have been able to furnish. Some have guarded against a portion of these errors, but not against all. Some have guarded against all, perhaps, but one or two, and for want of completeness in some one direction, the entire fabric of their conclusions fall to the ground. For here, especially, is it true that to be guilty of one omission is to be guilty of all. I assert with absolute positiveness that none of these stupendous claims are founded in fact; that the myriad recorders of clairvoyance, mind and thought reading, prescience, retrovision and second-sight, odic and psychic force, in trance or out of trance, would never have been heard of but for the non-expertness of writers and experimenters; that these claims, under the eye of the expert, are hollow, empty and transparent; and

further, I assert that to the expert there is, in this whole subject, no mystery whatever, save the general and universal mystery that surrounds all existence. I am fully aware, that in making this absolute assertion, I stand for the present, almost if not quite alone. I do not ignore the fact that the human race, savage, barbarian, and civilized, have almost unanimously believed in these claims, and that to-day among the more thoughtful classes who long since renounced or out-grown alchemy and spiritualism, witchcraft and astrology, practicing clairvoyants reap their best harvests; and that even among the best educated physicians, the belief in reality of clairvoyance, animal magnetism, and mind-reading, is very slow in dying out. In regard to all these claims, it may be conceded at once that none of them are theoretically impossible. Our existence is a greater mystery than the wildest assertions clairvoyants or mediums ever made. We might have been made with wings, so as to fly through space from star to star, but we are not so made, and without examining into the history of every human creature, we yet know, as well as it is possible for mortals to know anything, that no one here takes such a flight. Similarly it is now known to experts, and will in time be known to all reasoning creatures, that no one has ever read minds, predicted the future, seen into the past, or possessed any odic or psychic force. What is true of clairvoyance and allied delusions, is also true of the claims of witchcraft and spiritualism. When the hand of the expert touches them they vanish into air. Here, as in all branches of science, expert skill is everything; honesty and general ability and attainments as such count for nothing. Powerfully this appears in the report of the second committee of the French Academy; worse experiments, in the name of science, were never made, and very properly the report has not commanded respect. Here it is interesting to note that none of the committees ever fully solved the problem of mesmerism or animal magnetism; they found out what it was not, they did not find out what it was. The history of these delusions is marked by the labors of many able, honest non-experts, among whom Reichenbach, Olcott, Owen, Elliotson, Gregory, Hare, Crookes, Wallace, Cox, and some of the members of the scientific faculty of Yale are most conspicuous. It cannot be too often repeated that the phenomena of trance and of the involuntary life of which trance is a part, can be studied with success only by those who are profoundly and acknowledgly versed in the

physiology and pathology of the nervous system. The horrid blunders that mark the history of this science, have been made by great chemists, statesmen, lawyers, judges, astronomers, physicists, and naturalists. It is from the ranks of physiologists and practicing physicians that the experts in this branch must come, and in proportion as experts are devoloped, and as a knowledge of their conclusions become diffused, in that proportion will all these wondrous claims disappear from the civilized world.

Predisposing Causes.—All other conditions being the same, those are most predisposed to the different varieties of trance who are physically of a nervous, and mentally of an imaginative and credulous temperament. While there are very few, if any, who cannot be wholly or partially entranced through some of the emotions, when the operating causes are powerful, or through some form of disease or injury, there are many who cannot be made by any one, or by any of the known devices, to enter into the mesmeric form of trance. Although nervous susceptibility, credulity, and imagination, are frequent factors in the factors in those that are predisposed subjects to the trance, yet the most resolute in mind, and the most vigorous in body, may be and are put into the trance, and that too in spite of their determination to resist. Poor health and feeble constitution, as has been supposed, are not necessary elements. Women are, on the whole, rather more susceptible than men, but the difference is not very great. All ages, from infancy up to extreme old age, are susceptible; but the very young are not so susceptible as those between ten and twenty.

Hysterical persons, as a rule, are more easily entranced than those who are not hysetrical; but a person may go through all the stages of hysteria without being in any sense entranced.

Although the susceptiblity to trance varies with the individual, some entering into this state easily and rapidly, under any psychical or physical cause, others resisting the same influence with equal ease, up to a certain point; yet there are none who cannot be put into the trance state, provided the influence—psychical or physical—is adapted for the temperament. Some are insensible to the emotions of reverence or wonder, but are quite susceptible to fear, and can readily be entranced by it; and there are elements of terror that few can withstand. Thus, Rev. Dr. Buckley, who has studied medicine, and who has given very many public lectures on the trance, and performed publicly numerous experiments in so-called

mesmerism, informs me that, on one occasion, while preaching or lecturing, an alarm of fire was raised in the building, and great disturbance arose, as usual in such cases, men and women rushing furiously for the doors. For a time he kept cool, and was able to command himself; grasping the hand of a friend, he exhorted him to likewise keep cool, and not suffer himself to become entranced. Even while giving this good advice the symptoms of trance came upon him, and he became convulsed.

On another occasion, while preaching, he became entranced, and stood for fifteen minutes in that state, unconscious of what he was doing. He came out of the trance before his sermon was over and resumed his usual manner. Of what he said, and how he said it, during these fifteen minutes, he had no recollection, but his hearers declared that he was then unwontedly eloquent and spoke with extraordinary fervor, so that what was unusual under his preaching, a large number were affected seriously on the spot and came up to the anxious seat.

The same gentleman informs me that a well-known clergyman, at the time of the great preaching epidemic in Kentucky, went out there, in company with a friend, to investigate the phenomena, and both, on witnessing the contortions and hearing the cries of the victims, were themselves quickly taken down with the very jerking symptoms that they had come to investigate.

At one time Dupotet, the French apostle of animal magnetism in England, was giving a public lecture on his favorite theme, when a skeptic arose in the audience and declared that he could not mesmerize him, whatever he might do with others. "This moment thou shall feel my power!" shouted Dupotet, raising his arm and pointing at the skeptic, who involuntarily became affected.

In physiology there is a limit to the power of the will; in the strongest natures there is a limit of strength, on passing which they may act after the manner of the weak and cowardly.

Dr. John K. Mitchell* tested mesmerism on thirty-six children in one of the asylums of Philadelphia. Out of these thirty-six, ten were put to sleep, and of these three awoke when shaken or spoken to; of the other seven, three had the flushed face, accelerated pulse, and cold clammy hands.

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* Essay on Animal Magnatism, in Five Essays, p. 158.

Exciting Causes.—The causes or influences which give rise to the trance, are capable of a general classification. It will be seen that the different varieties of trance have received their names from the manner of their development, or from some prominent symptoms. In our ignorance of mental physiology and pathology it has been necessary to do this, just as is the case of many diseases. Thus, epilepsy is named from the single symptom of falling; hysteria is simply an endorsement of the now rejected theory that disease originates in the uterus; neuralgia means simply pain in the nerve, and gives no clue to the real pathology of which the nerve-pain is a symptom. Similarly hemiplegia and paraplegia are prominent and visible symptoms in various diseases of the brain and spinal cord. Hay fever is a term that will not soon die, although hay is but one of perhaps twenty or thirty exciting causes of that malady.

On the same principle of nomenclature which, in our ignorance of the ultimate mechanism of nerve-action in health and disease, we are forced to adopt, trance may be thus sub-divided.

1. *Spontaneous Trance.*—The subject falls into a trance as he falls into sleep during the day time, not only without any special exciting causes, but without any effort of his own will, even against his will. The liability to this form of trace comes from native nervous susceptibility, from injury or the use of drugs, producing a pathological state, or from certain diseases of the brain.

Under this head belongs somnambulism, which is the name given to most prominent symptoms of that form of trance—that is, walking in the sleep—catalepsy and ecstacy.

2. *Self-induced Trance.*—Some persons have the power of putting themselves into the trance state whenever they wish to do so. To this class belong the genuine trance speaking mediums. Trance, when it appears in this and the previous form, is usually called natural somnambulism. An interesting case of semi-trance, of the self-induced variety, came under my observation in the Fall of 1874.

Mr. R., aged 31 years, a clerk in a law office, came to my office one day, representing that he had some strange experiences that he wished to have explained. He stated that a few years before, while in California, he attended a table-tipping seance, and there learned that he had the power of involuntarily moving tables.

This surprised him. He was yet more astonished at the other symptoms that accompanied the movement of the table, the flush-

ing of face and eyes, the sighing respiration, the violent muscular action, and the subsequent exhaustion; he found, subsequently, that he could induce this condition whenever he chose, while sitting alone or with others, or when he lay down at night. He never became unconscious in any of these experiments, and at any moment he could resume his natural state.

Mr. R. did not understand what these facts indicated, and he professed to be very anxious to have them elucidated. Spiritualists, he alleges, had claimed him, and had urged him to join their ranks and become a medium. He was opposed, he said, to spiritualism, and yet he could not explain the phenomena that occurred in his own person, but referred them, in a general way, and after the manner of common speech, to magnetism or electricity. He had consulted various physicians of various grades, none of them, however, experts in this department, and had obtained no satisfaction.

The appearance of the man gave little that was peculiar—of medium size and statue, a reddish face and brown hair. His temperament was not very markedly nervous, and there was no special nerve history in his family. At different times he gave me a number of exhibitions of his peculiar gifts, both alone and in the presence of medical and other friends. Rev. J. M. Buckley, whose experience in the study of trance has been greater than that of any other person I know of, spent a portion of an evening in observing this case, and noticed the peculiarity, that the muscular movements were out of all proportion to the mental state; that is, when there were violent and involuntary jerkings and contortions, the subject was quite conscious, and could at any moment return to his usual condition.

The process by which he entered into the trance is as follows: He sits down, resting his hands on a small table or stand, or on his knees, and closes his eyes. In a very short time, less than a minute usually, the face begins to flush, the breast heaves, the breathing is through the nose and audible, just as with one taking nitrous oxide gas and beginning to get under its influence; the arms jerk backwards and forwards, like a patient with chorea, and sometimes the legs also. If his hands rest on a table, he may, when requested to, keep them on it, and in the course of a few minutes, the table, if not too heavy, will roll to and fro and perhaps be upset. If a pencil be placed in his hand he will write on a slate or paper, in a coarse and illegible manner; sometimes he will rise and walk

about the room, moving his arms backward and forward; if the suggestion is made by any one in the room he will make a trance speech, with all the emphasis of manner and gesticulation, beginning in a stumbling, incoherent talk, and rising to clear and easy delivery. The pulse is usually raised a few beats.

Mr. R. represents that the involuntary movement of the limbs he can restrain, if he tries to do so. Sometimes a chill is felt through the body, beginning it may be at the top of the head, and thence extending down the limbs; other times these special sensations are not experienced, but the feet and hands are always cold. The next symptom that he feels is heaving of the breast and labored respiration; then comes a feeling of congestion in the eye-balls and face, in rolling them, and involuntary closing and opening of the lids. If he keeps a long time in this state the symptoms deepen somewhat, but in all the stages that he has yet succeeded in reaching, he is sufficiently conscious to return, whenever he chooses, to the normal state. Even while he is jerking his limbs, tossing his head backward, tipping a table, and making a speech, he has a certain knowledge what he is about, although none of these actions are voluntary. He appears, indeed, to be in the state familiar to persons of great self-control, who have become partially anæsthetized by nitrous oxide gas or chloroform. Resolute persons may so far succeed in resisting the action of these agents, that they can watch the anæsthetizing process for some time after it has commenced. They may do all sorts of strange things while this process is going on, may laugh, or strike, or kick, or run around the room, and yet be all the time conscious of their action, and if they wish to do so they can control themselves. I was curious to ascertain what the effect of electricity would be on Mr. R., and I used, at different times, both currents on him, making the application just before he was to enter the trance and while it was upon him. I used currents of moderate strength, placing one pole at the back of the neck and the other in the hand. The effect was apparently to diminish the muscular motions, and correspondingly, according to his own statement, to increase the mental state; in other words, to reduce the jerking and general spasmodic action, and increase the tendency towards unconsciousness. I was desirous, also, of ascertaining whether the retinal circulation was at all affected during the trance, and accordingly I sent Mr. R. to Dr. E. G. Loring, who examined the eye with the ophthalmoscope, just before, during,

and just as he went into the trance. He found no decided change in the retinal circulation. It should, however, be remembered here that it is the belief of some at least of the experts who have studied the relation of retinal circulation to the general circulation, that the former does not share in the latter to the extent that has been supposed.

Mr. R. states that he had many times tried to reach the stage of complete unconsciousness, but had never once succeeded; but he found this, that long continuance in the trance tended to deepen the mental and muscular phenomena, but only to a certain point which he could never pass. The after-effect of these experiments was general nervousness with depression; he usually slept less soundly after an evening of experimenting, and on that account was indisposed to pursue the subject farther than was necessary to give me an opportunity to study him. He stated, when he first came to me, that he had not gone into this state for six years.

The query at once arises whether this man was not a deceiver. Had he not studied the manifestations of trance so far as to successfully counterfeit them at will? That it is possible to counterfeit some of the symptoms of trance when any object is to be gained by so doing, clairvoyants, mind-readers, and mediums, daily prove. Mr. R. had no conceivable object in deceiving me. He made no money by his performances, and had no hope of money thereby. Notoriety could not have been his object, since he was disinclined to exhibit before a large medical society. On the occasion of my reading a paper on this subject, he promised to appear, as a favor to myself, but failed to keep his promise. Another similar invitation was similarly declined. In a purely private way he was willing to show what he could do, but then only by special request. To this fact it may be added that his whole appearance suggested straightforwardness and honesty, but these qualities can be counterfeited to perfection, as all who deal with mind-readers and mediums soon find out.

Dr. Hammond* has described an interesting case of a young lady who had the power of inducing the trance. She had been a somnambulist, but under treatment and hygiene, she had recovered, but relapsed through over toil, and acquired the faculty of putting herself in the trance state. Her method was to take and read a

*Physics and Physiology of Spiritualism, p. 29.

book of philosophy in which she was much interested, select a paragraph that demanded thought, or calculated to arouse the emotions. After reading she would close the book, fix her eyes without looking at anything in particular, and think over what she had read. In this way she could pass into the trance state. Dr. Hammond tested her with a portion of the Apology of Socrates, of which she read a few sentences. "As she reached the close her voice became inexpressably sad, the book dropped from her hands, her eyes were fixed on vacancy, her hands lay quietly in her lap, her breath came, and tears were flowing down her cheeks; her pulse, which before she began to read was eighty-four per minute, was now one hundred and eight. As her abstraction became more profound it fell, till, when she was unconscious, three minutes after she ceased reading, it was only seventy-two." Testing her, by applying a bottle of strong equa ammonia, or by touching the eye with the finger, it was found that there was no sensibility. The subject was thoroughly hypnotized. It had been claimed, that while in this state, "she read books held behind her, described scenes passing in distant places, and communicated messages from the dead." The doctor tested her in various ways, and found, of course, these claims were baseless. She could not tell the time, by a watch held to the back of her head, nor read a particular line in a closed book, for, although she gave some sort of a reply, it was always wrong. The only senses that were active were those of hearing and the touch, but they were not exalted. There was *analgesia*, or lack of sense of pain, for although she could tell the shape or quality of object, by feeling them, she felt no pain when a pin was thrust into the calf of her leg, or when a coal of fire was brought near any part of her body. She was capable of entertaining hallucinations.

Emotional Trance.—Under this head are included mesmerism, or hypnotism (artificial somnambulism), as well as the large class of cases where the trance is produced without the intervention of any persons, but simply through some influence that powerfully acts on the emotional nature. Mesmeric trance is derived from Mesmer, who, although a charlatan, really did some good service in calling attention to this remarkable phenomenon. His theory, and all other theories of animal magnetism, must now be abandoned, but the phenomena produced by ceremonies that he employed—passes, pressure of hands, stareing—are permanent facts, but are differently interpreted, for it is now known that the same effects can be pro-

duced spontaneously, at the wish of the subject, or by any process that displaces the will.

Dr. Mitchell contends, that in mesmerizing through passes, the effects vary with the direction of the current. He claims that only passes in peripheral directions produce mesmeric effects, while passes in the central, or centripetal direction, restore to the natural state. The centripetal passes relieve the rigidity or the paralysis of the limbs, caused by the peripheral passes. Dr. Mitchell claims that when precautions are taken, such as blindfolding the subject so as that he cannot see the direction of the passes, or enclosing the arms, from the tip of the fingers to the shoulders, in a glass tube which was wide enough to allow of visible motion, the results were the same. Peripheral passes cause rigidity, central or centripetal passes cause relaxation and restoration. The evidence on this point, as given by Dr. Mitchell, is conclusively overthrown by other facts of trance with which he was not familiar, but which are recorded in this paper. His theory of vital induction is an unnecessary and undemonstrable hypothesis.

The time required to induce the condition of trance, through any of the various methods of fixing the attention, ranges between the fraction of a minute and half an hour; the average of time being perhaps ten or twelve minutes. Usually it is of little use to work over a subject more than half an hour. Many subjects possess, and others acquire, the power of coming out of the mesmeric state, especially from the milder stages. If left alone, and no efforts are made to awaken, those mesmerized subjects will almost always awaken of themselves in from half an hour to two or three hours. The fears that they will not awaken are not, therefore, well founded. The nervous system is, however, sometimes affected most seriously, and rare cases have been reported, on the authority of those who are more or less experts, where these special efforts have been required to arouse the sleeper, and illness has followed.

The notion, that a mesmerized subject can only be awakened by the operator under whose supposed influence he goes to sleep, has no just foundation. Any one of the by-standers can awaken the subject. He will awaken himself, if left alone through some hours. So far as I can learn, there is no case where a mesmerized subject absolutely refused to awaken. Cases where there is difficulty in awakening the subject, or where, being awakened, unpleasant and alarming phenomena appears, do now and then occur. Thus, Dr.

J. K. Mitchell reports the following case: "At 4 o'clock A. M., one tempestuous morning, a parent, in the agony of his apprehension for the safety of his only child, called me to assist in rescuing her from a mesmeric sleep as deep as ordinary coma. The mesmerizer, young and inexperienced, loosing hope had toiled vainly from 10 o'clock P. M., and was himself in a state bordering on phrensy. A calm deportment, choice of position, quiet passes, sufficed in an half hour to restore this child to the arms of her parents." In such cases the difficulty is usually not so much with the subject as with the operator. He looses confidence in himself, becomes alarmed, and communicates this fear to the subject, who thereby is kept from coming out of the trance, or if he comes out, is nervous or excited. Dr. C. L. Mitchell tells me a story which will illustrate this fact. A friend of his came to his house one morning being terribly distressed in countenance, and telling a frightful story of a night's experience in mesmerism. He had mesmerized a young lady, a relative, and on bringing her out she began to shriek and cry so violently and so loudly that the neighbors became alarmed, and it was necessary to mesmerize her in order to keep her quiet. On again restoring her to her natural state, she renewed her shrieking, and again it was necessary to put her back into the trance; so this alternation of going into and coming out of the trance was kept up during the night. Prof. S. G. Armor informs me that he once had quite an unpleasant experience of a similar kind. A young man was put to sleep and he could not at first awaken him. He tried all methods, and even walked him about the streets in the night. In all such cases, lack of confidence on the part of the inexperienced operator is communicated to the subject, who becomes nervous and hysterical, for the same reason that a drowning man would struggle when he loses confidence in the strength and swimming powers of the one who attempts to save him.

The methods of fixing the attention to induce trance can be indefinitely varied. The processes usually employed are the following:

1. The operator makes passes to and from the subject near to him, but usually not touching him. These passes may be in various directions.

2. The operator sits down before the subject and pressing his thumbs against those of the subject, stares him closely in the eye.

3. The operator holds some bright object a few inches above

the head of the subject, forcing him to strain his eyes as he gazes at it.

4. The subject gazes fixedly at any object on the wall, at a little distance from the eye.

These two methods were adopted by Mr. Braid, of Manchester, hence the term *Braidism*, or *hypnotism*.

5. The operator stands before an audience, requests them all to rise, and to fix their gaze on him for a few minutes. A certain number of the audience will in time be hypotized.

6. The subject sits down quietly, takes one hand in another, and controls his thoughts.

7. The subject stands quite still, in an attitude of reverence, with folded hands and closed eyes.

This is a favorite method with Rev. Mr. Buckley.

In all these three latter methods it is an advantage to have a number of persons tested at one time. It is also an advantage to have the experiment follow a lecture, in which the symptoms of trance have been described, and the subject knows what to expect.

8. The subject holds in his hand a round or oval shaped piece of glass, or jet, or crystal (the so-called "magic crystal"), or simply a button or piece of coin, or other object, and gazes on it.

If the subject is sufficiently susceptible and imaginative, he may in time see figures, forms, faces, and all sorts of appearances in the crystal, and the other symptoms of trance may also be developed. This was the method employed by the famous charlatans of the middle ages. Holding a button, coin, or other bright object, simply helps to fix the attention. Some of the very best cases of mesmeric trance that I ever saw were produced by simply directing the subjects to sit still and control their thoughts, the hand being held on the wrist of the other, as in the act of feeling the pulse. The sorcerers of Egypt, it is said, made their subjects gaze at a drop of ink (a liquid mirror), at the same time using fumigation and manipulation.

9. The subject drinks water that he supposes to be magnetized. Under the influence of the imagination the water which he supposes to be magnetized will acquire at once a different taste, and thus, while drinking, he may fall into the trance. Holding any object, as a letter or book, supposed to be magnetized—a real magnet or an imitation of one—will have the same effect.

10. Direct suggestion or command. A celebrated mesmerizer could put some of his subjects into a trance by uttering, in an authoritative manner, the command, "*Dormez!*" In all these different methods of mesmerizing or hypnotizing patients, the one common fact is, the attention of the subject is fixed; and this fixing of the attention results in weariness. This is sometimes reinforced by the influence of the emotions of expectation, awe, and reverence, and hence it is that mesmerizers of great fame are more successful than those who are unknown or just beginning, for in the presence of the famous operator the subject expects to become mesmerized. Much also depends on the manner of the operator, in his confidence in himself, and his capacity to so inspire the emotion of confidence in the subject. A mesmerized subject can be made to believe that the water that he drinks is milk, or rum, or wine, or tea, or coffee, and it tastes as such to him. Drinking it, as whiskey, he may become drunk, or reel like one really intoxicated. They can be made to fish or to shoot, to swim or to speak, to play billiards, or to row in a boat. They can be deluded into the belief that a chair is an elephant, a stool a hyena, and will run from it in terror; a book an accordion, and will try to play on it. They can be made to hear a coming storm, and to hide for shelter; to pick up fruit from beneath a tree, and hand it to the spectators. Give the subject an apple, and tell him it is an orange, and it will become yellow to him, when opened and put to the mouth it will taste like an orange. These delusions take place with perceptible slowness, and oftentimes it is possible to trace the conflict between the reality and the illusion in the face of the subject. The *en rapport* or sympathy of the subject with the operator, so that he obeys his voice and suggestion, is wholly a matter of imagination with the subject. The belief that there is some peculiar physical sympathy between subject and operator, has no foundation. If the subject enters into the mesmeric trance in the presence of one whom he supposes to have superior and peculiar "magnetic" powers, and who, by some one of the various modes of fixing the attention, "puts him to sleep," he will very likely act in obedience to the suggestions of that person. These suggestions may be conveyed by audible speech, by touch, or by movements of various kinds, or by looks, gestures, or by any mode of conveying the wish of one person to the mind of another.

The person with whom the subject supposes himself to be *en rapport* can transfer this supposed relation to some other person.

In the public exhibitions of mesmerism the supposed *en rapport* makes a great impression. The notion, that the silent, unexpressed will of the operator is appreciated and obeyed by the subject, can readily be disproved where all errors are rightly excluded.

Prof. Czermak has proved that animals can be hypnotized. If a crab is placed on its head and claws, and held there, it soon stops struggling and becomes motionless; in a little time, if left to itself, it resumes its natural state. If the animal is held on its back, by a glass, the result is the same. Ducks, geese, and swans can be hypnotized by holding them on the back, keeping the head in a fixed condition by means of the thumb and forefinger and keeping the head and neck somewhat stretched backward. If a frog be laid on its back, and a band be drawn moderately tight around the upper part of each leg, it also becomes hypnotized; remove the band and it keeps in its quiet condition for a time, then resumes its natural state. A pigeon cannot be hypnotized by any of these methods, but by fixing the attention on some object. Chickens can be thrown into this state by means of a piece of pasteboard cut into the form of a horseshoe and hung over their comb, allowing the ends to come just in front of the eyes; they fall into a condition simulating sleep, in which their heads can be raised and lowered, remaining where placed, as if the neck were made of wax.

One may become entranced through the emotion of anger. Passionate natures easily lose self-control, and, under exciting causes, the most trifling may become as thoroughly entranced as though they were mesmerized, but, of course, with different manifestations. In violent fits of rage the subject sees nothing, hears nothing except what relates to the object of his resentment; he exaggerates his real or fancied cause of displeasure, and may see and hear what has no existence except in his own brain. Hence the wisdom of deferring all important action in such cases until the storm of passion has passed away.

The emotion of grief may put one into a trance. The sudden and terrible agony that follows the first news of bereavement may so thoroughly divorce the mind and will, that the unhappy subject is for the time as much at the mercy of the nearest second person as in the so-called mesmerized subject. The distracted mother, bending frantically over the form of her lost child, is oftentimes wholly

under the control of her grief, her words and actions being as involuntary as her sobs and tears. How often does it happen, under such circumstances, that the afflicted wife or mother displays unwonted physical strength and endurance like those who are put into the trance state through the passes of an operator. The emotion of wonder may put one into the trance. Wonder and awe, complicated with reverence, are, for the average untrained mind, the most frequently acting of the causes that produce the trance state. Strikingly and constantly this is seen in the seances of mediums, clairvoyants and magnetizers. The emotion of reverence is so potent that very few who, for the first time, enter a room where professed communications are received, are able to be as cool and as calm as though no such pretence were made. Even those whose skepticism is absolute, who know full well that the mediums whose exhibitions they are studying are stupid swindlers, yet are at first influenced more or less, by the very pretence of spiritual communications; and if the proceedings are conducted with proper form and flummery, they may, in spite of themselves and unknown to themselves, be brought under the influence of the emotion of reverence, or its allies, wonder, awe, and fear; being thus partially entranced, and in the power of dominant emotions, and the will, as it were, slipping off its throne, they are incapable of closely investigating the phenomena before them, they are, like partially paralyzed patients, trying to run and fail, not knowing why or how they fail. If this be true as it is of skeptical, strong-minded investigators, it is true all the more of weak believers in these pretentious performances; they are powerless as babes; their honesty, like their credulity, may be unlimited. But honesty is of no use to a man entranced; honesty alone, unaided by the will and reason, can no more find the truth than it can take the place of the legs and run, or of the arms and fight. These tender and credulous natures, as soon as they enter the room where mediums profess to bring up the forms of departed spirits, or to communicate with them by signs that the senses can appreciate, become entranced at once—they leave their will at the door. Tests that once occur to one in an active state, and which, if tried, would show instantly the cheapness of the trickery, is either not thought of, or if thought of, is badly used, or not at all. Under these circumstances they may go into the severe stages of the trance, so that they see whatever they are told to see, hear whatever they are told to hear, or feel whatever they think they

ought to feel, and any statements they may make of what they suppose to have transpired are of about as much worth as the statements of discharged lunatics of the treatment they received while in asylum. It not unfrequently occurs at these seances that weak and believing spectators go off into the convulsions of trance, and see all manner of apparitions, and hear any variety of rappings, knockings, and other spiritual sounds. Thus, in an extempore seance at the Eddy homestead, at which I was present, one lady in the circle became convulsed, like a patient in the attack of hysteria, fell off the chair, clasping her hands nervously together, declaring she saw a spirit.

In connection with the phenomena of trance, as developed through the emotions of wonder, reverence and expectation, the following extracts from a series of directions "*How to form a spirit circle,*" taken from the *Spiritual Scientist*, are interesting and suggestive. It will be observed that a large number of the symptoms of trance are correctly described. It is in the interpretation given to these well known and fully understood phenomena, that the non-expertness of the author is shown. My comments are in brackets.

"It is calculated that one person in every seven might become a medium by observing the proper conditions." [About this proportion are capable of being mesmerized, or hypnotized, the first trial, although estimates vary. By some methods of producing trance, and at the hands of a performer in whom the subjects have great confidence, the proportion will be greater.]

"Should no results be obtained on the first occasion, try again with other sitters. One or more persons possessing medial powers without knowing it are to be found in nearly every household." [Many who are not entranced first, develop this power by practice. This is true of all the various methods employed.]

"Let the room be of a comfortable temperature, but cool rather than warm—let arrangements be made that nobody shall enter it, and that there shall be no interruption for one hour during the sitting of the circle." [Subjects in a "circle" are entranced through the concentration of the emotions of wonder, reverence, and expectation; any serious interference with this concentration of attention will interfere with the development of trance.]

"Let the circle consist of from three or five to ten individuals, about the same number of each sex. Sit round an uncovered wooden table, with all the palms of the hands on its top surface.

Whether the hands touch each other or not is usually of no importance. Any table will do, just large enough to conveniently accommodate the sitters. The removal of a hand from the table for a few seconds does no harm; but when one of the sitters breaks the circle by leaving the table, it sometimes, but not always, very considerably delays the manifestations." [If the table were covered the cover would slip under the involuntary movements of the fingers, and no movement would be likely to take place unless the table were small or very firm pressure were used. Leaving the table interferes with the concentration of attention, both on the part of the person who leaves, and also of the other sitters.]

"Before the sitting begins, place some pointed lead pencils and some sheets of clean writing paper on the table, to write down any communication that may be obtained." [The special phenomena that takes place in trance depend on the attendant circumstances; if a pencil and paper be near at hand, writing, through involuntary action of mind and muscle, may take place, and the medium may record many things that he has long since forgotten.]

"People who do not like each other should not sit in the same circle, for such a want of harmony tends to prevent manifestations, except with well-developed physical mediums; it is not yet known why. Belief or unbelief has no influence on the manifestations, but an acrid feeling against them is a weakening influence." [The emotion of hatred interferes seriously with the concentration of attention through the other emotions; similarly with unbelief, but the unbelief of one or two will not keep the other members of the circle from becoming entranced.]

"Before the manifestions begin, it is well to engage in general conversation or in singing, and it is best that neither should be of a frivolous nature. A prayerful, earnest feeling among the members of the circle gives the higher spirits more power to come to the circle, and makes it more difficult for the lower spirits to get near." [Every thing that tends to deepen the emotions of reverence aids the developments of trance.]

"The first symptoms of the invisible power at work is often a feeling like a cool wind sweeping over the hands. The first manifestations will probably be table tiltings or raps." [Mediums describe these sensations variously; some speak of a "galvanic thrill," others of an "aura," others of a feeling of "coldness."

Subjects of all kinds are apt to experience similar sensations at the commencement of the trance, however produced.]

"When motions of the table, or sounds, are produced freely, to avoid confusion, let one person only speak, and talk to the table as to an intelligent being. Let him tell the table that three tips or raps mean 'Yes,' one means 'No,' and two means 'Doubtful,' and ask whether the arrangement is understood. If three signals be given in answer, then say, 'If I speak the letters of the alphabet slowly, will you signal every time I come to the letter you want, and spell us out a message?' Should three signals be given, set to work on the plan proposed, and from this time an intelligent system of communication is established." [The table is moved unconsciously by some one or by several of the operators, and whatever they agree upon to expect, will happen, provided it is possible to produce it by involuntary action of mind and body. If they should agree that thirty tilts or raps meant "yes," ten meant "no," and fifteen meant "doubtful," the results of the interview would be the same, unless the "mediums" should become fatigued through so much exertion.]

"Afterwards the question should be put, 'Are we sitting in the right order to get the best manifestations?' Probably some members of the circle will then be told to change seats with each other, and the signals will be afterwards strengthened. Next ask, 'Who is the medium?' When spirits come asserting themselves to be related or known to anybody present, well-chosen questions should be put to test the accuracy of the statements, as spirits of the body have all the virtues and all the failings of spirits in the body." [The "spirits" here referred to are in the body. They are the automatic actions of brain and muscle; they are untrustworthy and liable to blunder, because they represent the untrustworthiness, and mistakes, and ignorance of the entranced operator.]

"A powerful physical medium is usually a person of an impulsive, affectionate, and genial nature, and very sensitive to mesmeric influences. The majority of media are ladies." [Spirit circles are the best of all mesmeric influences. The trance which they develop is similar, in very many important features, though usually less profound, to that which is developed by "passes," "staring," "looking at bright objects," &c. Ladies are more easily entranced, as a rule, than men, for the obvious reasons above given.]

"The best manifestations are obtained when the medium and all

the members of the circle are strongly bound together by the affections, and are thoroughly comfortable and happy; the manifestations are born of the spirit, and shrink somewhat from the lower mental influences of earth. Family circles, with no strangers present, are usually the best. If the circle is composed of persons with suitable temperaments, manifestations will take place readily; if the contrary be the case, much perseverance will be necessary. Possibly, at the first sitting of a circle, symptoms of other forms of mediumship than tilts or raps may make their appearance." [The manifestations are born of the emotional trance, and shrink from the reason. Family circles, where there are a number of children—especially girls—make good subjects for trance. In hypnotism, mesmerism, &c., perseverance is required, and often succeeds where at first we fail. Trance, in all its varieties, require practice. Trance tends to repeat itself in special phenomena. What the phenomena of the first trance will be, it is impossible to predict. When a subject gets into the habit of developing a certain class of phenomena in the trance, the same class of phenomena will appear in subsequent experiments.]

The different methods of putting one into the trance state, by fixing the attention, was illustrated in the case of a subject whom a friend of mine was accustomed to mesmerize by passes with the hands. At one time it took him eight minutes to get him into a state where he could not open his eyes, and when his arm was extended, when told that he could not flex it, it remained pretty steadily flexed. Immediately after I tried the same patient by the method of Braid, holding a key a few inches over his eyes, and compelling him to strain the eyes somewhat as he fixed them on the key. In fifteen minutes he was in the same state as he had entered with passes. This experiment proved, as clearly as a single experiment could, that whatever animal magnetism there might be in the matter, belonged as much to me as to my friend. I then made an experiment, the object of which was to show that "Animal magnetism," or any other force proceeding from any second party had nothing to do with the matter. I took the subject into another room, told him to stand with hands folded in the attitude of prayer, and eyes raised somewhat and fixed on the upper hinges of a door. I told him that in a few minutes he would be sleepy; I left him there, closed the door, and chatted with my friend in the adjoining room about various matters. In fifteen minutes I entered the room

where the subject was standing and found him drowsy, and with a sensation, as he represented it, as though he would fall backward. On extending the arms they exhibited a tendency to remain in a fixed state, but a heavy chair placed in one of them slowly brought it down.

Intellectual Trance.—Concentration of the reasoning powers, on any one theme, may induce a semi-trance state, with various physical symptoms, as fixity of position, flushing of the face, rapid pulse, cold extremities, and so forth.

The recorded cases of absence of mind in great thinkers and scholars are very interesting. Thus, of a great mathematician, it is said that he seemed for hours more like a dead person than a living, and was then wholly unconscious of every thing going on around him. Joseph Scaliger was so absorbed in the study of Homer, during the massacre of St. Bartholomew, that he knew nothing of it until the following day. I have heard of a great lawyer who made an engagement to marry a lady to whom he was sincerely attached. The day of the marriage was set, and on the part of the lady all the arrangements were made, but he forgot all about it, and it did not occur to him for over a month when he thought of his appointment and hastened to the home of his expectant bride, to find her married to one of his friends.

Pathological states—temporary or permanent—disorders of the brain, such as appear in the different forms of insanity, or as are caused by certain drugs—as hasheesh, opium, or by nitrous oxide, ether and chloroform—or by exhausting diseases, induce the first variety or *spontaneous* trance. None of these causes, uniformly, produce the effect of trance. Indeed, only occasionally are we to look for any of the prominent and distinctive marks of trance from injuries to the brain, from insanity, or from drugs. The question naturally occurs, through what part of the nervous system does the automatism of the trance arise. Is one half of the brain inactive in this state? Dr. Laycock has suggested that the central ganglia are the centers of automatic movements. Dr. Hammond has sought to explain the automatism of the trance by the theory that the spinal cord, as well as the brain, may be the organ of the mind. That important reflex movements, which have a definite object in view, are made by frogs from which the brain has been removed, is well known, but that these definite and apparently intelligent reflex movements depend on conscious-

ness in the cord, is difficult to prove, although it is not an impossible consideration. Against this theory are these considerations. 1. The experiments that illustrate these interesting reflex phenomena are made mostly on the lower animals, as frogs, that have but little conscious life, who are almost entirely automatons, even when the brain and whole nervous system are intact. It is entirely probable that with the lower forms of life the center of nerve action, such as it is, is not in any one point of the nervous system, but at many points or everywhere. In the higher forms of life, certainly in man who has consciousness, the probability is that this consciousness is restricted to the encephalon, while reflex movements of various kinds, which are common to men and the lower animals, take place through the spinal cord. 2. In those infantile monstrosities that have no brain, the reflex acts of sucking, and so forth, are performed through the spinal cord, it is true, but these same acts in the healthy infant are at first purely automatic, and are no evidence of consciousness. The new born baby is simply a machine. 3. In most of the stages and varieties of trance some of the senses that depend on the brain are active, and frequently they are much exalted, and, besides, the subjects give as much evidence by word and deed of an active and conscious state of the brain as in the ordinary state, save that the will has no influence over them. Even in the somnambulist form of trance, the brain is active, and is evidently dreaming, though the act of walking, like all the acts is automatic.

Contagiousness of Trance.—The contagiousness of trance is one of its most suggestive features. The condition may spread through vast multitudes, or through a large army, more rapidly than contagious diseases from which men suffer, for psychical contagion is as much more speedy, as it is more subtle, than physical contagion. In 1374 troops of men and women came out of Aux le Chapelle in a state of trance, dancing round and round with terrific violence, groaning fearfully, and complaining of horrible visions. In many cases there were tympanitic distensions of the abdomen, which they sought to relieve by bandaging, or by kneading with the hands. Through psychical contagion the disease spread over the country; as usual, it led to immorality; at the meeting places of their half crazed fanatics, orgies of the most abominable kind were celebrated. In 1418 Strasburg was afflicted, and thence vast multitudes made pilgrimages to the chapel of St. Vitus, where they expected to be healed; hence the term St. Vitus dance.

Another well known form of dancing mania was the so-called Tarantism of Italy. The disease was supposed to be caused by the bite of a species of spider found on the coasts of the Mediterranean. The bite of this spider has a certain degree of poisonous effect, but this disease, Tarantism, was really moral contagion, in which many of the symptoms of genuine poisoning appeared, complicated with nervous symptoms, such as attended other dancing manias of the middle ages. The majority of those who suffered from this disease had never been bitten by the Tarantulus at all, and all their symptoms were the result of imagination only. Learned men of that time tried to solve the difficulty by supposing that the bite of other insects caused this disease, but there was no proof of any such thing; it was psychical contagion, and nothing more. The patients fell into a state resembling that produced by the bite of the Tarantulus, and then followed melancholy, which caused them to seek lonely and out of the way places where they lay on the ground groaning, sighing, or howling. Sometimes they jumped up and ran furiously about, or they stripped themselves and rolled over and over and begged to be pounded and beaten as a special favor. Sometimes they breathed with difficulty and sighed terribly, and again they would lie still, as though dead. The attack usually went off with profuse perspiration. Twelve hours a day, by the clock, some of these patients would dance at the sound of music, they would then rest a little in bed, and then, unwearied, return to the dance, and this they would do for several days in succession. These attacks would occur annually at the same time. In some parts of Scotland there was, at one time, an epidemic of "leaping ague." Those afflicted with the disease complained, at first, of pain in the head and back, then came on convulsions and fits of dancing. During the paroxysms they acted like maniacs; they leaped and jumped incredible distances, in the most perilous positions, with an agility and precision that were amazing and terrifying. These actions were all involuntary, but they were performed with greater skill and correctness than similar performances by professed gymnasts. In 1841 an epidemic of religious ecstacy broke out in Sweden, in which every case was noted by competent medical observers. The affection was mainly confined to those of from sixteen to thirty years of age, the plurality being females. Excepting the first, a nervous girl of sixteen, who may fairly be said to have read her-

self into it, no one is known to have been affected, except after seeing or hearing another so affected. Like most epidemics, this one attained its maximum by degrees and then in the same manner declined. Treating the persons affected as diseased, rapidly effected cure in most cases. Removing an audience was the most successful of all measures. The exact number of cases is not known, but could not have been less than several thousand. The epidemic resembles, in all essential particulars, the jerking revival which raged in Kentucky and Tennessee in 1800, described by Dr. Robertson and others. According to Zimmerman, a nun in a large convent in France commenced to mew like a cat, other nuns in the convent followed her example, and then all the nuns mewed for several hours in succession at a certain time of the day. The disorder was cured by telling the nuns that soldiers would enter the convent and whip them with rods, unless they desisted.

Effects of Trance on the Nervous System.—The usual effects of ordinary trance, spontaneous, or self-induced, or mesmeric, are not permanently or even temporarily injurious. In some nervousness, and very frequently, weariness follows a severe fit of trance; indeed, weariness is so constant a symptom that it is feigned almost invariably by public mediums, mind-readers, clairvoyants, and other imposters, who wish to counterfeit trance. This weariness is, however, not unlike that which follows severe active exertion, and soon passes away. Only rarely does this weariness pass into chronic nervousness. Dr. J. K. Mitchell reports that a lady of previous good health was thrown into an alarming convulsions by an attempt to mesmerize her. In ten years she had not entirely recovered from the evil effects. The same observer states, that while attempting to mesmerize a stout, healthy man, the circulation was suddenly arrested, and the heart stopped beating; he fell on the floor as if dead. A few passes restored him.

Therapeutical Uses of Mesmeric Trance.—The therapeutical uses of mesmerism, or hypnotism, are not so important as at first thought, it would seem they should be. It is easy for the mesmerizer to make the subject under his control imagine pain in any part of his body, and, by suggestion, can cause the pain to depart.

Subjects who are in pain may be relieved of the pain during the state of trance, and in some cases this relief is permanent, but more frequently the pain returns sooner or later, and needs a repetition of

the treatment. There is no evidence, that long-standing cases of nervous, or other diseases, have ever been cured by the trance, however induced. Mesmerism, or hypnotism, is, therefore, not to be recommended as a regular therapeutical procedure in important cases. Many of the results that are derived from, or during mesmeric experiments, are due to psychic or mental influence, and can be explained readily without resort to the influence of the trance. It is possible, as I have proved and am now proving by systematic experiments, to relieve and permanently cure a vast variety of nervous symptoms, without the aid of trance, by mental therapeutics alone.

The above, so far as I know, is the first systematic attempt that has been made in recent times, to reduce the study of trance to a science; to define its nature and unify its varied phenomena.

The phenomena of "animal magnetism" are really the phenomena of trance. "Animal magnetism" is the mother of the great delusions of modern times—clairvoyance, spiritualism, and mind-reading. Whatever scientific basis there may be to these delusions is found in the trance, and in the involuntary life of which the trance is a part. The study of trance is, therefore, of the highest interest, both scientific and practical. Had the trance and the involuntary life been thoroughly understood by the profession, and a knowledge of them widely diffused, these delusions would have had no vitality.

MISCELLANEOUS NOTES.

Chromated Lead as an Electro-Negative Element.

A number of inquiries have been received in regard to the value of chromated lead, spoken of in the first number of this journal, over carbon. Dr. Sass, who has used it, claims that it wears out under hard usage. Mr. Thomas Hall, of Boston, informs us that after trying the chromated lead, for a given time, in his faradic machine, he has abandoned it, convinced that its enduring power is less than that of carbon, although at first it works excellently.

Platinized Copper as an Electro-negative Element.

Dr. Byrne has devised an electro-negative element of platinized copper, which he used in his galvano-cautery battery. The copper is platinized in such a way that it keeps on, in spite of hard usage, so far as can be judged by experience up to date. The theoretical advantage of this element is, that the copper, by virtue of its superior conductibility, allows the electricity to escape from the battery, and thus prevents the great evolution of heat in the battery, which, in all the cautery batteries, is a serious disadvantage. The heat in the battery, like the heat in the wire outside the battery, is caused by resistance. As all the electricity cannot pass on account of the resistance, it degrades into heat in accordance with the law of the transformation of force. In all medical batteries, when in action, there is more or less heat, and especially in these batteries that are used for the purposes of galvano-cautery; all the electricity thus changed into heat within the battery is, of course, wasted. What is needed is, as much as possible, heat outside the battery in the platinum wire. On account of this evolution of heat in the galvano-cautery battery, and the waste of the electrical force, it is necessary to make the batteries very large and cumbersome. Even Dr. Byrne's small battery is larger than it would need to be if much of the electricity were not wasted by

being degraded into heat. To meet this difficulty he now employs platinized copper—the platinum and the copper both being good electro-negative elements, and the copper especially a most excellent conductor of electricity.

Central Galvanization for Chronic Eczema.

Confirmations of the results we have claimed for central galvanization, come in from various sources.

"Dr. Palmer reported that he had now under his care a lady at the climacteric period, who had an attack of eczema about the age of puberty. After leaving her it did not again appear until during her first pregnancy; after this she was not again affected until the establishment of the climacteric period. The disease now affected the scalp, face, and neck. In order to thoroughly test galvanization he used no local or constitutional medication, although the patient was in a broken down condition of body. In one half week after the first application she expressed decided relief, and has progressed steadily ever since then. In one other case he had employed central galvanization without obtaining any appreciable result."—*Transactions of Cincinnati Academy of Medicine, Feb. 6th, 1875. Reported in the Clinic, April 3d.*

Remarkable Phase of Hay Fever.

Our attention has been called to a case of what appears from the history to be eczema, appearing in the Fall every year about the 20th of August and lasting until cold weather—the precise season for the later summer catarrh. The patient also has asthma, in connection with the eczema, and like hay fever patients in general, is affected unfavorably by dust, bright sunlight, or gas-light. Irritants seem to make the eczema of the face worse, just as they make catarrh, which usually attends hay fever, worse. The eczema seems to act vicariously to the nasal catarrh. The patient describes the affection of the skin in these words: "Little pimples will rise under the skin on my face, with sharp stinging pain, when the skin will thicken up, become red, almost purple, very much in-

flamed and swollen, then crack and discharge a thin yellowish fluid. After a while it will stop discharging, but keep swollen and very red. Twelve or thirteen years she has been thus affected. As with hay fever in general, the eczema has its remissions. Sometimes it seems so much better that I feel as if I should soon be well." The asthma comes on towards the end of the attack.

This case is interesting and suggestive in various directions. First of all, to those dermatologists and neurologists, who are studying the relation of diseases of the skin to the nervous system. Secondly, it is an argument in favor of the theory we have recently advocated, that hay fever is a complicated disease, and largely a nervous disease. No one, we think, would claim that the vibrios, which in the nasal passages have been supposed to be the cause of hay fever, also cause this eczema.

Observation vs. Generalization in Science.

The last number of the *Chicago Journal of Nervous and Mental Disease* contains a very able editorial on the relation of observation to generalization in science. The writer contends, vigorously and justly, that the present tendency is to undervalue the *reflective, generalizing* faculties, and to correspondingly overestimate the observing faculties. He cites the case of Mr. Darwin who, as is well known, was rejected by the French Academy, on the ground that he was a generalizer more than an observer. On the broad platform of science, there is room enough for both classes of mind. The observing class is comparatively large, the generalizing class small. Those who combine in themselves the highest observing and generalizing powers are very rare. On this subject, Jevons, in his *Principles of Science,* speaks as follows: "All inductive investigation consists in a marriage of hypothesis of and experiment. * * * The mind of the great discoverer must combine contradictory attributes. He must be fertile in theories and hypotheses, and yet full of facts and precise results of experiments. He must entertain the feeblest analagies, and the merest guesses at truth; and yet he must hold them as worthless, until they are verified by experiments."

Hitzig.

Dr. Edward Hitzig has recently been appointed Professor in Zurich. This worker in science deserves all the honor he may receive; he is a patient, faithful, laborious man, utterly absorbed in his profession, and withal very kindly and communicative. The quality of patience, he possesses in a degree that is remarkable even for a German. He felt quite keenly the injustice that was done him after Ferrier had popularized his discoveries. Time will make that all right; indeed it has has done so already.

American Neurological Association.

The association held its first meeting in New York, June 2d, 3d and 4th. An abstract of the interesting proceedings have already been published. There should be, in the whole country, sufficient material to keep this society alive. The one practical difficulty with which it must contend, is the limited number of specialists in neurology who are sufficiently interested in it to take a long journey to attend the meetings. Ophthalmology is an old specialty, and the number of workers in that department is quite large. The specialists in neurology and electro-therapeutics could be counted on the fingers. A great deal is said in journals and societies about specialism, as though it would drive general practice from the profession, and yet we doubt whether there are one hundred specialists in the whole country in all the departments.

Psychological Lessons of the Beecher Case.

In the few suggestions that we have to offer on this topic neither the guilt nor the innocence of the defendant will be assumed. The following criticisms will hold good whatever the result of the trial may be, and some of them apply not to the defendant alone, but to other prominent actors in the drama.

1. The intimate connection between the religious nature and sexual passion. It is the loveliest, kindest, sweetest, tenderest, most sincerely religious natures, that oftentimes are in the greatest danger through the sexual passion; the skeptical and hard-hearted are safe. Clergymen of popular and attractive qualities agree in this, that they are worried and hunted after oftentimes to their infinite dis-

tress by devout, sympathetic women. Physicians are rarely annoyed in this way, nor lawyers nor teachers. On this theory of the intimate connection of the emotions, we can explain the fact, well known to everybody, that when the restraint of the will is removed by insanity, women talk more obscenely than the most depraved men. On this subject the great preacher, Robertson, who carried science into the pulpit, and who, if he had lived later, would have been a scientist, writes thus profoundly in one of his letters:

"The devotional feelings are very distinct from uprightness and purity of life, they are often singularly allied to the animal nature; the result of a warm temperament; guides to hell under the form of angels of light, conducting the unconscious victim of feelings, that appear divine and seraphic, into a state of heart and life at which the very world stands aghast."

Mr. Lecky, in his "History of Morals," quotes substantially Miss Mulock, as follows: "She notices the experience of Sunday-school mistresses; that of their pupils who are seduced an extremely large proportion are 'of the very best, refined, intelligent, truthful, and affectionate.'"

2. The decline of the moral faculties in old age, even when the intellectual faculties are yet active and brilliant. When the worm is gnawing at the roots, the topmost twigs are the first to wither. When the brain is dephosphorized, moral courage first gives way. On any theory of the scandal, the want of moral courage on the part of the chief actor has been everywhere conspicuous, and has been freely and fully confessed. Timidity and irresolution in those who in youth and middle life were couragous and strong, are the best of all evidences of a slow wearing out of the cerebral forces. And these symptoms may appear long before the muscles or the intellect exhibit any marked decline. "After thirty-five a man gets tired of being honest, and a woman of being virtuous," says Dean Swift. This is an exaggeration, but suggests a great pathological fact which biography confirms. The melancholy of the aged is oftentimes a part or result of moral decline. Very beautifully and very eloquently says Chateaubriand, as in his old age he stood on the stormy beach: "The wind that blows on a hoary head never comes from a happy shore." To be happy requires courage, resolution and hope, all of which emotions are likely to decline in old age. "Young men have more virtue than old men," says Dr. Johnson. Longfellow, in his latest poem, thus writes:

"As the barometer foretells the storm
While still the skies are clear, the weather warm;
So something in us, as old age draws near,
Betrays the pressure of the atmosphere."

3. Great emotional distress may quicken, stimulate, and inspire the intellect to feats, of which otherwise it would be incapable. There is no doubt that the intellectual efforts of Mr. Beecher were, in some respects, more brilliant during the past three or four years than ever before. In the realm of imagination great things are oftentimes done in old age, for the office of imagination is in part to bring up and utilize what the brain has done in the past. Mr. Beecher, for the past ten or fifteen years, has been working over, in brilliant and powerful style, the ideas and fancies of his earlier years. The thoughts he utters are so vitalized by his powers of imagination, that they are new to his hearers although old to himself. Some one asked him once how he could preach so well amid such excitement; he replied, "for the same reason that a mud-turtle jumps when you put a coal on its back." "They learned in suffering what they taught in song," is as true of other intellectual workers as of poets. Some of the extracts from Mr. Beecher's letters, written under circumstances of acute distress, are the finest productions of his pen, and will probably be immortal in literature.

4. The case also raises a very important psychological query, whether a man can have nearly every mental faculty, except conscience, whether one may be not only highly intellectual, but also benevolent, kindly, generous, and yet devoid absolutely, or almost so, of moral sense. Not a few of the greatest men of the world were conscienceless. Gœthe, Napoleon, Daniel Webster—it would be hard to find any occasion in the lives of these great men when they did any thing because it was right, or abstained from doing it because it was wrong. Writing, speaking, and preaching, are purely intellectual and emotional performances; on the moral sense, as such, they make no demand whatever. The great orators of antiquity, Demosthenes and Cicero, were, in the time of trial, found to be abjectly and absurdly wanting in the very elements of courage, patriotism, and honor that formed the staple of their eloquent orations. Those who believe Mr. Beecher guilty must also believe that his conscience, if he ever had any, is entirely swamped in his other faculties. Those who believe him innocent must believe the same of some of his accusers.

GLEANINGS.

Investigations on the Brain.—In a paper bearing the title *Untersuchungen über das Gehirn*, Dr. Ed. Hitzig reports about a new series of experiments which he made, in order to prove that the motor centers for the extremities are not located in the convolutions of the anterior lobe of the cerebrum. His experiments on dogs were conducted with the care and minuteness that characterize everything the author undertakes. He opened the skull by trepanning, and if the shock or loss of blood were serious enough to influence the general condition of the animal, so as to interfere with the result, he would wait till the animal recovered again before he proceeded to take out a part of the brain, varying in thickness, by cutting around the piece to be taken out afterwards by means of a cataract spoon. All his experiments were performed on the left hemisphere. The first series of five experiments were confined to the first three convolutions, and no injury, deep or superficial, was followed by a disturbance of functions that might be attributed to the cerebral wound, thus adding additional strength to Nothnagel's observations. Another series of nine experiments were chiefly confined to the posterior, or fourth convolution of the anterior lobe, bordering and just anterior to the sulcus cruciatus, and these would suffice to decide the question whether this lobe is in direct relation to the mobility of the muscles or not in the negative, thus confirming the results obtained by his irritation experiments. Partial changes following the operation, especially a defect in the energy of the will, lasting however only a short time, were evidently due only to a disturbance of nutrition of the surrounding parts, caused by the injury especially to the vessels lying in the sulcus cruciatus, or to slight injury of the convolution behind the sulcus cruciatus. He does not wish to draw any comparison between these physiological experiments and pathological observations, and the autopsies of persons that died from brain lesions, where the circumstances are apt to be so complicated, but he hopes that, by future experiments, more light will be shed on this interesting subject. M.

Lead Paralysis.—Prof. W. Erb, of Heidelberg, reports in the *Archive für Psychiatrie*, a very interesting case of lead paralysis. He says, in connection with it, that it is still doubtful whether this form of paralysis is due to an affection of the peripheral nerves or to the spinal apparatus. His observations have not been able to solve this question, but they are rich on interesting and new facts. The paralysis commenced in the right deltoid muscle, and was soon followed by that of the extensors of the right forearm, a short time after the first attack, which was explained by the patient to resemble a very heavy feeling in both arms. After the patient had been under treatment a few days, a change in the contractibility of the affected muscles was noticed, the electro-

faradic contractibility decreased, and the electro-galvanic increased—a circumstance which is not rare in cases of lead paralysis—and in about two weeks after it first appeared it reached its highest point, but commenced to decrease soon after this, until it became less than normal, the electro-faradic contractibility remaining as bad as before. However, the most remarkable feature in this case was, that this change of muscular contractibility made its appearance also in the left deltoid, which was not paralyzed at all, but acted under the control of the will. Similar cases were noticed by the author before, in cases of progressive muscular atrophy, but then only a smaller muscle was affected. This would lead to the belief that histological changes must have taken place, and any changes of the motor nerves ought to be excluded, as they were under the power of the will. There may be cases of complete paralysis and the nerve not excitable, or complete paralysis and degeneration and the excitability of the nerve not diminished; and again, no degeneration or paralysis but the loss of excitability of nerve. From this he draws the conclusion that this change of contractibility may take place, when no lesion of the motor nerve exists, and is, therefore, independent of it, and if it is at all dependent upon nervous (trophic) influence this must be transmitted through others than through the motor channels. He believes it due to special trophic nerve fibers in the muscles, connected with central trophic fibers of the spinal cord, and that it is a lesion of these fibers that produces the trophic disturbance. He thinks these fibers may have a greater resistance against mechanical irritation—probably they are thin, gray, pale nerve fibers, without medullary matter. If this supposition is correct, as also that which separates the centers of the trophic and motor nerves, we could expect to find these at times separately diseased. Of course the independence of the peripheral trophic channels will have to be proved yet. M.

Explanation of the differential action of the Faradic and Galvanic Currents.—In an essay which appeared in the *Journal de l'Anatomie et de la Physiologie de Mr. Ch. Robin*, under the heading, "De la difference d' action des courants induits et des courants continuus," Dr. Onimus calls attention to the fact, which by most medical men is not sufficiently appreciated, that the effect of the two currents on the contractibility of the muscles in certain paralysis is quite different, as, for instance, in the facial paralysis caused by cold, where we find the induced current without effect on the muscles, whilst the direct current produces promptly contractions at the interruption of the currents, and to do this even a weaker current is required than would be necessary to produce the same effect on the corresponding healthy muscles. These two points he examines with great exactness. This contractibility depends partly upon the vitality of the muscular fibers—it may be weakened, altered, or abolished. It is the altered condition that interests us here. Hallé, toward the end of the last century, noticed this first. He observed that, during the absence of motility, the electro-galvanic contractility is even easier to provoke, increasing up to a certain point and diminishing again with the return of mobility, when the influence of the induced current begins to be felt again. The contractibility of the striped muscular fibers, that has been during the paralysis more like that

of the unstriped variety, becomes in this state again normal. The physiological experiments of Erb and Ziemssen have led to the same result. A change in the muscular contractibility lasts, like the paralysis, in proportion to the injury of the nerve. Charcot and others thought that only in slight lesions, producing an irritation of the nerve, this difference of the two currents was to be observed; but this is contrary to clinical and physiological experience. Schiff thinks that the induced current acts not directly, but by the motor filaments, on the muscles, but the galvanic current acts directly. This seems to be in harmony with clinical facts, as mostly in peripheral paralysis of motor nerves this difference is noticed. In these cases the muscular fibers themselves are not altered, and even after a long continued paralysis do not undergo any atrophic changes, and the nearer the injury is seated to the terminal muscular branches the sooner will the difference of the two currents become apparent. There are two causes that play the most important part in this: First. An alteration of the intra-muscular nerve filament; and, second, an absence of great changes of the muscular fibers, as the induced current acts only through the nerve filaments; and, on the other side, the direct current directly on the muscular fibers, and this is of great importance as a means of diagnosis, indicating that the intra-muscular nerves have suffered and that the muscular fibers have not yet undergone any atrophic changes, but, on the contrary, are so slightly altered that they will soon be restored, as soon as the nerves are again regenerated. It also proves that the nerve itself, and not its origin, has been affected, and that only the motor nerve has suffered.

Another explanation of these facts the author finds in the circumstance that the induced current is exceedingly short, and the direct current relatively long; and where a healthy muscle will contract under an influence of a current with twenty interruptions in a second, a paralyzed muscle may require one of only five or eight interruptions in a second; the contraction becoming slower, the shock requires more time to spread through the muscles. The shock lasting seven-hundredths of a second may be effective in a healthy muscle, whilst a paralyzed muscle requires one lasting from twelve to twenty-hundredths of a second, and even a fatigued muscle will require more time than a healthy one. The two currents differ, as is well known, also in tension and quantity—the induced having much tension and little quantity.

But not only does the direct current produce contractions where the induced current fails to do it, but even a weaker current is required to do this than for the corresponding healthy muscles of the opposite side, which may require a current from ten to twenty cells, and the affected muscles only one of two to five elements, and in the muscles laid bare only one element may produce contractions. The stimulus required for the muscular fibers direct is weaker, as if it should have to go through the motor nerve. It is an equally important physiological fact that the direct current has a better effect on the unstriped muscular fibers than on those of the striped variety.

This difference of the two currents on the nervous system must be more marked than that on the muscular system. The mode of action of the induced current is easily understood—its passage through the nerve produces each time a mechanic concussion, acting like an excitation. The short duration of the

induced current explains their powerful action on the nerves, changing rapidly and roughly the molecular state of them, and if at last they remove the excitability of a nerve, it is not like that of the direct current, by a chemical alteration, but by a series of concussions.

The electricity which we find in all tissues of the body is due to the chemical actions and changes going on in them, and, as a rule, the longitudinal surface is positive in rapport with the transverse. All the electric phenomena are governed by the law of the electro-capillary currents of Mr. Becquerel. The electric current peculiar to the nerve or muscle disappears if we make the muscle contract or excite the nerves; a nerve possesses other electromotor qualities when in a quiescent state than when in a state of activity, and exciting its function leads to a corresponding modification of the electromotor faculties, and a contraction of a muscle produces a change in its electricity. If only a part of a nerve is brought under the influence of a stronger current, its own electricity, for its entire length, will be strengthened if the current has the same direction; in the other case it will be diminished, and if it is examined in its different points it is found that its irritability is increased near the negative pole (katalectronic zone), and that it is diminished near the positive pole (analectronic zone), probably due to the collections of acids at the positive, and of irritating alkalies at the negative pole. Its irritability is also increased, when its molecules pass from the ordinary state into that of the greatest mobility (katalectrotonus), or when they pass from the lessened mobility (analectrotonus) into the ordinary state. The author thinks the best explanation are the facts, that the direct or descending currents act more energetically on the motor nerve, or, in other words, that the descending current provokes stronger muscular contraction. All currents applied to a nerve determine an opposite current at the moment they cease to act; a descending current will be followed by the formation of an ascending current. There will be an increase of irritability each time, when, after the cessation of a current, you reapply a current of the same direction, and a diminution of irritability if you let a current of a different direction follow the first one. But not only the nerves and muscles, but in fact all the tissues, have their own electricity. All over they accompany the chemical processes, and, consequently, also nutrition. They are a product of changes of the organic tissues, and are a manifestation of life. In fact, he says, all living elements not only nourish themselves and produce heat, but also determine the formation of electric currents, and the influence of artificial electricity brings on a dynamic nodification, an increase of nutrition. The therapeutic value of their application rests in the powerful agency of the induced current to produce a deep, energetic, and short irritation. Their action is much more exciting than that of the direct current and they should be employed every time we want to provoke the excitation of the motor and sensitive nerves. They act quickly on the cutaneous nerves, and are preferable to all other agents to excite reflex action. The continuous current, on the other side, modifies more slowly the molecular state of the nerves, but their action is gentler even at the time of their interruption, and the concussion they produce less mechanical, but their influence more markedly polarized and lasting. It is more that of a tonic and

slight stimulant, whilst that of the induced current is more of an irritant and exciting nature. The induced currents should not be applied to the central nervous system ; but for this purpose the continuous current should uniformly be selected. M.

Study of the Motor Centers in France.—At the meeting of the Societè dc Biologie, April 3d, Rouget introduced the subject of the localization of the motor centers in the brain, and spoke favorably of the conclusions of Ferrier, but was not satisfied with the arguments of Carville and Duret. By the suggestion of Brown-Sequard, a committee was appointed to investigate the subject. Messrs. Brown-Sequard, Moreau, Lépine, and Vulpian, were appointed.

Electrolysis in Goitre.—Dr. Morell Mackenzie, in a paper on bronchocele, in which the various methods of treatment are explained, says that thirteen of his cases were treated by electrolysis; nine were cured. In two cases the goitre was diminished in size, and two that resisted treatment were afterwards cured by subcutaneous injections of iodine.

Compensation in the Functions of the Brain.—"I stated what I now call the principle or hypothesis of compensation, as regards chorea, in the *Edinburgh Medical Journal*, October, 1868. The year before (in this journal, December 21, 1867), I tried to show how it was that destruction of parts of the brain often did not cause symptoms. In all the statements I have made of this principle, it is assumed that the cerebral hemisphere is made up of nervous arrangement representing impressions and movements.

The word "compensation" itself shows what is meant. A region of the body is not permanently paralyzed when a part of the brain representing it is destroyed, because the neighboring parts also represent the very same region. The principle applies, I believe, to partial lesions of all nervous centers, but more evidently the higher the center. This is what we should expect on the principle of evolution, for the higher the center the greater the number of different movements and impressions represented in it. This implies a greater number both of nerve fibers and cells. Now, of course, the more fibers in a center, the less loss of movement will result from destruction of part of it ; and, of course, the more ganglion cells, the more over-movement from discharge of an unstable part of it. When we come to the highest center, the cerebral hemisphere, it is notorious that destruction of much of it may occur without the production of any very obvious symptoms. This is a fact which is forced on every surgeon or physician. And then, on the other hand, the discharge of very limited parts of it produces considerable external movement. I suppose I have stated the principle or hypothesis of compensation a score of times, and many times before the experiments of Hitzig and Ferrier were begun. I will not, therefore, state it again here, but will refer to an essentially similar hypothesis by M. Taine.

The hypothesis of compensation is the result of observation of cases of disease; but the facts of experiments on animals have a similar bearing. M. Taine has, chiefly from these facts, but also from cases of disease, come to a

conclusion which is very like the one I have come to. He says: "The brain is a kind of polypus, whose elements have the same functions." I think the same general truth is contained in the statement I have made of a subordinate center, "that the corpus striatum is a mass of small corpora striata" (*Medical Mirror*, Oct., 1869).

Referring to certain experiments by Vulpian, M. Taine says: "We see that, in the case of the frog, the *eighth part* of its brain supplied the place of the rest; a larger p ɔrtion would be required in the case of a superior animal; and, when we come to the summit of the animal kingdom, the mutual dependence of the different parts of the brain is much greater. But the conclusion is the same—the brain is a kind of polypus whose elements have the same functions."

I do not think the compensation is ever absolute (I speak of destruction of parts of the brain producing no *obvious* loss of movement). I think it probable that what is called loss of muscular sense in a limb is, in some cases, loss of the most special, or, metaphorically speaking, "most delicate" *movements* in that limb. I say "movements," as I hold it to be as misleading an expression to say that the convolutions represent muscles, as it is to say that language is made up of letters."—*Dr. Hughlings Jackson in Medical Times and Gazette, May* 19, 1875.

Spinal Paralysis in Adults.—Attention has been recently called in this country to spinal paralysis in adults, resembling infantile paralysis, by a monograph of E. C. Seguin, and by a paper by Dr. D. F. Lincoln (*Boston Medical and Surgical Journal*, March 25, 1875). In Europe, the subject has been originally studied by Duchenne, Charcot, Gombault, and Bernhardt. The symptoms are:

1. Paralysis of motion, coming on suddenly or gradually, and confined to the upper or lower limbs, or sometimes the speaking or swallowing muscles, and muscles of the eyes and face. This paralysis does not attack the muscles of the neck, chest, abdomen, or usually the sphincters of the bladder and rectum.
2. Fever and vomiting sometimes precede the paralysis, as in infantile paralysis.
3. Sensations of numbness, pricking, tingling, and of a band around the abdomen or one of the limbs.
4. Atrophy of the muscles, affecting entire muscles or group of muscles. This atrophy is not usually accompanied by fibrillary contractions.
5. Diminution or loss of electro-muscular contractility; at first of faradic, and ultimately, in some cases, of galvanic contractility.
6. Coldness of the paralyzed limbs.
7. Tendency to improvement, and in some cases to recovery.

Negatively, the disease is marked by absence of great anæsthesia, usually (though hyperesthesia may exist) by the fact that the sphincters of the rectum and of the bladder, and the muscles concerned in respiration are not usually affected, and by the absence of spinal tenderness or bed sores.

The disease may be acute, sub-acute, or chronic.

The lesion in these cases is "granular degeneration of the ganglion cells of the anterior horns."

The disease appears to be caused, like many diseases of the spinal cord, by taking cold, after repeated exposure to cold or wet or to both.

The treatment for the acute and sub-acute forms is counter irritation to the spine, and internally ergot and belladonna. For the paralysis in the later stages faradism and galvanism, especially the latter.

Noë's Thermopile.—In an article (*Ueber die Noë sche Thermosäule und ihre Verwendung in der Electrotherapie, Berl. Klin. Woch.*, No. 50, 1874) Dr. A. Eulenburg recommends the use of Noë's Thermopile, because it is less expensive, more durable, and possesses greater electro-motor power than any other make, and because it is very easy to handle. It consists of twenty elements of two different metals—the composition of which, however, is still a secret—and is heated by an alcohol lamp accompanying the apparatus. The flame acts first on short hollow copper cylinders. The elements are arranged horizontally in a circle, so that all the position cylinders are within its radius and terminating in a point running toward the heated center, where they are isolated by two plates of mica. The different elements are connected by means of copper wire terminating in a flat piece. They are all fastened to a stiff isolating ring, thus forming a large cylinder.

The electro-motor power of this pile is = 19.4 (a Bunsen element being = 20), and if the points are moderately heated, the power of resistance of the twenty elements is = 1.110; according to Siemen's measure, that of a single element = 0.056.

It requires but thirty or sixty seconds to produce a quite powerful current. Its principal advantages are, that it does away with the filling of the cells, and that it lasts much longer than any other battery. Its weight is about nine pounds; it is therefore, easy to carry about. M.

Hemiplegia Caused by a Shock of Lightning.—(*Ein fall von Hemiplegia durch Blitzschlag, by Dr. Eulenburg, Berl. Klin. Wochenschrift*, No. 17, 1875.) The literature of such cases of hemiplegia produced by lightning being limited, the following case may be of interest:

A guard at a railroad station was struck by lightning, while in the act of winding up a clock with his left hand. The lightning passed down from the connecting telegraph wires, through the clock, to the arm of the man; he fell down insensible, and when he awoke some time afterwards he found on his left side complete loss of motility and great diminution of sensibility. The next few days he complained about headache, sleeplessness, vertigo, and uncontrollable trembling of muscles. The treatment consisted first of cold compresses to the head, and as no improvement was observed warm baths and faradizations were substituted; but as no improvement in the motility of the extremities followed, treatment was discontinued. The lower extremity recovered gradually, to some extent. Ten months after the injury the patient came to Dr. Eulenburg. His special senses were not disturbed, but a marked symmetry of the face was observed. The left arm was completely paralyzed, and only slight flexion of the fingers was possible; passive mobility of the joints was perfect, and no contractions of the muscles was present. The sensibility almost normal, and the electro-muscular contractibility and sensibility was not diminished, and no atrophic changes could be found. The left

lower extremity was only slightly affected, but temperature and sensibility of it were somewhat diminished ; the shedding of the epithelium more marked, and slight atrophic changes had become evident. The muscles of the left side of the trunk were also slightly affected. Faradic, as well as galvanic excitability, almost normal. The treatment consisted in peripheral applications of electricity—faradic as well as galvanic—applied alternately to the plexus, peripheral nerves, and muscles of the arm, and these applications were soon followed by a decided improvement.

Dr. Eulenburg thinks that the true nature of the affection was a central cerebral lesion, probably hemorrhagic, because the paralysis behaved like one of that kind, and the slight disturbance of nutrition and the integrity of the electric excitability would strengthen this supposition. The seat of the lesion was probably in the corpus striatum of the right side; but he is at a loss how to explain this sufficiently as the lightning reached first the left side. M.

Extension of Time of Prize.—The time for the prize for a paper on the use of electricity in acute diseases, is extended one year, to September 1, 1876.

Time of Appearance of the Journal.—A semi-annual journal would naturally have greater latitude, in regard to time of appearance, than a monthly or even a quarterly. No attempt is made to have the ARCHIVES appear on the first, or even in the first half, of the month in which it is dated; and in some cases a margin of two, three, or four weeks may be needed. A reasonable delay gives opportunity to complete articles, and saves the annoyance to authors of keeping over papers for the subsequent issue. The prolonged delay in the appearance of the present number was caused by the difficulty in preparing, revising and copying the last article on Trance.

Contents of next Number.—The next number of the ARCHIVES will contain articles on the treatment of Chorea by Conium; the use of Iodoform in Nervous Disease; the Involuntary Life, or Man as an Automaton; the treatment of Hemorrhoids by the Galvano-Cautery; Electricity in Obstetrics; case of Reflex Irritation; and a letter on the present state of Electro-Therapeutics in Europe.

CONTENTS FOR NOVEMBER, 1874.

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The Archives will hereafter appear in the latter part of the months of May and November, or the first part of June and December.

NOTICES OF THE PRESS.

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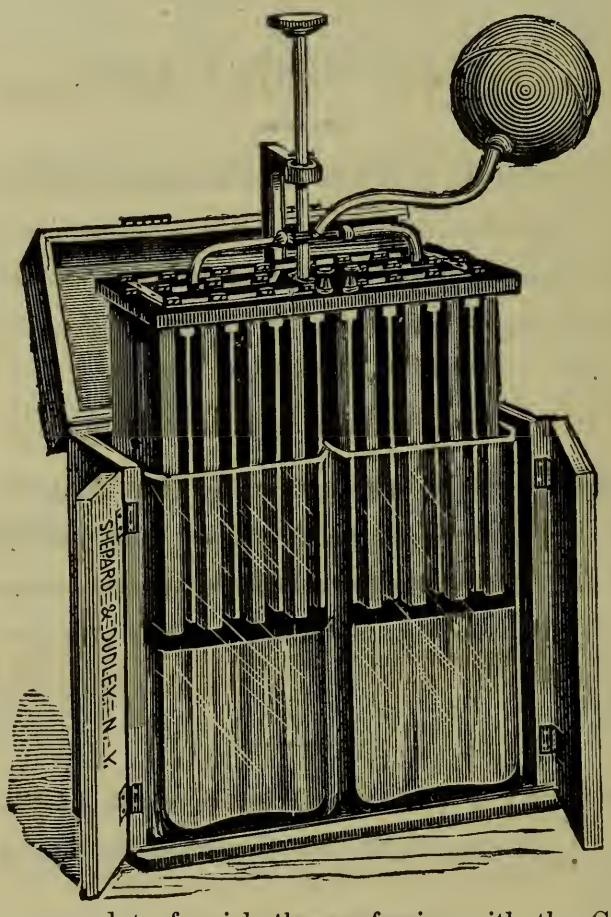

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Prof. of Diseases of the Eye and Ear, Bellevue Hospital Medical College; Surgeon-in-Chief to the New York Eye and Ear Infirmary.

113 WEST 44TH STREET, March 13, 1875.

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EDITED BY

GEORGE M. BEARD, A.M., M.D.

Vol. II. NOVEMBER, 1875. No. II.

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ARCHIVES

OF

ELECTROLOGY AND NEUROLOGY.

VOL. II. NOVEMBER, 1875. No. 2.

ORIGINAL COMMUNICATIONS.

I.—*Galvano-Cautery for the Removal of Internal Hæmorrhoids.*

By T. F. FRANK, M. D., Titusville, Penn.

THIS method of destroying hæmorrhoidal tumors, although it has engaged the attention of surgeons since Middeldorpf, of Breslau, in Prussia, demonstrated that when a metal like platinum, possessing great resisting power to the electric force, is traversed by the latter, the metal is heated in proportion to this force, yet does not receive as a surgical measure, the encomium from the general profession, to which a few special experimenters claim it entitled.

Dr. Van Buren, in his work on diseases of the rectum, admits, that it promises well when proper apparatus is at hand; and Allingham claims to have personally proved its safety for the removal of piles; but does not recommend it, for want of improvement in apparatus.

With a five years' experience in the use of galvanic instruments for operations on various tumors, piles included, I incline to the opinion that so promising and safe a device for their removal is justly entitled to the highest rank with other appliances recommended for the same purpose, and its selection for the amputation of hæmorrhoids need be no longer delayed, provided the operator possesses a knowledge of the

laws governing electricity, and sufficient dexterity in the use of the apparatus now offered to the profession. Most of our surgical instruments will probably be superseded by improvements, of which some will be needful, others fanciful. Galvano-Caustic Batteries I am sure should undergo some modification, better adapted to the convenience of operators, and of that I will speak hereafter; but the crudest batteries with which I am acquainted possess all that one skilled in their use requires for those operations. Dr. John Byrne, of Brooklyn, has on several occasions in my presence produced the finest results with an electro-cautery instrument of the most simple construction, and to some of his kindly suggestions I consider myself indebted for the success I have achieved with like batteries in the removal of hæmorrhoids.

The electro-cautery comprises all the other methods usually employed on such occasions within itself, and is thus proved to be the most effectual remedy. It possesses the advantages of the knife in separating a hæmorrhoid from its attachment with great rapidity, and while it cuts its way through the tissues produces a most powerful astringent effect upon the severed blood-vessels, sealing them up as thoroughly as a ligature, and I may say better than a ligature, for after the sloughing away of a ligated pile, the galvano-cautery frequently has to be employed as the controlling power against secondary hæmorrhage. By its sedative influence the cautery reduces the after-suffering of the patient to its minimum, and leaves the seared tissues in the most fit condition for cicatrisation.

With these means at our command are we justified in torturing a patient with one or more ligated piles in his rectum during 8 or 12 days, the period required for the sloughing of the tumors, when everything necessary can be done in a few minutes? I say not! no more so than a surgeon would dare to advise his students to ligate an arm and allow the parts to slough away, in case he is not in possession of a good amputating case, or if so, does not have the skill to use it.

I give the following cases out of a large number operated upon by me for internal hæmorrhoids by the electro-cautery in confirmation of the advantages I claim for it.

Case I.—Mr. R. N., æt. 64 years, a farmer, residing in Chaut. Co., N. Y., consulted me Feb. 21st, 1870, on account of two large piles, which it was impossible for him to retain in recto without compress and bandage.

He gave me the following history. About twenty-five years ago he found upon defecating in the field a considerable quantity of blood accompanying the faecal discharges; and previous to this discovery he had suffered much distress in the rectum. Those symptoms continued unabated, though under constant treatment by his family physicians, till 1860, when he applied to Dr. Bodenhammer, of New York, who found upon examination a number of capillary hæmorrhoids. Those were treated by Doctor B. with nitric acid, and from that time till the summer of 1868, Mr. N. considered himself cured.

That season a protracted diarrhœa brought him down again, and it was then that he first found something protruding from his bowels. The sphincter never regained, under any treatment, the power to retain the tumors without mechanical support or the supine position, and that was the condition I found him in upon his first visit to my office. When thus supported his piles did not give him much trouble, only when, as he described it, they became enlarged, the pain was very great, and he had to abandon all support and take to his bed for weeks at a time. He had not come prepared to remain in town as long as I desire my patients after operations, but promised to return at his earliest convenience; which he did on June 20th of the same year.

The parts had become considerably inflamed during his journey, and manipulation without anæsthesia was out of question. I ordered compresses of ice to be applied till morning and an injection of water previous to the operation, which I promised to perform some time during the next day. At night he had a free evacuation from his bowels, and in the morning I found him with two large pulsating venous hæmorrhoids and a portion of the rectum protruded. I anticipated some trouble from hæmorrhage during the operation and came prepared with ligatures and styptics in addition to my cautery battery. Having placed himself upon a strong table the pa-

tient took the ether, administered by Dr. Rhodes, of this place, with a determination to come under its influence, and soon became unconscious. The operation was conducted in the following manner: his legs being flexed upon the abdomen and placed in charge of a couple of friends who accompanied him to this place, I seized one of the tumors with the thumb and forefinger of my left hand, drawing it upwards, putting its lower margin upon the stretch. I carried the platinum instrument, brought to incandescence by a galvanic battery, with a slow motion across the tumor, at its base, till the entire mass hung by a small portion of tissue inclosing the supply vessels. Then folding the pile against the protruded rectum upwards, I continued the cauterization till the entire mass dropped into my hand. The removal of this tumor occupied in all four minutes, exclusive of the administration of ether. The surface from which it had been removed had the appearance of well-boiled beef and not a drop of blood was visible upon it. The second tumor was removed in the same manner and with like results. Upon the protruded portion of the rectum were two little nodes which appeared to me old capillary piles in a state of progression towards the arterial or venous variety. Those I simply cauterized to a level with the mucous membrane of the bowel; and thus ended an operation which with the ligature would have kept the patient, (saying nothing about the pain,) in a state of apprehension as to its final results during 10 or 12 days. He readily recovered his consciousness and expressed himself free from inconvenience about the rectum. Nothing at all occurred in this case to require interference except after the first stool following the operation, which on account of too mild an administration of the opium, happened about the second day, sooner than was desired. The pain during that process and for two hours thereafter was quite unbearable, but yielded to anodynes and warm hop poultices. The evacuations then appeared regularly every other day despite my efforts to control them by opiates; not much pain however followed them, nor could I discover any blood. On the ninth day after the operation, Mr. N. called at my office, contrary to my wishes, determined to re-

turn home, saying that he felt as well now as he should in two weeks, nor could I persuade him to remain. I heard from him frequently through his son and occasionally a neighboring patient tells me that Mr. N. has had no more trouble and is in good health.

The battery employed was of the kind hereafter to be described and the electrode a platinum wire about three inches long and $\frac{1}{16}$ of an inch thick, formed in the shape of a lancet and a little flattened.

Case II. Mr. James T., æt. 35, of Titusville, Pa., had received treatment from a couple enterprising homœopathic practitioners in this city for the radical cure of piles by faradizing the rectum with a Kidder's Electro-Magnetic instrument, without perceptible benefit, and was finally advised by a friend, who had witnessed some electro-cautery operations, to consult me.

An examination which I made upon him, Sept. 15th, 1871, revealed three venous hæmorrhoids, varying in size from that of a chestnut to an English walnut. They only came down upon great fatigue, which the patient frequently experienced from riding on horseback over rough roads, when following his business as a torpedo agent. The sphincters closed tightly upon such occasions and compelled him to keep the supine position for days, and use poultices for the return of the tumors. He had been a sufferer for a number of years and his general health had been much impaired. He made no objection to the operation and provided accommodations for himself and wife at the nearest hotel.

Having previously prepared himself by freeing his bowels, I removed, on Sept. 17th, 1871, those hæmorrhoids while he was under the influence of ether, in the presence of several medical gentlemen from this city, in my accustomed manner by the electro-cautery.

No hæmorrhage occurred during or after the operation, except a slight oozing of blood during the forcible dilatation of the sphincters.

With precaution in diet, exercise and the confinement of his

bowels the patient made a rapid recovery, and was in the street in ten days. He is now in excellent health.

Case III. Mrs. D. C. W., æt. 40, of Titusville, Pa. came to me March 11th, 1873, recommended by her family physician, Dr. Moody, for the cure of a fissure in ano and anticipated internal hæmorrhoids. Long suffering having brought her down in health she could neither attend ordinary household affairs nor enjoy the society of friends.

On the day of her first visit to my rooms, I made no examination of the parts above the sphincters on account of excessive pain she experienced from the slightest touch, delaying the same for the occasion when I was to operate upon the fissure; with the understanding that, if upon the forcible dilatation of the anus I discover hæmorrhoids they should be removed at once.

This patient was determined to be operated upon at my office, for reasons known to herself; and she being previously prepared for it, presented herself for that purpose March 17th, 1873. Dr. Moody administered the anæsthetic and got her under its influence in a few minutes.

The sphincters being now fully dilated and a good portion of the rectum exposed to view, one arterial hæmorrhoid and several capillary hæmorrhoids were readily discovered. Great caution was required in the amputation of the arterial hæmorrhoid, on account of its great vascularity and disposition to bleed; but with the exception of a little more time consumed during the operation I experienced no trouble whatever, and the parts from which the tumor had been removed presented the usual appearance of well-boiled beef, and were free from hæmorrhage. The capillary prominences were next seared down completely, and finally the fissure were cauterized. The bowel being returned, the patient soon recovered her consciousness, and walked home by the assistance of her husband a distance of three blocks, positively refusing to use a carriage in waiting for her; claiming that she experienced no inconvenience from the operation.

In four days thereafter, a son of Mrs. W. was taken with in-

flammation of his lungs, and she allowed herself to be in attendance night and day, despite mine and Dr. Moody's cautions against the consequences which might result from such negligence.

Dr. M. attending the boy during his sickness, and keeping an eye on the mother, has often expressed himself surprised at the recovery of this patient under so unfavorable circumstances. It is the opinion of Dr. Moody, that Mrs. W. could not have endured before this operation what she did immediately thereafter. She is now in the enjoyment of perfect health.

Case IV. Miss E. M., of Lockport, N. Y., was brought to my office, Aug. 6th, 1873, by her mother and a lady physician on account of hæmorrhage from her bowels, to which she had been subject since her nineteenth year; her age at the time she consulted me being twenty-two. According to the mother's estimate this young lady had lost quarts of blood on many occasions, causing her to faint and remain unconscious for hours. However correct that statement as to quantity of blood lost, may have been, the patient certainly looked as if she had none of that fluid in her body; she was almost transparent. Her menses appeared regularly and in proper quantity.

She was very averse to an examination, but finally after some reasoning with her, promised submission if I would administer some ether, to which proposition I assented and left with directions to have her bowels properly cleared by an enema.

I informed the mother in private of my intention to operate for any trouble I might encounter in the rectum of her daughter, while she was under the influence of the anæsthetic, to save a repetition of its administration. To this arrangement the mother consented.

We met the next day as agreed upon. My cautery instruments were placed in the adjoining room and were kept in charge of my assistant. The patient having been brought under control by ether I attempted to explore the rectum with my finger, when a profuse hæmorrhage set in, which almost determined me to plug the rectum and allow the patient to be-

come conscious. Upon a second thought, however, I felt satisfied the bleeding would not be much increased by dilating the sphincters, and that probably I might be of better service to her if I took advantage of her present condition, forced the anus open and allowed the rectum to fall out. This done I saw five very prominent capillary tumors scattered about above the inner sphincter, granular and of the raspberry appearance, and all bleeding profusely. There was no other indication of disease, and I lost no time in bringing a dome-shaped cautery electrode heated to an orange color to bear upon the tumors one after the other till no trace of blood could be seen to ooze from the cauterized parts. The entire process of destroying those hæmorrhoids did not occupy over ten minutes. When this patient recovered from the effects of the ether it was quite late in the afternoon, the operation having been performed between the hours of ten and eleven A. M. It was impossible to arouse her from the profound sleep she seemed to enjoy. By the time she awoke all evidences, of what had transpired had been taken away.

As an evidence of the slight suffering that the operation occasioned, I may say that she conversed freely with her mother about the condition I found her bowel in, and discussed the propriety of an operation such as I had already performed, and for which she seemed to feel a great horror. She finally dropt into a sound sleep again which lasted till morning. Upon my arrival after breakfast I found her in good spirits, and not till then was she informed of what had been done. She remained in town several weeks, but required no treatment.

I saw her in the fall of the year 1874 while I visited Lockport for an operation upon another patient, and found her in excellent health.

Case V.—Mrs. R. P., of Titusville, Pa., æt. 58, came under my care Nov. 9th, 1870, for obstinate constipation, pain in the rectum, and general debility. In her younger days she has been a hard worker. She is the mother of a large family. Has never noticed blood coming from her bowels, nor was there protrusion of piles. A fulness which was constantly ex-

perienced in the lower region of the rectum, she ascribed to accumulated hardened fæces.

My proposition for a digital examination of the rectum was unfavorably received. Mrs. P. being of the opinion that if I could suggest a treatment which would free her stools, without the administration of medicine, her former health would return; consequently I ordered galvanization to the sympathetic and pneumogastric nerves with general faradization. In addition she received occasionally an electric bath. The latter consisted of a weak solution of carbonate of soda into which the patient was placed with the negative pole in the rectum while the entire fluid contents of the tub formed the positive.

Though she did well under the treatment, the pressure in the rectum remained the same, and in Jan., 1870, she permitted me to become satisfied of the condition which caused her the trouble. The examination was conducted with considerable difficulty, an almost entire occlusion of the rectum immediately above the outer sphincter arresting my finger in its progsess.

My first impression was that I had to deal with a stricture, but subsequently distinguished three hard tumors tightly compressed against each other, reducing the passage to its minimum.

These tumors I diagnosticated as old, hardened venous hæmorrhoids surrounding the bowel, my opinion being verified at the operation which I subsequently performed.

Jan. 29th, 1870, with the assistance of Dr. Moody and Rhodes, the patient being previously etherized, I amputated three hæmorrhoids corresponding to the above description by the electro-cautery, and all did well. The patient recovered sufficiently in seven days to visit my rooms for the purpose of continuing the electric baths which benefitted her greatly in the restoration of her general health. I have frequent opportunities to see this lady, but up to Sept., 1875, she never has been troubled with the pressure, as before the operation.

I selected those cases as representatives from a variety of others I have successfully operated upon during the past five

years in demonstration of the advantages we possess in the electro-cautery for the removal of internal hæmorrhoids, and it remains for me only to draw attention to the requirements of Batteries used for the purpose to insure success in an operation in a proceedure so promising and safe.

Failure in the applications of this agent in surgery does not seem to exist in a want of arrangements to produce heat in platinum instruments by electric force but in a lack of provision made for the perpetuation of this force during protracted operations, and the conviction is forced upon me that with a proper calculation of the power required to produce the desired result, proper apparatus can easily be designed by those wishing to use them.

Simplicity in a cautery apparatus is its most recommendable feature; many of the proferred improvements, consisting of intricate connections, switches, &c., add nothing but confusion to the application and disgust to the operator. The rapid development of heat in the electrode, and the right method of keeping it during protracted operations are the ends to be sought in such instruments, and those will be found, (1) in a correct estimate of the quantity of battery fluid in proportion the size of elements selected; (2) the efficient strength of the liquid used; and (3) in the greatest obtainable difference of conductivity between the positive and negative plates.

Instead of mathematically demonstrating to the reader the most useful relations of parts in the apparatuses in question. I prefer giving the construction of an instrument which on account of its dimensions has proved reliable in the many and varied operations by electro-cautery which I have performed during the past five years, as a guide to manufacturers, and a caution to the purchaser.

It consists of a light wooden box twelve inches square, divided into four equal compartments or cells, well soaked in paraffine and its inner surface lined with a coat of the same material one-sixteenth of an inch thick. This lining remains unaffected by the strongest acids employed for battery purposes and answers well in the absence of glass or rubber vessels. A top board is provided to which the battery plates are

secured in such a manner that all the zincs of each division are united to form virtually one plate, and all the carbon respectively the same. This arrangement is effected by strips of copper on the upper surface of the cover to which the plates are secured by nuts and bolts; and the regular order in each cell would be thus: zinc–carbon–zinc–carbon–zinc.

The elements are each 3×10 inch ×¼ inch thick, and when placed in position should constitute an intensity battery of four cells. The centre of the top board is provided with a strong handle by which the plates can be raised and lowered in the battery fluid as required by the operator. With this arrangement and a solution of four ounces Bichromate of Potash in one quart of soft water, to which is added three ounces, by measure, of strong sulphuric acid, and one scruple of Bisulphate of Mercury, I have never failed to bring a platinum wire three inches long and $\frac{1}{16}$ of an inch thick, to an orange heat instantly upon the immersion of the plates into the fluid when the intensity of two cells was brought into requisition, and when all four cells were brought into the circuit a like wire drawn out to ten inches in length was heated in a moment. By proper agitation of the battery-fluid the heat can be kept up during three-fourths of an hour.

From the description of my battery it will be evident that the proportion of liquid in the cells is greatly in excess of the required quantity for immersing the plates, and this I wish to impress upon the reader is absolutely necessary for the long keeping of heat in the platinum instruments. The agitation of the liquid is necessary to preserve it of uniform strength by washing away the metallic solution from around the zincs and also by dispersing the bubbles of hydrogen from the negative plate; but there is a limit to the capability of the liquid to act quickly upon the zinc, and as soon as this limit is reached no sufficient heat can be produced for operations.

The crowding of a large surface of elements into a disproportionately small quantity of liquid, for the purpose of reducing a cautery-apparatus to a very small size will invariably be productive of failure during protracted operations.

Dr. John Byrne, of Brooklyn, has done more than any ex-

perimenter in Electro-cautery I know of to produce elements of small sizes, and to him is great credit due for the advantages he has placed before the surgeon in that special department; but his attempts to crowd the elements of his battery in an insufficient quantity of liquid must meet with disappointment whenever they attempt very long and large operations.

The platinised copper element, suggested as a negative by Prof. Byrne, cannot be too highly estimated; it really possesses great merit. I obtained the most satisfactory results from it since the Doctor drew my attention to it last summer. I am however not satisfied with his theory of preventing the evolution of heat in the battery-fluid by the use of plates combining great electro motivity and conductivity as referred to by Dr. Beard in his archives of Electrology and Neurology under the head of miscellaneous notes. On the contrary I think that the more rapid the production of electricity in the elements and the more quickly it is carried away to a distance, the greater must be the chemical action of the electrolyte upon the zinc and consequent evolution of heat in the battery liquid.

Noticing during one of Dr. Byrne's attempts to heat a heavy platinum electrode with one of his diminutive elements that the heat did not come up till after considerable agitation of the liquid, I conceived the idea that the previous heating of the acid might prove an advantage to those instruments with very small cells, and I instituted after my return from New York experiments for that purpose which gave me the following results.

When the elements were immersed in cold liquid, much of the chemical action has to be expended in bringing the liquid into a fit condition for rapid action upon the zinc; to create the electric force in quantity sufficient to cause heat in the platinum, proportionately diminished the strength of the acid and consequently reduced the time during which the glowing of the Electrode could be maintained. Knowing it to be a fact that warm acid will attack a metal soluble in it more speedily than when cold, I next used the solution of Bichromate of potash immediately after having added the sulphuric acid

and while the liquid was hot, and to my greatest satisfaction I found upon immersing the plates an instantaneous glowing heat produced in the platinum, and that this heat could be kept up much longer than when a portion of the strength in the liquid had to be expended to favor its condition for quick action upon the metal.

I now leave this subject to the reflection of abler minds than mine, with a hope of further demonstrations in the science of Electro-surgery.

II.—*A Thesis on the Dual Constitution of Man, or Neuro-Psychology.* By S. S. Laws, A.M., M.D., New York.*

I.

The caption of this Thesis points to the common ground where Physiology and Psychology have been accustomed to meet, only to ignore each other's presence, or to cross swords in fierce conflict, rather than to shake hands in manly recognition of each other, as friends and co-workers, to a certain extent, in the same important field of investigation. The Physical and Metaphysical Sciences, of which Physiology and Psychology are special branches, must ultimately meet on friendly terms somewhere. Neither can hope to drive the other to the wall, for each rests on a solid and enduring foundation. The evidence of the reality and the coëxistence of both matter and mind, cannot be invalidated, respecting either, without overturning the foundations on which all knowledge rests. It is, therefore, quixotic for either to run a tilt at the other, with the view of overturning it and establishing its own pretended title to exclusive existence.

But if matter and mind exist at all, they are brought face to face in the constitution of man, and, without question, that part of man's body which is in proximate relation to *mind* is the *nervous system.* It can only be intimated here that the term *Neuro-psychology* may yet be vindicated as entitled to rec-

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* "*An Inaugural Thesis* on the Dual Constitution of Man or Neuro-Psychology. Presented to the *Faculty of the Bellevue Hospital Medical College* for the Degree of Doctor of Medicine, by Samuel Spahr Laws of New York City. January 31st, 1874."

ognition in the vocabulary of science. There is more than one beautiful binary star in the firmament.

On discussing the phenomena of man's nervous system, the thoughts consciously or unconsciously, must necessarily move within the orbit of some one of three or four general theories of nature. 1. The first is that of the *Nihilist*, who acknowledges the substantial reality of neither matter nor mind, and in whose vision of the universe, body and soul alike vanish, as the illusions of a dream, indeed as not having the reality of a dream, nor even of the dream of a dream. 2. The second is the system of the *Idealist*, who accepts mind, but explains away, or repudiates the reality of the attributes of matter as phantasms of the senses. He holds to only *one* substance, and may be termed a *Monist* or *Scientific Unitarian*. 3. The third is the system of the *Materialist*, who pursues a precisely similar course respecting mind, by attempting to explain all its phenomena as the phenomena of matter. He is also a *Monist* or Scientific Unitarian, but his one substance is matter. 4. The fourth system recognises both mind and matter as substantial realities, each having, as to the other, its own distinctive and incommunicable properties, and resting on a footing of evidence equal with the other. This *fourth* view commends itself to the common sense of the world, and the history of opinion shows, that it has stood, like Gibraltar, unshaken by all the storms that have dashed against it. It has been aptly termed *Natural Dualism* or Natural Realism, as it looks at nature just as she presents herself, in the double aspect of mind and matter. The thirst for unity is so insatiable, as to have become an abundant source of error; and one of the most prodigious and unreasonable of these errors, is that of violating the *Law of Parcimony*, by allowing, in its application, either mind or matter to push aside the other, and to obtrude itself into the place of both.

By this law, such and so many causes are to be admitted as are necessary to explain the facts.

If a single cause or force will not do it, then more than one must be accepted as valid. It is on this principle that physicians recognise the coëxistence of several distinct maladies in

the same patient, as in the case of typho-malarial fever, bronchitis associated with asthma and emphysema, or phthisis with circumscribed pneumonia and pleuritis. The concepts or "bundles of attributes," which to the mind's eye define separate diseases, will not allow us to jumble them into an indiscriminate heap, when found coëxisting in the same patient, but require us, in theory and practice, to discriminate between the phenomena presented, however intimately associated, or affected by that association they may be, and to refer them to their separate and distinct morbid conditions. It should not, therefore, seem very strange, that the exercise of the same professional discrimination, in regard to the *mixed* phenomena of the nervous system, should likewise recognise the necessity of distinguishing amongst these phenomena and of referring them to distinct and separate, but coëxistent and active producing causes. And in the proper place, it will be noted that the doctrine of a complex or dual nature of the patient is quite as important professionally, as that of a complexity of diseases.

The object of primary interest, in all scientific investigation, is a concise view of the *facts*. Theories arise from attempts to explain the facts; for, as my Lord Verulam has pithily observed, "Facts without theory, are blind." The explanation of a phenomenon consists in the reference of it to the true law of its occurrence. The identification of *mind* with nerve *force* is a fundamental postulate with those physiologists who attempt to explain such phenomena as those of muscular contraction, sensation, perception, consciousness, memory, will, imagination, judgment, loving and sorrowing, hoping and fearing, happiness and misery, by referring them all equally and alike to the activities of mere matter, as the immediate and sole source of their production. All the facts connected with our voluntary, social, moral, religious, rational and æsthetic nature are grouped into a single category, and first and last they are explained as the products of nervous activity, the phases and transmutations of nervous energy; just as the secretions are produced by the various glands. Mental action is cerebral *ideation*. Thought, imagination, feeling and willing are forms and phases of *cerebration*.

It is perfectly obvious, that this sweeping theory, if sustained by the facts of our nervous system, settles finally man's position in nature, and his destiny forever. If these facts can by way of explanation, be thus grouped, as the phenomena of one substance, then Monism or *scientific unitarianism*, must by the law of parcimony, be accepted as the established system of nature of which *we* form a part. As physiology is one of the sisterhood of liberal and progressive sciences, and stands on the broad, fundamental principles of universal knowledge, therefore, so far as it is founded upon this unitarian principle of interpretation, all its interest in the future involves this question. Will this theory of identification stand the test of coming ages? Does it adequately respond even to the accumulated evidence confronting it in the present? Do we find in nerve-force the true and final and only law of the occurrence of this vast multitude of diversified facts?

In what shall be said in answer to this question, it is not intended to go into the general argument, against materialism or idealism as a partial and inadequate theory of man, but to limit the attention strictly to that specific point of view, under which the caption of this thesis presents the subject.

The general discussion of the coëxistence and equal substantiality of both mind and matter, is indeed very inviting, as the intellectual associations into which one feels himself brought by the mere contemplation of it are exhilarating in the extreme. For, not a few of the most brilliant, highly cultivated and thoroughly stored intellects that have shed lustre upon the history of our race, have entered into this conflict of ages, and unsparingly lavished upon it the princely treasures of their genius and acquirements. Yet strangely enough, the precise point of view, under which the subject is here presented, has been either wholly overlooked and ignored or only considered incidentally, or entered into chiefly by those preoccupied with a unitarian view. It may almost be said, that there has really been a hearing only on one side: on this side, by the mere physiologist; on that, by the mere psychologist. But who, it may be asked, has toiled in patient preparation for

his work, and attempted to look with steadied and equal gaze, as a Neuro-psychologist, upon the problem, whether man be of a *unitarian* or *dual* constitution, discussing his subject in the day-light of valid evidence and not drawing on his imagination for facts? Let us hope that such investigators will be less rare in the future.

Neurology and Psychology, are both difficult subjects, and the number and discord of the laborers in each separate field, is quite embarrassing, but it is believed that the careful study of both physiology and psychology, will help to simplify both and to ultimately bring an abundant reward, in the conciliation of the two and in the consequent scientific solution of some of the most puzzling and momentous problems of life.

II.

In proceeding to the consideration in a more specific manner, of some important leading anatomical and physiological points, a concise summary will first be submitted.

The nervous matter is found in all animals, with the exception of some of the very lowest and oldest in the scale of animal life, such as the protozoans, *g. amoeba*, *g. monas*, &c., in which it may exist although as yet undiscovered. Throughout the subdivisions of the animal kingdom by Cuvier, 1812, into vertebrates, articulates, mollusks and radiates,* "the nervous system and the parts belonging thereto, as found in the perfect animal," enters into the structural type so "essentially," that it is placed at the very foundation of this great anatomical classification. The nervous element, then, is not an incidental circumstance, but a great central fact in the construction of animals. Keeping this in view, it is pertinent to observe, that there is not a precise but a general gradation of the mass and distribution of nerve matter, which places man relatively, above all other animals—I say relatively, for the brains of sev-

* This subdivision rests upon a principle of classification, not likely to be subverted, it is true, but, in no event, could the importance of the distribution of nerve matter, be compromised. Vide *Atlantic Monthly*, Jan., 1874. Evolut. and Perm. of Type. Agassiz' last contribution to Science.

eral animals greatly exceed that of man, in absolute weight.*

But as the interest of the present discussion centres chiefly in the nervous system of man, a more extended summary of the structure and function of that system will now be given.

The general average of the entire mass of nerve matter in the human body—estimating what is outside of the encephalos at one-eighth of the whole—may be set down at from three to four pounds avoirdupois, which would be somewhat less than the weight of the liver.† It is divided into the *gray* matter whose anatomical element is the *cell* and into the *white* matter whose anatomical element is the *fibre*. The principal accumulations or ganglia of the gray matter, are in the cerebro-spinal system and are found in the olfactory bulbs, the cerebral convolutions, the corpora-striata, the optic thalami, the cerebellar lobes, the tubercula quadrigemina, that of the pons Varolii and of the medulla oblongata; to which must be added, the cornua and the commissure of the spinal cord, the enlargements on some of the roots of the cranial and on all the posterior roots of the spinal nerves, together with the ganglia of the sympathetic system.

The distribution of the white nerve matter, is in tracts, commissures and laminations, immediately and variously associated with the gray matter or accumulations enumerated.

From these central bundles or masses of gray nerve matter, nine cranial‡ (Willis) and thirty-one vertebral, in all *forty pairs of nerves* of white matter go off, with great symmetry,

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* Gray's *Anatomy*, p. 580. Flint's *Nervous System*, p. 340.
Brain of elephant, 8 to 10 lbs. and in specimen of large whale, above 5 lbs. The largest human brain about 4 lbs. The superiority of man's nervous organism, whatever may be the exact purpose it subserves in the economy, is not, therefore, one of mass, but probably, of texture, of specific structure, and of diverse distributions and relations.

† The rapid and large development of these two organs, the brain and the liver, in fœtal life, is a most striking fact. It may be only a superficial explanation, to point out the provision by which they are immediately supplied with best blood.

‡ Viewing the human skull as composed of 3 expanded vertebræ, (occipetal, parietal and frontal,) whose bodies in the adult are fused into the *os tri-basilare*, we would by analogy expect only 3 pairs of cranial nerves instead of 9 or 12.

and together with the sympathetic nerves, ramify to the remotest extremities of the body, supplying the skin, the muscles the bones and all the vessels and organs of the entire body, excepting chiefly the enamel of the teeth and the tendons, cartilages, hairs and nails—the parts not supplied being destitute of contractility and of sensibility. But under all circumstances, the white matter, whether in commissural masses, or in its minutest distributions, is made up of fibres which never coalesce with each other, anastomose, branch or inter-communicate, as do the blood-vessels, the lymphatics, the air-passages of the lungs, or the ducts of the liver and of the kidneys. Each nerve fibre preserves its individuality and continuity throughout its entire course.

The gray matter, in like manner, is constant in its adherence to its anatomical element, the *cell*, with its nucleus; and these cells of the gray matter, according to the usual statements, give origin to the white fibres. The deep origins of the several nerves, however, are deemed obscure. No *functional* subdivision of the gray matter is settled, although some important and interesting points of distinction, have been marked respecting the decussation of fibres and the diverse action of various excitations and lesions. But great importance attaches to the functional classification of the fibres into those that are *sensory*, and those that are *motor*.

The anatomical constituent of the ganglionic or gray matter, as seen above, is the cell, and it is now to be noted, that the specific property or function of the nerve-cell, is, according to current notions, to generate, (produce, originate,) nerve-force. This is the work of the cell. According to the current doctrine, the peculiar force or stimulus evolved or liberated by the nerve-cell, in some unknown manner, is, when liberated, then conducted by the white fibres, and this conduction of the nerve-force, is the sole function of the white fibre wherever found. The sensory fibres conduct only from the periphery inward to the central ganglia or cerebro-spinal masses of grey matter, which elaborate the impressions into ideas and volitions. These are called the *afferent* fibres. The motor fibres conduct only from the centre outward, and hence

are called *efferent* fibres. But whether afferent and sensory, or efferent and motor, the capability of conducting nerve-force is the sole physiological property or function of the fibre.

For the past half century, or since Magendie's experiments, 1822, physiologists have recognised the *anterior* roots of the spinal nerves, as *motor*, and the *posterior* roots, as *sensory*. The fibres of the motor (non-gangliated) roots are distributed to muscles; and the fibres of the posterior (gangliated) roots are distributed especially to the skin. The same general physiological distribution of motor and sensory functions obtains likewise amongst the cranial nerves but on a more complicated scale. In this view, the cranial nerves may be divided into—

I. The cranial nerves of *sensation*, and these again into—

A. The cranial nerves of *special sensation*.

1. *Smell*, the 1st pair.
2. *Sight*, the 2d pair.
3. *Hearing*, the 2d root (portio mollis) of the 7th pair.
4. *Taste*.

   a. The chorda tympani from the 1st root (portio-dura) of the 7th pair, (in probable relation to the portio-intermedia of Wrisberg) and, joined with the lingual branch of the 5th pair, distributed to the anterior half or two-thirds of the tongue.

   b. The glossal branch of the glosso-pharyngeal or 1st root of the 8th pair and distributed to the posterior third of the tongue.

B. The cranial nerves of *general sensation*.

1. The large root of the 5th pair.
2. The first two roots of the 8th pair:

   a. The glosso-pharyngeal, (the 1st root.)

   b. The pneumogastric (the 2d root,) in the distribution of its root-fibres, its fibres to the mucous membrane of the larynx and epiglottis being extremely sensitive and, as Professor Flint, Jr., expresses it, "acting as a prompt sentinel to guard the entrance of the air-passages against foreign bodies."
3. The 9th pair by derivation.

II. The cranial nerves of *motion* are the 3d, the 4th, the 6th and 9th pairs, the small root of the 5th pair; and from the 7th pair, the portio-dura or facial, (except the chorda tympani,) and from the 8th pair the spinal-accessory whose spinal-rootlets give motion to the sterno-cleido mastoid and trapezius muscles, whilst its medulla oblongata rootlets make it the nerve of phonation.

It can be seen plainly enough from this sketch that the cranial, like the spinal nerves, cluster around and vibrate between the opposite poles of sensation and motion.

This general view of the nervous system of man will be rendered sufficiently complete for our present purpose, by a few words respecting the *sympathetic system.* It is identical in anatomical structure with the cerebro-spinal system and forms with it one continuous and completed whole. "The sympathetic is made up, just as is the brain and spinal cord, of cells and fibres. * * It has been unwarrantably assumed that the cells of the sympathetic system were uniformly smaller than those of the central nervous system; but it is easy to convince one's self of the error of this assertion, as cells of the largest size may readily be isolated from sympathetic ganglia. The two systems may properly be regarded as functionally conjoined organizations."*

The sympathetic contains, therefore, both motor and sensitive fibres. "The peculiarity of the sympathetic seems to consist merely in the mode in which it assembles its radical fibres, and again distributes them in the peripheral direction,"† and in the more widely dispersed condition of its gray matter, which is collected into smaller but more numerous masses, united by means of peripheral fibres.

This summary of the structure and functions of the nervous system, is perhaps sufficient to indicate the *general basis*, upon which repose the inferences, indicated above, of such tremendous import touching the constitution *of man.*

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* Dr. Sigmund Mayer. Stricker's *Manual of Histology*, pp. 767, 768.

† Baly's Müller's *Elements of Physiology*, Second Edition, p. 715.

III.

Criticism and Counter Theory.

1st. The first point to which I ask attention, is that there is in the view of physiologists above stated, an exaggerated function assigned to the nerve-cell. It is assumed, throughout, as a settled fact of nature, that the nerve-cell, originally, is the source and fountain-head of all the characteristic phenomena immediately associated with the nervous system. It is the work of the nerve-cell, to liberate or evolve, by the action of its inherent and distinctive properties, and as its own peculiar product, not only volitions, which stimulate muscular action and contractions, but ideas, as well, and thinking and feeling and imagination; and in short, all the phenomena that are commonly spoken of as those of mind. Scientifically and physiologically considered, mental phenomena, properly speaking are, therefore, simply nervous phenomena and are truly explained by referring them to the single force of nerve matter.

The favorite illustration, is that of the Galvanic battery and its conductors, which device is supposed to illustrate this subject with singular aptness. The action and relation of nerve matter, nerve-cells and nerve-fibres, are thereby supposed to be pictured, as it were, before the eye. The general fact is very simple: the cells of a battery generate a force, and the wires conduct it. The wires do not produce, but only transmit the electricity, which originates from the peculiar reactions in the cells of the battery. This illustration will aid us in getting at the truth in this case. In the *first* place, it has been shown by demonstration, that the electricity conducted by the wires, actually originates from the re-action of the cells of the battery; but, it has never been shown, that the stimulus or force conducted by the nerve-fibres, originates in the nerve-cells. It has not been shown, that any of the nerve influence originates from the nerve-cell and yet it is assumed and repetitiously and dogmatically asserted that it all originates

from that source. It is not *known* that any of the nerve force originates from the nerve-cell, and therefore this assumption that it all thus originates cannot be set down, and reasoned from, as a fixed fact and the most *confident* inferences be drawn from it. I do not deny, that any or any kind, of nervous influence, is attributable to the cell, as it will be seen further on, but, I protest against putting an hypothesis in the place of a *fact*. But, *again*, the actions of a battery are unique and uniform, resolving themselves into reactions, attractions and repulsions, in one settled succession or round. Whoever heard of a battery, with all its cells, in the best possible working order, its conductors and communicating appliances in perfect condition—I say, whoever heard of a battery, under the most favorable circumstances, sending a message of intelligence without an operator? The kind of force that originates from the cells and is conducted by the metallic fibres, as the result of the arrangement and combination of physical elements, can do much, but it cannot, of itself, and independent of a separate and ab-extra influence, do *that sort of thing*. The agency of a separate and superior force must be brought into appropriate and intimate relations to the subordinate force of electricity, and be capable of acting through its instruments and instrumentality before the phenomena of intelligence, of mind, will associate and blend with what would otherwise be the dull round of unrelieved physical action. It is *known*, that this strikingly analogous state of facts presented, is owing to the action of *two* agencies or forces—that its only explanation, is in the recognition of a dual source of influence.

May it not be just as reasonable, then, to explain the mixed and heterogenious phenomena of man's nervous system by a reference of them, to *two* forces as to *one*—yes, more reasonable to conclude for dualism, than for unitarianism, as the true theory of man's nature. Reasoning from the *known*, to the unknown, is the natural order and not the reverse. Even conceding, then, that the nerve-cell originates all the nerve-force proper, as the battery-cell originates all the electric force proper, still, the illustration, if of any value, suggests the conclusion, that the effects are wholly referable to that force *only* as

controlled and determined by a superior force in all manifestations of mind or intelligence.*

2d. Again, the monistic or unitarian theory, as stated above, presupposes that the fibres originate from the nerve-cells; that the ganglia, are made up of these cells, as their constituent element; and that the fibres lead forth from the cells direct, or as a continuation of their poles, as the conductors lead off, from the cells or poles of a battery; or as the Croton water-pipes lead off from the Croton reservoirs and convey the water to various preärranged points of distribution. And as these pipes distribute only reservoir-water, so, the nerve-fibres convey only cell-force. But it disturbs the repose of mind that this view might reasonably be expected to give, to learn that the *primary question*, as to the relation of the nerve-fibre to the nerve-cell, is not settled; and not only so, but that the view presented, seems to be *overturned*, or, at least vitally modified, by the most recent observations. The fundamental structure of the nervous system, would appear to be the axis cylinder, which is a bundle or faciculus of primitive fibrillæ; and *the cell itself is fibrillar*,† being in fact, only *an enlargement of the axis cylinder*, caused by a finely granular substance being interspersed, or embedded, *between* the primitive filaments; and often containing a yellowish or yellowish-brown pigment. (I have here followed the views of Max Schultze, as found in chapter 3d of Stricker's Manual.) "In the present state of our knowledge, however well we may be acquainted with the peripheric termination of a great number of nerve-fibres, it *cannot be said that the mode of central origin of any single fibril, has hitherto been proved.*"‡ "No perfectly satisfactory conclusion, can be said to have been as yet attained on this point; and it is even conceivable, according to my observations, (M. Schultze) that there is

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* It is not forgotten, that analogy is not direct proof; but it serves to clear away rubbish, to open the mind to the exact issue and to raise a presumption, as all truth is consistent with itself. Thinking is probably more needed, at present, than new experiments and observations.

† The so-called poles are also fibrillar.

‡ This passage is quoted with approval in Gray's Anat., last edition, p. 66, foot note.

no actual termination of the fibrils in the brain or spinal cord; in other words, that all fibrils originate at the periphery, and thus *only traverse the ganglion cells.*

"The cells of the cerebrum, as I have already observed, (in other parts), possess an exquisite fibrillar structure and rather appear as a point of *junction and intersection* for nerve-fibrils that are already developed, *than as a point of origin* for those which have not hitherto been in existence."*

According to these views, and they are the last words of the highest authority on the subject, whilst the nerve-fibres may sustain an important relation to cell-substance, so called, it is made quite certain, that, in large part, they do not have cell origin; and also that it is still an open question, whether *any* of the nerve-fibres originate from nerve-cells. And if the case stands thus, then the cell must be *subordinate* to the fibre and *not* the fibre to the cell. Under this aspect of the case and head of our discussion, it may be stated, then, that the *assumption*, that all the stimulus or nerve-force conducted by the fibres, originates in the cells of the gray matter, is *not proved.* No one can pretend that it is proved. It is a mere hypothesis, to explain a supposed state of facts that probably does not exist.

3d. This modified view of the anatomical relation of the fibre to the interfibrillar cell substance, as just set forth, may warrant the suggestion, which I here venture to submit, that NUTRITION, is the proper and peculiar function allotted to the cells. The demand for nutrition by the nervous system, is *probably* greater than that of any other part of the body.

As bearing upon this idea of *nutrition* as functioned by the cell, these facts, amongst others, should be considered: viz.— 1. The character of the cell substance. 2. The relation of the gray matter to the blood circulation. 3. The amount of work done, which depends on nerve energy and causes nerve waste. 1. The interfibrillar, granular substance is probably a residue of the embryonic protoplasm, which possibly remains in greater abundance in the immediate vicinity of the nucleus, and there retains a power, allied to that which it possessed when

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* Stricker's Manual, p. 141 : p. 139. The italics are mine.

in the embryonic state.* 2. The blood supply, to this gray matter, is estimated at five times what it is to the white nerve matter.† The ganglia or nodes, or cross roads of the fibres, are thus the depôts of supply and the places where, preëminently, nourishment and stimulus might be, perhaps are imbibed from the blood. 3. As to the work done, all muscular activity depends on nervous activity, and hence muscular waste and nerve waste would be expected to proceed with equal step. Take for instance, as an illustration, a single muscular organ, the heart.

It is a powerful hollow muscle: according to an estimate given in Flint's Physiology,‡ as "based on more reasonable data than any other," the heart, in every complete revolution or beat, exerts a force of about 75 lbs. At an average of 70 beats a minute, for an adult, this gives us over 5,000 lbs. or 2 1-2 tons a minute, and 150 tons an hour of initial force.

Respiration, is, also, a strictly muscular action. An adult makes about 16 respirations in a minute; and it has also been estimated, that each respiration marks an expenditure of force, equal to the raising of 500 lbs. one inch; and this gives us the exertion of an amount of force in one hour, that will, in that time, raise 24 tons one inch. If to this, we should add the ceaseless action of the rest of the involuntary muscles, and, also, that of the voluntary muscular contractions, verily, the result would show, that, could this force all take shape in external mechanical effect, such a worker as is the body of each man, could, in an open field, with plenty of accessible materials and *fair weather*, soon build the Pyramids. But, in all sobriety, the muscular energy exerted by the body, as a strictly physical organism, must be immense; and this astonishing expenditure of force, involves a corresponding waste or destruction and renewal of muscular and nerve tissue. The *source* of nutrition is the blood. The nerve fibre drinks in its nourishment from it, along its paths of dis-

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* Stricker's Manual, p. 141.

† From data given in Koelliker's *Microscopical Anatomy*, (Huxley's.)

‡ *Physiology of Man, Blood*, &c., by Austin Flint, Jr., M.D., p. 198.

tribution, but especially, perhaps, as elaborated for it, by means of the interfibrillar and nucleated cell substance of the ganglia, and so, the real source of the stimulation of involuntary muscular contractility may be the blood itself, through the nervous system as an intermediary. And hence, the cell, instead of acting the exaggerated and *hyper-physiological* part assigned to it, of *ideation*, and elaborating thought and all mental activity, may find its hands full of the more natural physiological work of ministering to the nutrition of the busy fibres, as they ceaselessly functionate muscular contractility and subserve psychological as well as physiological demands.

The battery wastes, as it works, in producing electricity and it has no power of self-renewal, or it might, like the body, act unceasingly. The blood supplies the nerve-tissue its material of renewal, and hence its ceaseless action in the stimulation of the muscular activity of the organic or vegetative system. But, now, see where we stand, for the blood itself is dependent on voluntary action for the procurement and supply of its food.* We are thus brought round again by this voluntary procurement of food, as a necessary condition of existence, into the presence of mind, in voluntary activity, as a hyper-physiological force, or element, which in some form and gradation, is seen at work in all animals. "Besides the material substance of which the body is constructed, there is also an immaterial principle, which, though it eludes detection, is none the less real and to which we are constantly obliged to recur in considering the phenomena of life."†—The psychic element in man has a substratum of endowments of conscious sensation and will, in common with animals, but his specific and distinctive endowments of personality and moral agency, of rational consciousness and abtract reasoning remove him from them not merely in degree, but in kind, by an impassable barrier, by a chasm unbridged

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* "For the life of the flesh is in the blood."—*Lev.* 17: 11–14. Gen. 9: 4. It is a remarkable circumstance that these old writings of Moses present an appreciation of the vital function of the blood quite up to modern investigation.

† *Principles of Zoölogy* by Agassiz & Gould, §128, §129.

by structural alliance. Evolution is, of course, compatible with difference only in degree.

4th. As pointing to the dual constitution of man, I wish also to call attention to the *intermediary* character of the nervous system in two other important aspects:

1st. In relation to *voluntary motion.*

2d. In relation to *sensation.*

I use the word intermediary in this sense, viz.: that, on the physiological side, in some important respects, the nervous organism is not final, but only a link in the chain of natural forces; and on the side of mind, that, in the movement from without inward, the nervous organism is only an intermediary between the external world and sensation; and in the movement from within, outward, the nervous system stands between the willing mind and voluntary muscular contraction.*

Let it be remarked that, in a word, the nervous system does not functionate for its own sake, but that like other vital viscera, it has a ministry committed to it. The forces of nature are veiled by phenomena, and if we would have a direct intellectual vision of them, we must with caution and reverence lift that veil in a spirit of "indifferency"†—not indifferency as to what the truth itself may be, but with a willingness to accept it, come whence it may, and whatever may be its bearings on preconceived opinions or interests. The watch is not understood rationally by him who only knows enough of it, to wind it, and to read the indications of time from its face. The movement consisting of a graduated train of wheels, cogs, pinions, fugee, stop, springs and escapement, mean little to the mere mechanic. All that is food for thought lies concealed from the superficial gaze; but there is in it all the beauty of a picture, to him who intelligently interprets the workings of the instrument; each part, in its place and relations, may be as suggestive as the snow-flake or the dew-drop. There is hid

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* The mind, by its actual presence and by dynamic or catalytic or other influence may condition the involuntary activities—but of that I do not now speak.

† In the sense of John Locke, M. D., (1632–1704,) in the introduction of his great essay on the "*Human Understanding.*"

away behind the sensible phenomena in each case, a power that determined the movements, or constructed the crystal, or gave the drop of water its form.

> That very law which moulds a tear,
> And bids it trickle from its source,
> That law preserves the earth a sphere,
> And guides the planets in their course.—*Rogers.*

Whatever may be the class of the facts which we may propose to interpret, if they do not group themselves consistently under the action of a *single* force, we are bound to explain them by a reference of them to different forces, only bearing in mind that by the law of parcimony, we are restrained from assuming forces, other than what may be necessary to explain the existence of the facts.

1. But to proceed with the intermediary character of the nervous system in relation to voluntary motion. Muscular contractility, as we have seen, is an inherent property alike of striated and unstriated muscles. The involuntary muscles constitute an *automatic* system, only indirectly and incidentally under the control of the will. To this automatic system is entrusted the vital functions, so that they are sustained in sleep, as when awake. As already pointed out, the *bulk* of the work done in the economy, is done by it, and voluntary movements, as compared therewith, are only occasional and incidental and transitory, but, excepting the action of the heart, more sudden and violent. *Weariness* comes from voluntary movements only and when excessive and too much prolonged. The automatic system never tires, as it calls into play neither volition nor thought, nor directly any act of mind or intelligence. In the healthy body, there is no *knowledge* of these movements as they progress, for they are quite as much beyond the grasp of consciousness as is the law of gravitation, although we are immersed in its action continually.

The automatic phenomena are simply muscular contractions dependent on nerve-influence, and the voluntary phenomena are also muscular contractions dependent on nerve-influence. The two groups of facts are quite alike as physical phenomena but the circumstances and manner of their occurrence put us on

very different lines of inquiry. Habits may cause the action of the voluntary muscles called into requisition to become allied to the automatic system, as in walking, but the main fact remains, that the voluntary activities come within the domain of direct knowledge, choice and purpose, and are not simply expressive of, but are also prompted or restrained with more or less directness and certainty, by feelings, likes or dislikes, tastes, fancies, interests, passions, prejudices, pleasure and pain, judgment and conscience—a host of circumstances, which create an atmosphere for the voluntary phenomena, so called, in which the automatic system does not and cannot breathe at all. The two spheres of activity, are, in this respect, as unlike as the earth and the moon—the one, with its atmosphere and oceans, being instinct with the conditions of animated voluntary existence, the other from this point of view, being only a dreary waste. The voluntary sphere is that of active personality; the automatic sphere is that of physical activity.* To recur again to the illustration of a battery. A system of electrical appliances, may do an allotted round of work automatically and regularly, without the active interference of an operator; and in so doing, it *remotely* evidences the wisdom and skill of the one who pre-established this self-acting combination. We are not here concerned with that remote implication, but with the fact, that a feature of the very same system of arrangements and con-

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*Such phenomena as *blushing* from passion or the emotions of modesty, or *pallor* from fear or rage, or the *flow of saliva* from the thought or sight of food untasted, show an intimate inceptive relation between the mind and the sympathetic system to which these physiological phenomena are to be referred. But physiologically these are automate phenomena, as we are not conscious of the relaxation nor of the contraction of the arteries (*vasa vasorum*) under the control of the sympathetic nerves, which congests or empties the capillaries of the face or arouses the gland into action in these cases. It is curious to remark that there is also a broad domain of the unconscious activity of the mind, the same as of the body. It was Leibnitz who first called attention to this *law of latency* as to the mind; I am not aware that its *two* phases—physiological and psychological—have been articulately correlated. The conscious modifications of man's mind, as compared with its unconscious modifications, I have in teaching represented by a small circle inside of a large one, the small (conscious) circle having the diameter say of the axle and the large (unconscious) one, of the wheel of a carriage. The same symbol serves to represent the small amount of conscious as compared with the larger amount of unconscious activity of man's body.

nections may be such, that a present individual personality, properly endowed, and in proper relations to the system, may use it without confusion, in giving present and immediate expression to the phenomena of intelligence. All the phenomena, both the automatic and the volitional, are in this case electrical phenomena, but the circumstances and manner of their occurrence, are such as to constrain the recognition of the action of two entirely distinct forces. It would be quite as rational, to confound electric force with mind-force in this case, as nerve-force with mind-force, in man. In both cases, the *intermediary physical force* is subordinate to the action of a higher power. The muscular act of grasping with the hand is the same, whether it be to lay hold of and to cling to your own pocket-book, or to that of another. The muscular act of bending the finger is the same, whether it be to pull the trigger in the sport of the gallery, or the chase, or to defend life against an assassin, or to take life as an assassin.

May it not be asked with incisive pertinency, whether he who *sees not* back of, and above, such identical physical acts as these, the active presence of a controlling personality, of a force, entirely different from and superior to nervous and muscular force, must not be pre-occupied and infatuated by some preverse hallucination?

2. But I must hasten to consider the relation of the nervous system to *sensation*. The reality of sensation being assumed, the question arises as to its *locus*. Are the phenomena of sensation the product of nerve-action, or does the property or *power of sensation* reside in some substance different from nerve-matter? Contractility, resides in muscle, as an inherent property of its tissue. The nerve-influence does not generate it, nor impart it, but only wakes it into action, as something already existing. This contractility exists distinctly from, and independently of the nerve-influence, and may be excited by other agents, yet physiologically it is in such intimate and peculiar relation to the nerve-matter, as in some unknown way, to be excited into activity by it. Why, then, may not the power of sensation be the property of a substance quite as distinct as muscle from the nerve-matter?

It is just as easy to recognize the one alternative as the other. On the efferent, or outward movement, the power of contractility is excited *in the muscle*, by nerve-influence; on the afferent or inward movement, the power of sensation *in the mind* is excited into action by nerve-influence.

The reason of the case, then, warrants the supposition that the sensation is no more produced, nor generated, by the nerve force, than is the muscular contractility: the one, is *located in the muscle;* the other, is located *in the mind.* This, however, lands us again in *natural dualism* as the theory of man's constitution. And the reasoning that will throw down the tower of mind that stands at one end of this line of communication, will as certainly overturn the tower of muscle that stands at the other. On the one hand, the nerve-change is the physiological condition of sensation whose seat is not in nerve nor nerve-force, but in mind and mind-force; just as on the other, the nerve-change is the condition of muscular excitation whose seat is not in the nerve but in the muscle. The nerve is thus a physiological intermediary or conditionate of the muscular and also of the mental act. The connection is as intelligible in one case as in the other and the evidence of both is equally valid. The reality of the sensation in consciousness as conditioned by nerve-change is less doubtful, if there be a difference, than the reality of the muscular contraction as conditioned by nerve-action. Both are known only and alike by consciousness under empirical conditions.

But I must close this part of the discussion abruptly, as it is growing beyond the bounds of all expectation, notwithstanding the disadvantage to what has been said, that may be occasioned by the omission of a number of specific and pertinent considerations of lively interest, that have not even been intimated.

The attempt to reduce the complex phenomena associated with the workings of our nervous system to scientific unitarianism, appears to me very much vitiated by the fallacy of incomplete observation and of hasty generalization.

Whether man is a compound being, consisting of body and mind (or soul) is simply a question of *fact*, which must be set-

tled, if at all, by the authority of evidence. That evidence is doubtless in existence and would seem to be the most accessible evidence in the world, as each one contains it completely within himself. But it is found to be extremely shy and difficult of approach.

I am satisfied, on purely scientific grounds, that not only the testimony of the senses (objective), but also that strictly on the (subjective) side of consciousness must be admitted, before the case is made complete; otherwise the case is like that of a man believing in what he sees through a microscope or a telescope, but, refusing to believe in what he sees with the naked eye. But it will be observed, that the movement of the foregoing discussion, is entirely within the sphere of neurology, that of consciousness or psychology not having been entered at all; yet, it is there, in the domain of psychology that the argument is supposed to have its main strength.

5th. But suppose the theory of the coëxistence of matter and mind, back of the complicate phenomena of man's nature as advocated in what precedes, to be conceded—and if conceded (as not contradicting the necessary import of established facts, but and only as having, in view of the available evidence, a title to serious consideration as claiming to be in accordance with fact,) then, before accepting it in full, there arise several questions, as to the *nature* and *extent* of the necessary *relation* of these coëxistent united substances, two or three of which may be considered briefly.

1. The attempts to formulate the *extent* of this relation, have been very varied, from (*a*) that of Descartes, who seated the mind in the pineal gland, to (*b*) that which holds to the *omnipresence of the mind throughout the nervous organism*—an opinion, which, in its phases, has a wonderful history, and with which, from the exigencies of the discussion in the future, physiologists may have occasion to be better acquainted, than they appear to be at present.

Some of the ablest investigators have pronounced it (*b*) "more philosophical, and, consequently, more probable than any other opinion." It was not this view of the mind's omni-

presence *to the nervous system*, which was to Aristotle an undigested heap, but, of the mind's essential and indivisible oneness and indiscriminate and equal relation to the whole body that originated the peripatetic aphorism, *The soul is all in the whole* (body) *and all in every part.**

But it is interesting to note, that this view of the soul's integrity was enunciated by Aristotle, who was the discoverer of the nerves in the animal organism, and the most distinguished anatomist and naturalist of antiquity; and who acquired no less glory in philosophy, than in the sciences accessory to medicine.†

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* "The doctrine, that the faculties and capacities of the soul, are the mere modes, in which the simple indivisible principle of thought, acts and exists, is the catholic doctrine of psychology. It is a proof of its universality, that few modern psychologists have ever thought it necessary to make an explicit profession of their faith in what they silently assumed.

No accusation can, therefore, be more ungrounded, than that which has been directed against philosophers, that they have generally harbored the opinion, that faculties are like organs in the body, distinct constituents of mind.

The Aristotelic principle, that in relation to the body, "The soul is all in the whole, and all in every part,"[1] that it is the same indivisible mind, that operates in sense, in imagination, in memory, in reasoning, &c., differently indeed, but differently only because operating in different relations—this opinion, is the one dominant among psychologists, and the one which, though not always formally proclaimed, must, if not positively disclaimed, be, in justice, presumptively attributed to every philosopher of mind."

† Dunglison's *History of Med.*, p. 129. "The principal discovery made by Aristotle, in Anatomy, was that of the nerves. But although he was well acquainted with the parts of the human frame designated under that name, he appears to have observed them only in animals.—He erroneously asserts, that there is no continuity between the brain and organs of sense, and he therefore derives all the senses from the heart."

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[1] *Arist. Περὶ Ψυχῆς*, I. v. 31.

* * * ἐν ἑκατέρῳ τῶν μορίων
ἅπαντ' ἐνυπάρχει τὰ μόρια τῆς ψυχῆς, κ. τ. λ.

"In the Greek Philosophers, the term, *ψυχή*, (soul) comprehends, besides the sensitive and rational principle in man, the principle of organic life, both in the animal and vegetable kingdoms." The two, however, are not to be confounded. In this *Thesis*, it is after "the sensitive and rational principle in man," and *not* "the principle of organic life," that search is made.

Vide Sir Wm. Hamilton's *Lects. on Metaphysics*, pp. 271–273.

If, as is the fact, sensations be *in the mind* and not in the body, nor in any part of it, the nervous system only furnishing the physical conditions incident to their occurrence, then sensation may properly be defined, as *the mind's cognizance of any change in the nervous organism.* The change itself is not the sensation, but the mind's cognizance of it.*

There appear to be three degrees of intensity in these nerve-changes. 1st. Those that stand on a level with consciousness and come within its grasp, and so are matters of knowledge. 2d. Those below that level, as in all the processes of waste and nutrition, and the ordinary operations of the organic or automatic system. 3d. Those of hyperæsthesia. The first arouse intelligence and will, the second, leave only a diffused impression of a sense of health and well-being, when normal. But excessive excitation may occasion the intensest agitation and suffering. It is in the singleness of consciousness, that all these phenomena attain a unity and significance of higher moment, than could attach to them as the routine occurrences of an animal organism.

2. The *conditions* of the union of mind and body and of their reciprocal action are doubtless found, on the physical side, in the anatomical structure and physiological functions of the

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* "We class *sensations* along with *emotions*, and *volitions*, and *thoughts*, under the common head of states of *consciousness*. But what consciousness is, we know not; and how it is that anything so remarkable as a state of consciousness comes about as the result of irritating nervous tissue, is just as unaccountable as the appearance of Djin when Aladdin rubbed his lamp in the story, or as any ultimate fact of nature." Huxley's Physiol. § 238.—"A state of consciousness," then, is accepted as "an ultimate fact of nature." This concession is very important, as we are not called on to explain consciousness, for we do not explain ultimate facts, but we do explain derivative and dependent facts by a reference of them to ultimate facts. We do not explain ultimate facts but we do explain by means of them. Consciousness being an ultimate fact of nature, we are no more at liberty to ignore it or to refer its appropriate phenomena to some other subject, as nerve action, than to identify the facts of pure mathematics with the facts of chemistry. Consciousness is the eye of the mind or soul, and truth is its medium of vision, like natural light to the eye of the body. Consciousness is our primary and fundamental organ of immediate as distinguished from inferential knowledge. Let us not forget nor ignore, therefore, this vital point, viz.: *That consciousness is an ultimate fact of nature.*

nervous system. It is at this point, that the psychologist approaches the anatomist and physiologist, and craves his kindly help.

If it be ascertained and settled that the corpora-striata are associated with voluntary motion; the cerebellum and posterior columns of the cord with the co-ordination of motion; the optic thalami with sensation; the tubercula quadrigemina with vision, and so on—all right; for facts as *facts* are sacred, but, no theory, however current or pretentious, has the slightest validity, except as an interpretation thereof. These functions, whatever they may be ascertained to be, are the conditions sought for, upon which mental modifications or operations have, as now known, some sort of dependence. The powers of mind are not to be identified with the functions of the nervous organism, nor to be supposed inherent in the substance of which it is composed. But this organism, is the instrument, whereby or through which, as an intermediary, the mind receives impressions from without and manifests itself from within. The varied pipes, octaves and stops of the organ capacitate it to convert atmospheric vibrations, into music. But it is the musician that gives the intelligent unity of life to these vibrations.

How ghastly the contortions of the cadaver, let the excitants be applied ever so skillfully—something is lacking, the horse has lost its rider. The harp of a thousand strings lies there, and not a string is unstrung or broken, yet no music can be swept from those cords. In life, each string, each pipe, each stop and key performs its part. "If," says Dalton, "these instruments be imperfect in structure, or be damaged in any manner by violence or disease, the manifestations of intelligence are affected in a corresponding degree."* Affected it is true, but certainly not always strictly "in a corresponding degree," whether the mind be limited to the brain or be omnipresent throughout the nervous organism. The idea may here occur that, on the doctrine of this Thesis, the loss of parts of the body would imply a corresponding loss of mind or mental capacity. But it is inept. The immaterial part not

* Dalton's Physiology, p. 438.

being mechanically divisible, the loss of a limb is only the loss of a string from the piano or of a stop or pipe from an organ and not a loss of musical power on the part of the performer. Of course the genius of the musician cannot reveal itself beyond the capacity of his instrument, and if the instrument be mutilated, although *his* powers remain intact, yet the manifestation of them is, so far as that instrument is concerned, lessened if not destroyed. The mind can reveal itself in sensible phenomena only through its bodily organs and in the manner and to the extent only of the capabilities of the bodily organism. If legs be lost, then leg-revelation ceases, but it is only the physical ability to walk that is gone. Animals survive mutilation so long as enough of the body is left to maintain the vital functions. Consciousness remains so long as the nervous conditions of its continued relation remain. The decapitation of a frog or of an alligator* is not at

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* "An alligator, 6½ feet long, was shot through the eye by my sister, in Lee County, Ga., March, 1865. I arrived home some two or three hours afterwards and proceeded with the assistance of a negro man to skin the animal, taking the precaution to sever the head from the body by several blows of an ax. Some minutes after this, (the head being several feet removed from the body,) I made an incision several inches long in the back of the animal near the lumbar region. No sooner had I done this than the animal gave a flounce with his tail, whereupon I withdrew to a respectful distance, to observe his movements. He then slowly and deliberately raised himself on his fore-feet, turned the decapitated extremity around to the right (the wounded side,) and shaped himself so that had the head been on he could easily have covered the wounded part. I concluded to wait until these signs of life had ceased and never repeated the experiment. (Signed,) JOHN A. WYETH."

My friend and preceptor, John A. Wyeth, M. D., (226 5th Avenue, New York, Assistant Demonstrator of Anatomy in Bellevue Hospital Medical College,) has kindly given me this statement of an interesting and important fact hitherto unpublished. It is only necessary to remark that even if the "flounce" of the tail and shudder be referred to shock or reflex action, the subsequent deliberate movement, especially in view of the somewhat exhausted condition of the animal, has probably a deeper significance. A marked sensation of a nervous change and a subsequently manifested appreciation, in accordance with experience, of an ab-extra cause to be warded off, are I conceive indicative of that pronounced phase of consciousness known as *perception*. So also the frog's appreciating and adjusting its ab-extra poise and relations, in the well known cases. It should be distinctly noted that, in the vocabulary of psychology, *perception* is sensation *plus* causation under the form of a *non-ego*; whereas in the vocabulary of the physiologist, it sometimes

once destructive of the physiological condition of the continuance of its consciousness; the decapitation of a man or of the higher animals is. This serves to intimate what I conceive to be the proper interpretation of the events and experiments to which in this connection, it is now only practicable to allude.

3. The *mode* in which the mind may act or be acted upon, through the nervous system as an organ, is just as intelligible as the mode in which the thought of the organist can take shape and be conveyed to our minds, by the manipulations of the stops and keys of his instrument. The how, may baffle comprehension, but the facts remain in their integrity.

How food effects nourishment, is an incomprehensible mystery, but the fact remains and we act on it daily. A comprehension of their mode of existence and correlation, is not, therefore, necessary to our most undoubted recognition of the reality of both body and mind in the constitution of man and as interfunctionating each other, in sickness and in health. We are competent to know that different parts of the nervous organism hold relations to the mind, different both in degree and kind; but the unity of consciousness and the oneness and immutability of our personality, which is the foundation of our identity, *preclude*, not from *relations* to the mind, but from actual or possible *identification* with the mind, all the distinctive and constitutive attributes of matter, such as extension, or diffusion, inpenetrability, division, form, weight and entire *destitution* of consciousness. It may be announced as a canon in psychology that personality has individual *ubiquity*, and that its acts must ever be somewhere, as well as somewhen, but that it only contingently respects the specific limitations that arise from the three dimensions of space, viz.: length, breadth and thickness, which hold matter in their inexorable grasp. It implies an egre-

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has a totally different and novel meaning, viz.: The ganglionic *nexus* between afferent and efferent currents in reflex action. For example, a muscular contraction, it may be in a dead body, responding to an impression upon a sensitive external or internal surface is said to be perceived by the nerve centre. As the so-called perception, in such a case, has nothing to do with consciousness, it has no psychological import. Perception (proper) implies a conscious distinction between self and not self—a cognition of the ego and non ego as coexistent and correlated. It is the core of psychology.

gious misconception of the true nature of mind, about which men undertake to reason, when they, avowedly or impliedly, parcel it out amongst various parts of the nerve matter, or attempt to divide, or to distribute, or to limit it by localizing processes. The attributes of mind and of matter are incompatible and mutually exclusive of each other and *cannot co-exist in the same* substance i.e. in the same ultimate principle or condition of unity ;* but, when each of these separate groups of attributes has found recognition as the properties of distinct and separate substances, then their respective relations may be reasoned about intelligently. But if things so different and opposite are confounded at the very outset, stumbling thus on the threshold, only confusion, inconsequence and mistakes can be the result. To attempt therefore, to localise the mind in the brain, or in any other part or parts of the nervous organism, is beset with vicious consequences, as it is violative of the testimonies of consciousness and of experiment. These testimonies will ultimately no doubt be seen to coincide

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* The assertion of this position, is not, as Professor Ferrier is pleased to call it, "an unshotted broadside, the brunt of which Materialism can very well stand;" but it is an impregnable fortress of truth, whose adamantine and glittering ramparts, can neither be battered nor broken, by the hostile missiles of *scientific unitarians*, whether they fight under the banner of *Idealism* or *Materialism*. If, as is conceded, the *attributes* of both mind and matter *seem* to exist, the law of Parcimony requires, not that we shall allow either to swallow up the other, but that we shall clothe each substance or object with its own qualities, as the only explanation that does no violence to the integrity of the facts of nature. The facts are patent and common property, and all acknowledge that both matter and mind seem to exist, but the difference is in the interpretation. All scientific unitarians insist, in their explanation of the facts, that this seeming is illusory and deceptive, either as to the one or the other of these substances; whereas natural dualists, adhering to the dictates of common sense, in their explanation, hold, that *this seeming* is not illusory but real and that we *actually* have in nature, just as we *seem* to have, not the mere appearances of matter and mind—not the mere semblances and shadows, but the *substantial realities*. If the seeming be wholly illusory, then neither matter nor mind exists; if it be not all illusory, then both matter and mind exist. There is no middle ground between *nihilism* and scientific *dualism*.

Tell me not in mournful numbers,
That life is but an empty dream,
For the soul is dead that slumbers
And things are not what they seem.
Longfellow's *Psalm of Life*.

and harmonise with the simplicity, ease and distinctness, which are ever characteristic of the truth when found. The most natural supposition would appear to be that the mind is present wherever it knows itself to be present; and this self-knowledge being a matter of consciousness, this is tantamount to saying that *the mind must be present and act, wherever it is conscious of acting.*

6th. Now, every person can test this matter for himself in various ways. *Press your toe against the floor.* You are perfectly conscious of resistance, you know it then and there, at the time and place of contact.

There is not the slightest perception, nor suggestion of currents afferent or efferent, nor of any transfer of the sensation or idea of resistance; nor is there any intimation of any lapse of time. The more often the experiment is repeated and varied, the better, as it always gives the same result.

But it is conceived to be a difficulty that the division of a nerve, or the pressure of a tumor, cuts off all sensation and voluntary motion from the distal parts. Sever the posterior roots of the lumbar and sacral nerves as did Magendie, and you may cut off the big toe or any other part of the leg on the side of the division without sensation from the operation. The division of the anterior roots destroys voluntary motion in the parts supplied and thus isolated. But this only shows that the normal *continuity* of the nerves is the physiological condition of the mind's presence and cognisance and volitional influence in those parts, and I venture the opinion that it shows and has been made to show no more. Moreover, the phenomena of reflex action cannot properly be identified with, nor made the criteria of, conscious sensation and volition.

All our knowledge, whether of self or not-self, is acquired. Innate knowledge and innate ideas have vanished like many of the fictions of physics and of physiology. Copernicus dispelled the illusion of the sun's revolution around the earth; and not till Galen did it, was it shown that blood and not air, as the name would imply, circulates in our arteries. The attributes of matter do not pertain to consciousness, and what knowledge we have of these material attributes is not in-

nate but acquired. The magnitude, form and parts of the body, are by degrees brought within the range of our knowledge and all the facts respecting transferred sensation, as in amputated limbs and rhino-plasty, have only an *empirical* and contingent support, and the new condition of the body ordinarily soon falls within its proper associations in relation to the rest of the system. The continuity and normal physical condition of the nervous system are circumstances which cannot be violated with impunity; and established empirical associations will necessarily mislead under altered conditions until empirically corrected.

As to the theory of currents, it is by no means demonstrated. Electricity, it is conceded, is not nerve-force, and it is a fallacy to *substitute* its responses for those of nature.* I

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* Flint's *Nervous System*, pp. 99—104. See *Popular Science Monthly*, Jan., 1873, p. 360, for a popular account of the experiments of others. This vicious substitution has hatched a brood of errors, of fallacies, of absurdities, such as that respecting the speed with which *sensation* travels along the nerves, and which fiction is in active public service, as a means of enlightening the masses! e. g.

Prof. Richard A. Proctor, in his recent course of lectures on Astronomy, credited to Prof. Mendenhall of the U. S., the honor of affording him the means of the following illustration. "Feeling is conveyed along the nerves ten times slower than sound travels. If therefore, an infant were born having an arm of the somewhat inconvenient length of 91 millions of miles, so as to reach the sun; and if, while in the cradle in boyhood he were to stretch out his arm and touch the sun, that infant might grow to the three-score years and ten allotted to man, or even four-score, but he would never be conscious of the fact that the tip of his finger was burned. He must live 135 years before any effect would be experienced." In the same connection, and speaking within his own chosen field of labor, the distinguished lecturer urged the fact that "because there is no appreciable increase in the length of the year, it is shown that the force of gravity acts instantaneously. Gravity, the sun's might, acts, so far as we can judge, instantaneously. It is one of the forces of which we are able to give no account whatever, for all our laws of matter are opposed to the conception of force acting otherwise than by contact."

If this be so, behold the superiority of gravity to thought! *Credat Judæus, non ego.* Electricity is very subtle, and I note very often that it misleads. Experimentations with it, like "words, are the counters of wise men, and the money of fools." Yet, on the popular theory of nerve currents, afferent and efferent, to and from the sensory, such inferences are not only legitimate but inevitable however strange they may appear to be. But no theory, however plausible in speculation, can hold its ground against the facts of consciousness and the opposing light and testimony of nature herself. To ignore the direct testimony of consci-

have experimented, to my own satisfaction, with the following result. Arrange electric magnets all in the same circuit, so that a single closure may bring points or surfaces of impact in contact with various parts of the body. Fasten the magnets with their armature levers on the limbs and parts of the body, so as to make sure that the contacts with the skin shall occur; likewise average the points and degrees of contact with due reference to the variations of the sensibility of the different parts.* If the *closures are simultaneous*, then the *impressions on different parts of the healthy body are known simultaneously.*†

The consciousness or knowledge of these impressions does not arise at intervals corresponding to the distances of the parts affected from the encephalos, *but simultaneously.* If this attests anything, it is the *omnipresence of consciousness throughout the nervous organism*, cognising the changes therein at the *time* and *place* of their occurrence.—The advantages claimed by me for this experimentation are, 1st. Nature is as little disturbed as

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ousness as primary when acting within its proper sphere, and to appeal to the testimony of instruments whose action is dependent on consciousness itself for its accuracy, is to reënact the role of the old lady who ransacked the house for her spectacles, through which she was all the time looking whilst making the search. That which is measured by the recording instruments operated by the subjects of experiments, is probably muscular contraction which, being only a mode of motion, is of course measurable, in time units; and then contingently, there may be an appreciable interval between the sensation and the volition to make the record, not to speak of the time consumed by the action of the most delicate instruments. In appreciating reflex phenomena, *the law of continuity* which I have laid down must not be ignored.

* Müller's Physiology, p. 752.

† This direct appeal to consciousness (the internal subjective standard,) must be accepted as valid, as its testimony is only checked and verified approximately by using recording instruments. If its *direct* testimony is not valid neither can its *mediate* testimony through instruments be reliable. This direct testimony is not an inference, deductive or inductive, but an immediate act and ultimate datum of consciousness. The two propositions, *I know, and I know that I know*, are, in this point of view, indentical. Every act of consciousness is self-luminous. This appeal to the testimony of consciousness direct, seems, therefore, to reduce the personal equation of error to its minimum terms. We are here dealing not only with the facts of body but of mind, and hence we must not beg the question on either side by the *method* of investigation adopted, but give all the facts and conditions in question a fair hearing.

possible; 2d. The electric action is the nearest possible approach to absolute simultaneity of impression; 3d. There is no limit to the number or variation of the points that may be brought into comparison; and 4th. The element of muscular contraction, a *source of palpable error*, is thrown out; and 5th, finally, even the time of the action of the instruments does not intervene to disturb the result, that is to say, there is no error in the *substitution* of the electric action, through its *appareil*, for the action of the mind itself. If the result reached be not an *illusion*, it annihilates the afferent current, and, by doing that, it overwhelms with doubt the efferent one, as physiological phenomena.

The fact, that the mind is present in the big toe and is there immediately conscious of the impressions made upon it, does not imply that the soul's energies are as fully exerted there, as where fuller and higher provisions, as in the cerebro-spinal centres, are made for furnishing it the physiological conditions of more diversified and exalted operations. That the mind *thinks in the great toe*, does not imply that it does not think also and more completely in the head; and vice versa; and the intricate arrangements of its parts, would by parity of reasoning, point to the brain as the sacred shrine where are veiled not exclusively, but pre-eminently the hidings of its powers.

IV.

I will only add, in conclusion, that the dual theory of man's constitution, has important bearings on the interpretation and treatment of morbid phenomena, and that it seems to be available as a principle of classification for what are called *Nervous Diseases.*

1st. *Neuroses.* Affections having their seat in some nerve lesion or functional disturbance, but mind not appreciably affected.

2d. *Psychoses.* Affections which have their seat in mental conditions, but body not appreciably affected. It is no more certain that some disturbances occur in the brain,

cord and nerves without involving mental disturbances, than that most distressing mental conditions and aberrations occur, when bodily health is not impaired. Such cases, however, may require the Pastor rather than the Doctor, as the prospect of relief must be mainly through the mind and not the body.

3d. *Neuropsychoses.* Those affections that have their initiative in nerve-lesion, deranged function or inflammation, but invade the mind.

4th. *Psychoneuroses* begin in psychic conditions but induce nerve-lesion or functional derangement and inflammation. Facts do not appear to sustain the unitarian notion, that the mind is a mere function of the nervous organism, so that insanity and all other nervous diseases are only the expression of a morbid bodily condition The forces that are etiological act and react in these cases, and they act from within, outward, as well as from without, inward. The bodily condition may be the symptom or the sequel, or the co-ordinate of the psychic. Mere mental depression or distress from domestic affliction, or business misfortune, sudden impressions of joy or sorrow, &c., may invade the bodily conditions on which health depends—yes, even life itself.

"Case 13,"* "A woman, aged 47, on admission, &c., gave the following account:

"Three years ago, *after a violent emotion*,† she had a feeling of numbness and formication in the upper limbs, more in the left, and afterwards in the lower limbs; gradual weakness came in all the left side, &c." Quite an evolution of progressive affections is given, evidently demanding time. "The pain went on increasing and diarrhea caused death." The author remarks respecting this case, that it is "very important, and has more value than most of the cases" related by him, on account of the microscopical examination of the altered parts of the spinal cord. "The brain and cerebellum, carefully examined, were

* Brown-Sequard's *Lects. on the Central Nervous System*, p. 66.

† The italics are mine.

found healthy." (Dr. Charles Robin assisted in the autopsy.)

This case began, or *took its initiative* from a purely *psychic condition*,—"a violent emotion," and the neurotic symptoms were consequent thereon, and *over* 3 *years* intervened before death. This was an abundance of time, for the occurrence of of all the lesions found in the examination. There is *no presumption* that any lesion *preceded* the "emotion." This, therefore, appears to be plainly a *psychoneurotic* case. The same distinguished authority, in his lectures on the diagnosis and treatment of nervous affections, places "the moral means of treatment" first in order, and observes in that connection: "I need not repeat, that I am now speaking only of those *neuroses, in which the power of the mind upon the body is so great*, that under the influence of an emotion, or another moral cause, a sudden or almost sudden *cure is not very rare.*"

The *psychic element* of our constitution, then, is not a mere function, but a functioner—a *substantial factor*, whose real and active presence cannot be ignored, in the diagnosis and treatment of disease, with any more propriety than could that of the nervous system itself.

I end this Thesis, therefore, as I began it, by invoking friendly co-operation between Physiology and Psychology, in the establishment of a Neuro-psychology, not as an abstract speculation, but as a practical philosophy, in the interest of medicine and of man.

"Dust thou art, to dust returnest,
Was not spoken of the soul."

New York, Jan. 30th, 1874.

[N. B. As the variations from the original manuscript are immaterial, only being such as to bring out the sense in a few passages more clearly or to guard against misapprehension, they do not require articulate notice.]

III.—*Two Cases of Locomotor Ataxia in Children.* By J. H. Kellogg, M. D., of Battle Creek, Mich.

The patients, two brothers, were first seen by me about the first of May, 1875, and were under treatment and daily observation during the months of May, June, July and August. The patients were aged respectively, seven and ten years, and were of average development for their age. The younger of the two, when not in motion, gave every appearance of perfect health, and was a very mirthful, intelligent child. The symptoms of the disease were most marked in the older boy. The ataxia of his lower limbs was so great that he was unable to walk; yet there was very little loss of muscular strength, or of electro-muscular contractility, with slight decrease of sensibility in the lower limbs. He could only move about by creeping on his hands and knees. The ataxic symptoms were quite apparent, though less-strongly marked, in the head and upper extremities. Speech was slow, indistinct and difficult. Sight and hearing were both appreciably impaired, and there seemed to be difficulty in controlling the eyes. The face wore an expression of stupid imbecility; yet, when aroused, the intellect did not appear to be greatly impaired.

In the younger boy, the ataxic symptoms were almost wholly confined to the lower extremities. He could walk without much difficulty, though clearly manifesting the peculiar gait, characteristic of this disease. His speech was distinct, and both sight and hearing were acute.

The mother of the boys stated that the disease was first observed in the older one about four years previous, when he was a very sprightly, well-developed child, having been healthy from infancy. He could then speak distinctly, and could see and hear as well as others. The disease had progressed steadily from that time. Only about one year and a half had elapsed since the first symptoms were marked in the younger

child; but the advance of the disease had been much more rapid than in the case of his brother.

In endeavoring to discover, if possible, the exciting cause of this grave malady, at so unusual an age, I was unable to fix upon anything which could be considered at all sufficient to account for it. Both parents were healthy and of good character and habits. I elicited, however, what seemed to me to be fair presumptive evidence that the predisposition to the disease at least was hereditary. The facts upon which this opinion was based, are these:

1. The same disease appeared in another child of the same family, a boy, and at about the same age. In this latter case it continued until it resulted in death from inanition; the muscles of deglutition being paralyzed, at the age of twenty years.

2. The same disease also affected several children in the families of two sisters of the mother of the boys, pursuing the same course as in the last case referred to.

In each of the three families there were other children who enjoyed perfect health.

In all of these cases various modes of treatment had been tried without the least apparent benefit. Magneto-electricity had been used, but without effect. I decided, in order to test the value of electricity as a remedy in this disease, to use no drugs, especially as the latter had been faithfully tried without effect, but to confine the treatment wholly to electricity and simple measures for improvement of the general health. The plan of treatment followed during the whole time the patients were under treatment, was thus:

Central galvanization, with prolonged application to the spine, every other day, with a current of ten or twelve cells, Stöhrer. General faradization once a week. Frequent sun-baths, sponge baths, and daily frictions of the whole skin with the dry hand, together with systematic active and passive movements of the lower extremities. The only additional measures were abundance of exercise in the open air, and a generous diet.

Results of treatment: For several weeks there was no apparent change, except that the progress of the disease was checked. This improvement has been very visible in the younger boy. During the next few weeks, there was a manifest improvement in both cases, which was remarked by all who saw them (they were much noticed.) The improvement was most decided in the younger boy, but the older improved so much that he could walk with canes. During the last month there was no further improvement, and treatment was discontinued, as the parents were unable longer to bear the necessary expense, being some distance from home.

From my observation of the effects of electricity in these cases, I am encouraged to believe that if it could be employed, at an early period in this disease it would not only check its further progress, but would effect a cure.

IV.—*Notes on European Hospitals and Specialists.* By W. F. Hutchinson, M. D., Providence, R. I.

During the summer just past, the writer made an extended trip through the British Kingdom and continental Europe, for the double purpose of renewing his special studies and regaining health somewhat impaired by an arduous winter's work. The journey was exceedingly interesting and valuable, and the remembrances of the holiday will long remain as among the pleasant ones of a lifetime.

Through the kindness of our old friend, Prof. Wood, we were furnished with credentials to Sir Henry Thompson, Mr. Erichsen, Dr. Reynolds and others, whose cordial reception and many courtesies made us at once home. Perhaps the most enjoyable days of all the London stay were those when, in response to a note of invitation from the former, we presented ourselves at his door in Wimpole Street, and accompanied him to witness his superb operations for stone. In this, his specialty, it is probable that he has no living equal, and his extended reputation draws to him sufferers from the four quarters

of the globe. He is unlike most of his countrymen in physique, being rather slight, handsome, and of a nervo-sanguine temperament, with a quick, energetic way of moving and speaking which is not common in England. There are a number of houses in the immediate vicinity of his residence where his patients from abroad obtain board and where he operates; thus having them under his own eye and his assistant's as well as in the charge of nurses trained to the special care of patients of this class. One adjunct struck us as particularly valuable and novel, although Sir Henry informed us that it had been in vogue some time in London. This was the presence of a gentleman Mr. Clover called a "chloroformist," who was a qualified surgeon, and thus to be thoroughly trusted with his branch. The anaesthetic used was a mixture of nitrous oxide and ether inhaled through an instrument covering the mouth and nostrils. It was wonderful to what skill this gentleman had attained. In less than five minutes the patient was ready, and the quantity of vapor inhaled was so accurately graduated that not more than three minutes elapsed after the operation was over before the patient was again conscious. Add to this the almost total absence of ether vapor from the room, and it is easy to see how great an advantage the London surgeons possess in this particular over us. It is to be hoped that in all our large cities, where there is much surgery, a similar practice may speedily obtain. Sir Henry operated in our presence four times, once cutting for stone, and three times crushing with the admirable lithotrite which is his own invention.

Of the personnel of Mr. John Erichsen, it is quite unnecessary to speak to an American public; for his late visit here has made his face as familiar to us as have been for many years his standard surgical works. Although in the height of the London season, with many society obligations pressing upon him in addition to his great practice, he gave us a cordial reception an hour of his time, and added, on parting, some cordial messages to his American friends.

The hospitals of the great British metropolis are so well known that no word can be said of them in description which will add to their deservedly eminent reputation. The name of

Guy's, St. Bartholomew's, St. Thomas' and St. George's, are well known on this side of the water, and a specialist in nervous diseases will find in the Hospital for Paralytics ample opportunity for study of these maladies in every form. Dr. Reynolds, whose monograph upon medical electricity has attracted much attention, leads the specialty in Great Britain, and the profession have generally conceded to him and his followers much more of the respect due to this separate branch of medical science than always obtains in America. Indeed, the tendency to division of study and labor is, I think, much more strongly marked in England than in any other country in Europe, and we were surprised to hear from many members of the British Medical Association, whose annual meeting, held in Edinburgh, we had the pleasure of attending, very decided opinions in favor of this plan, with many wishes that it might be still further extended.

In Paris, we presented our letters to Drs. Tripier, Onimus and Johnston, the latter, an American, long resident in France. The two former were exceedingly courteous at once, and made various appointments for hospital meetings, etc. To our regret Dr. Tripier was just leaving for his summer vacation in Algiers, and I saw but little of him. He is a thorough enthusiast in electro-therapeutics, a brilliant writer and a fine conversationalist, possessing a wide knowledge of the many theories in vogue, combined with large practical experience, and a way of deducing conclusions from data which ranks him among the foremost of the French Specialists. With M. Mallet he has founded a clinique for the treatment of urethral strictures by electro-surgery, which is largely attended, and wherein he has obtained excellent results. His favorite battery is composed of Leclanche cells, to which he awards the palm for constancy and evenness of action, two of the absolutely necessary qualities to be demanded from an electro-therapeutist's instrument. And just here, let me enter my protest against the use of any such clumsy title as the above. If any separate "*ist*" is desirable, which I deprecate, the English name of "medical galvanist" would be much less ponderous and more unassuming than the one above used, and would quite as

accurately define the specialty. Dr. Tripier uses an induction apparatus of his own contrivance, which is very ingenious and effective, but in no way superior in action or effect to those made by the Galvano Faradic Company, of New York. He has also devised several forms of urethral bougies, to be used in electrolytic treatment of urethral stricture, one of which protrudes from an insulated sheath an olive tip by means of a ratchet and screw, and struck us as better than any thing else of the kind before seen.

Dr. Onimus, his confrere in the specialty, is a younger man, who has also gained an enviable reputation on both sides of the Atlantic by his published writings. He is, if I remember aright, an Alsatien by birth, of fine personal appearance and suave manner. Several hours passed in his operating rooms, gave me a good idea of his method of using the currents, which differs materially from ours. The applications, chiefly of the constant current, were very short in duration, never exceeding four or five minutes, but he assured us that they were as effective in his hands as longer seances. He uses a constant battery of his own invention, which certainly seems to excel any other in the peculiar advantages which he claims for it; viz.: economy of space and accessibility to repair. It is a fact that a large part of the annoyance and trouble arising from galvanic piles is in consequence of the deterioration or destruction of the zincs, their replacement and the expenditure of money, labor and time thereby incurred. It may seem singular to the non-expert in medical galvanism, that a statement like the above, should be made; but the ideal battery which shall combine constancy, evenness of current and portability lies in the "dim vista of the future." Dr. Onimus claims to have given us something at once cheap, accessible and readily repaired, and his device really seems valuable. Of course experience in its use must be the only criterion of its status, and of that I have none.

With the doctor, we visited the famous home for aged women, La Salpetrière, where we met the celebrated Charcot. This gentleman is one of the very few illustrious French medical men whom death has left in Paris. His grand com-

peers, Nelaton and Velpeau are gone, but time has dealt so gently with him, that in twenty years we could see no sign of impairment of either physical or mental force. Certainly no one would dream, seeing him in the wards amongst his patients, followed by a group of students of all nations, that his trim figure, quick, firm step, and quiet, steady utterance, belonged to a man whose name has been amongst the foremost in the medical world, so many years. He speaks English, too, and speaks it well, a rare accomplishment among Frenchmen, who find our curious diphthongal sounds almost impossible. He welcomed us cordially, explained in detail his views of some singular cases, and invited us to attend his lectures at the Ecole de Medecine.

La Salpetrière is not a hospital, but a large establishment, having within its immense area complete villages of buildings for the use of aged and infirm women, and the insane of the same class. Every adjunct to usual village life, is present within its walls, and the aged women seem as comfortable and happy as possible. The hospital is merely a portion of the whole, and, as it dates back to 1660, presents no especial points for observation.

At La Charité, we were received by Dr. Trelat, who, with Verneuil, stands at the head of Paris surgeons. He made several operations with the galvano-causty, or, as it is usually termed in Paris, the galvano-caustique-thermique, electrolysis being called galvano-caustique-chimique.

The instrument employed was Trouvé's pile, which is the same in essential construction with the American galvano-causty battery. His operations were skilfully performed, and he assured me that the results were excellent. But I could not find in either London or Paris, any causty instrument which was in any single necessary point, at all superior to those made in New York, and no constant battery equal to the beautiful Siemens and Halske cabinet of the Galvano Faradic Company. La Charité is an excellent example of the Paris hospitals of the first order. Venerable with age and honors, the homes of what has been the first medical education in the world, it is none the less true that they are not equal in ar-

rangement or facilities for cure of disease to either English or American institutions of the same class. Their very age precludes many modern improvements, which the Direction de l'Assistance Publique would doubtless gladly have added, had any modification of the old walls been possible. I do not believe that there is any hospital in Europe to-day, in which sanitary science has so powerful an influence as in America, nor any wherein the general student of medicine can gain any better knowledge of the clinical principles of his profession, than here. With the specialist, the case is different. The divisions into different branches of study and practice have existed a long time, and there are to be found men who teach specialties with the advantages of long experience and abundance of material; advantages not met with in our newer land, where the better results from distinct, accurate study and practice consonant therewith, are not yet fully appreciated. The vast treasure-houses which contain the results of long years of careful observation, like the Hunterian Museum, in London, are yet to be built and filled; and, while days spent within their teeming cabinets richly reward the student, and teach pathology as only comparison can teach, I am still of the opinion that it is no longer necessary for the American student, who intends to make his home and his mark in his own land, to spend any time in roaming about the Old World, the usual definition of a course of lectures abroad. There can be no doubt, however, as to the manner of his reception by foreign medical men. He will be welcomed with a warm courtesy, and treated with a cordial politeness, which so far as America generally is concerned, is yet in the future.

V.—*The Elements of Electro-Therapeutics.* By GEORGE M. BEARD, M. D.

(Continued from page 23.)

The Differential Therapeutical Action of the Currents.

IN regard to the question of the differential therapeutical action of galvanic and faradic currents, there are two general principles, the truth of which is shown by experience.

First. Susceptibility to one or the other current, appears to be a matter of temperament, without regard to the disease or symptoms.

There appear to be certain persons, who, whatever may be the disease from which they suffer, are so susceptible to the galvanic current that it cannot be used upon them in a mild form, while they can bear the faradic current in large doses; on the other hand there are certain persons who are so susceptible to the faradic current, that it can only be used upon them very mildly, while to the galvanic current they show no special susceptibility.

I am not as yet able to trace any relation between these peculiarities of susceptibility and the appearance of the patients, and I see no way of ascertaining them save by actual trial. The general law holds good, that the delicate and nervous are more susceptible to electricity, than the hardy and phlegmatic; but to this very general law there are a sufficient number of exceptions both ways to make it pretty clear that beyond the general element of strength or feebleness, there is some subtle quality of the constitution by virtue of which it responds kindly, or the reverse, to the one current or the other.

These remarks apply mainly to the central and general methods of application; in purely peripheral treatment the whole body is less affected, and the differential action of the current is less marked; but even from purely localized affections quite important constitutional symptoms sometimes appear, and I think I have observed a differential constitutional effect of the two currents from such limited applications.

In the local treatment of paralysis there is a general rule that when the muscles refuse to respond to the faradic current the galvanic should be used, and the rule is usually observed that when the faradic current causes contraction the galvanic is not resorted to, but there appear to be cases where better results seem to come from the galvanic current, even when the faradic produces ready contraction. I think I have observed this fact in some cases of lead palsy. Whether this advantage, if it is a reality, is due to the special action of the galvanic current on the nerves, or not, it is impossible to say.

Cases illustrating these peculiarities are continually coming under my observation. The idiosyncrasies in this regard are highly interesting. Thus a man who is apparently and really strong, grows faint or sick under the galvanic current when applied in such a way as to reach the nerve centers while the faradic current may be applied all over him for a long time, and only pleasant effects appear. I have recently seen this illustrated in a remarkable case of hysteria in a woman who would bear general faradization and local faradization of the womb in large dose frequently given, but who seemed to be injured by a few seances of central galvanization with very mild currents. An important fact in her case, is that she was very sensitive to medical treatment of every kind, faradization appeared to be almost the only application, electrical or of any other kind, that she could well endure. In her case faradization was not only well borne, but was most efficacious; she has improved rapidly and there is every probability that the improvement will be permanent.

The Dose of Electricity.

In regard to the dose of electricity in medicine there has been on the part of writers on this subject a surprising amount of indifference.

In the use of all other remedies the question of dose is assumed to be one of prime importance; and it is well known that the effects vary with the dose, so greatly that between a very small and a very large one, opposite results may be produced. Still further, the matter of dosage of all new drugs is submitted always to elaborate investigation, and no one dares to extensively prescribe any new remedy until the results of such experiments are made known.

But in medical electricity very few of the pioneers have given any thought, so far as can be judged by their writings, to the subject of dosage, and hence the common practice is to order the application in a vague and indefinite manner, both as to time and strength of current, giving about as much as the patient can bear without great pain, and keeping up the ap-

plications oftentimes until, perhaps, both doctor and patient are tired out, and then when bad results or no results follow such hap-hazard proceedures they censure electricity and those who have written in its favor.

It is probable that the leading authorities in medical electricity have really given more thought to the question, than is apparent from their writings, and have honestly and earnestly experimented with a view to its solution, but on account of the complications and doubts that beset, and thicken with every step, have given up in despair, or at least have not attained sufficient certainty in their own minds to warrant positive expressions of opinion. Drugs can be weighed and measured, and the effects of some are so quickly and powerfully perceptible that there is little difficulty in ascertaining how much should be given to produce a definite impression on an average constitution; but electricity in its medical applications cannot be so measured, for reasons which will occur to every one who is familiar with Ohm's Law.

To determine the dose of an application of electricity four factors are to be considered.

1. The strength of the current.

2. The length of the application.

3. The locality and mode of the application, whether central, general or peripheral, and on what portion of the periphery, whether stable or labile, and by what kind of electrodes.

4. The electro-susceptibility of the patient.

Of these factors, the first, second and third, are peculiar to electro therapeutics, and do not apply to medicines in general, the fourth, individual susceptibility or idiosyncrasy, is common to all therapeutics.

In regard to the strength of the current, the easiest and most practical guide, and one that most of those who use electricity intuitively follow, is the sensitiveness of the patient in that portion of the body where the application is made. This guide, imperfect as it unquestionably is, answers better on the average than any determination of the dose from the number of cells or from the depth of immersion of the elements, or the

relative position of the coils, and for reasons which Ohm's Law makes fully clear; it has, however, this very serious drawback, that the electro-sensitiveness of the patient bears no even or constant ratio to his electro-susceptibility. Electro-sensitivness refers to the immediate effect of electricity on the sensory nerves. Electro-susceptibility, to its secondary effect on the part to which the application is made on the central nervous system, or the constitution in general. An application that is not at first painful at all, that is, indeed, rather agreeable, which the patient may ask to have prolonged, may be followed the same or the following day by secondary effects of a most disagreeable if not alarming character. In certain sclerosic conditions of the central nervous system the electro-sensitiveness, as determined by the reactions of the nerves of common or special sensation, may be very feeble, while the electro-susceptibility may be equal to the average. I have seen this point illustrated very recently in a case of insular sclerosis that I have been treating by central galvanization and galvanization of the brain and spinal cord. The patient, a lady about sixty years of age, scarcely feels a galvanic current from eight freshly charged cells when applied to the neck or cervical spine; and when applied over the forehead flashes of light, and the sour taste in the mouth are scarcely perceptible; and yet after an application of no great length, during which she has scarcely been aware that any current was running, she has sometimes felt decidedly worse the day following; and her case is one of many that I have seen.

The length of an application of electricity varies all the way between one minute and several hours; there are those to whom a minute is almost long enough, and there are some who appear to bear applications protracted for many hours without any traceable secondary effect of an unpleasant character; indeed results appear to be obtained in some instances by these very protracted applications, that could not be obtained by applications of the ordinary or average length.

Some years since, while visiting the leading specialists of Europe, I observed that nearly all used shorter applications than was the custom in America; and my friend, Dr. W. F.

Hutchinson, of Providence, who has recently returned from a visit abroad, tells me that he made the same observation, and he is of the opinion which appears to me just, that the European applications are for many cases too short for the best therapeutic effect, and in this cause we may, perhaps, find an explanation, in part, of the greater popularity of medical electricity in this country.

From five to fifteen minutes is a very good general guide, studying closely any secondary or reactive effects that may show themselves. For my own part, I rarely look at the clock in working electrical applications, and so far as I have observed, very few medical electricians time themselves accurately, excepting in surgical operations. As a rule long applications with mild currents are better than short applications with very strong and painful currents; a swift, severe shock will do more harm to a sensitive person, than a prolonged but gentle and steady application. There would appear to be some cases, as rheumatism, or cancer, or neuralgia, where the pain yields only to very prolonged applications, seances of the average length doing very little good.

In regard to the mode and locality of the application, these facts are apparent, that central applications should be used more continuously than peripheral applications; that peripheral applications in the region of highly-sensitive nerves, should be shorter and milder than applications in regions but little sensitive, and that electrodes of soft sponge can be used for a longer time than electrodes of solid metal or the metallic brush.

VI.—*Suicide and Religion.* A portion of an Essay on "*Penal Laws Relative to Suicide, in Ancient and in Modern Times,*" (read at the September meeting of the Medico-Legal Society of New York.) By R. S. GUERNSEY, Esq., of the New York Bar.

IN this paper the word *penal* was used, not in the narrow legal sense, but in its broad sense of penalty of every kind and nature; legal, social, moral and religious. On the latter

branch of the subject he said; "The attitude which the teachings of antiquity, and especially of the Greek stoics on the one hand and of almost all modern moralists, (for Christianity now colors all modern moral philosophy,) on the other, in regard to their conception of death, appears very plainly in their views of suicide. For this modern view of it among us we are mainly indebted to the great Roman Catholic Church.

The doctrine of future reward and punishments which is so prominent in the New Testament and the Koran, is the foundation upon which it was mainly built, in religion.

The disciples of Zeno, the Stoics, held that self-destruction, when not caused by despair, is not necessarily immoral, is frequently praiseworthy, and under certain circumstances is even prescribed by duty. Yet the corpse of the suicide, according to old usage, remained unburied. As Stoical philosophy, however, advanced in popular estimation, this custom ceased.

The stoical system of ethics was, in the highest sense, a system of independent morals. It taught that our reason reveals to us a certain law of nature, and that a desire to conform to this law, irrespectively of all considerations of reward or punishment, of happiness or the reverse, is a possible and a sufficient motive of virtue. It was also in the highest sense a system of discipline. It taught that the will, *acting under the complete control of the reason*, is the sole principle of virtue, and that all the *emotional part* of our being is of the nature of a *disease*. Its whole tendency was therefore to dignify and strengthen the *will*, and to degrade and suppress the *desires*. It taught, moreover, that the man is capable of attaining an extremely high degree of moral excellence, that he has nothing to fear beyond the present life, that it is essential to the dignity and consistency of his character, that he should regard death without dismay, and that he has a right to hasten it if he desires.

A council of Arles, about the middle of the fifth century, having pronounced suicide to be the effect of "diabolical inspiration," a council of Braga, in the following century, ordained that no religious rites should be celebrated at the tomb of a suicide, and that no masses should be said for his soul.

It was ordained in the sixth century, by the Canon law that no commemoration should be made in the Eucharist for such as destroyed themselves, neither should their bodies be carried out with palms, nor have the usual service read over them. Suicide and attempting suicide were to be treated as infamous and as far as possible amenable to penal discipline, and a suicide is considered as having "died in mortal sin," and could never enter the Paradise of the blest, and these provisions, which were repeated by later Councils, were gradually introduced with the Canon law into the laws of the barbarians and of Charlemagne, thus they were spread all over Europe.

The Capitularies of Charlemagne provided that though mass should not be celebrated for a suicide, yet any person might through charity cause a prayer to be offered up for his soul.

During the whole period of the supremacy of the Church of Rome in Europe the act was more rare than before or since. The influence of Catholicism was seconded by Mohammedanism, the teachings of which, on this as on many other points, are similar to those of the Christian Church and even intensified in this case, for suicide which is never expressly condemned in the Bible is more than once forbidden in the Koran; and the Christian duty of resignation was exaggerated by the Moslem into a complete fatalism, similar to the Calvinistic doctrine of predestination. Under the government and influence of Catholicism and Mohammedanism, suicide, during many centuries, almost absolutely ceased in all the civilized, active and progressive parts of mankind.

Since the reformation in the fifteenth and sixteenth centuries these laws have declined, yet the *position* which the Roman Catholic Church and its propagators took in its early days and in its strength and vigor is still maintained by it and its two main branches, the Greek Church and the Protestant Episcopal Church. In all these churches clergymen and others are prohibited, under penalty of excommunication and suspension, reading the burial service and rites over the body of any person who has laid violent hands on himself, whether that of a communicant or not. But this rule does not apply to insane or weak-minded

persons, and clergymen and priests argue that no sound minded person will commit suicide, or at all events there is a doubt about it, and they, in Christian charity, give the deceased the benefit of such doubt, so that the Church prohibition practically amounts to nothing. A refusal to perform the burial rites of those churches, or any other church, over the body of a suicide, for that reason, is almost unknown in the United States.

The statute law in England prohibits any funeral rites of any church in *all cases*.

The burial of the remains must be by private interment under the direction of the coroner, in the churchyard or other burial ground of the parish, and shall take place between the hours of nine and twelve at night.*

VII.—*On the Use of Electricity in Obstetrics.* By Dr. A. Tripier, of Paris.

The introduction of electricity into obstetric practice has been based on the property possessed by the muscular elements of the uterus of contracting under the stimulating influence of faradization. Radford in the first instance, after him Cleveland, Houghton, Barnes and Mackenzie, have seen in this a process capable of imparting greater activity in protracted labor, a resource in cases of hemorrhage and a means of promoting uterine contractions where it is essential to provoke a premature labor.

The detailed account of these attempts cannot be stated and their importance discussed unless we are in a position to appreciate the comparative efforts of faradization and those of a drug, which has been singularly abused by accoucheurs in all countries. We mean ergot of rye.

* The paper from which the above is an extract is soon to be published entire. From the researches it exhibits, and its comprehensiveness, it is evident that it will be a valuable contribution to the history of modern civilization.

Before the days of faradization, ergot of rye had been employed to stimulate what was considered as the insufficient activity of the labor; previous to this it had been regarded as a hemiastatic; finally and for a long time, it had borne a wide and evil reputation as an abortive agent. It will be necessary for me to show, in these various roles, what ergot of rye really does, and its effects as compared with those of electricity.

We will see that ergot of rye does not respond satisfactorily to any of the indications which it has been called on to fulfil. Consequently I should be greatly embarrassed were I to endeavor to classify its indications from its properties. In such a case, experience is the only possible guide. Ergot is then a drug, which is administered before, during, or after delivery. Hence it is in these different circumstances that we shall examine its action as compared with that of faradization.

Before term, it has been employed as an abortive agent, in order to promote premature delivery. It is not my province here to condemn a medicine or a poison from the fact that its administration might favor the perpetration of acts criminal in the eyes of the law. It is sufficient, that according to the most competent authority, ergot is not an abortive, at least at an early term.

Does this mean that abortion might not result from its long continued use? Á priori, nothing prevents us from admitting that such might be the case. What we know, however, of the toxicology of ergot does not seem to point in this direction; and I am not aware that any one has ever observed on the walls of the ovum any lesions of a gangrenous nature, observed on the extremities in ergotism. Were it so, the effects of ergot would remain those merely of a poison, capable of affecting the mother and ovum, and of provoking the fall of the latter if the intensity of the morbid conditions set up by it, were sufficiently strong.

It is a poison, but not an abortive agent.

Would it be otherwise with faradization? And what effect can it produce before the commencement of a spontaneous labor?

It promotes uterine contractions which we can at pleasure

render weak or strong; but I do not believe that these immediate effects can be easily exceeded. I have in former years, accidentally and voluntarily faradized the gravid uterus, and I published ten years since, in reference to the influence of artificial uterine contractions on premature parturition, the result of my observations, to wit: That the contractions of the matrix are not sufficient to detach, before maturity, a healthy ovum; and that abortion must have as its cause a malady, spontaneous or provoked, either of the ovum or of the surface to which it adheres. Since then I have had occasion to see that these conclusions based on observations continued up to the fifth month of pregnancy might very carefully be carried on, even up to the end of gestation. Having endeavored to precipitate the beginning of labor by provoking uterine contractions in the case of a multipara whom there was reason to consider had reached a full term, I could administer faradization during five days in two sittings of five minutes' duration daily, without obtaining the persistence or the spontaneous return of the contractions which I produced temporarily. My applications have almost always consisted in sittings of from three to five minutes of immediate uterine faradization, the negative pole being introduced into the cervical canal, the other, closing the circuit, in the bladder or the rectum.

Might we not obtain the wished for result by greatly prolonging the length of the sittings? This would not be very easy to do however. Barnes has attempted it: endeavoring to produce premature accouchement, he has succeeded, in cases which are relatively rare, of obtaining a commencing of labor; but to this end he devoted several seances of an hour's to an hour and a half's duration, employing Cleveland's process, which consists in keeping the two poles applied to each of the iliac fossa. Saint Germain has pursued the same object by means of poles applied to the lumbar region, on each side of the spine; in no case has he succeeded in producing uterine contractions when they had not appeared spontaneously. Saint Germain undoubtedly meant to say, that he had been unable to determine a beginning of labor, that is to say, contractions recurring spontaneously; were it otherwise, his process of

faradization must be regarded as more defective than one would be disposed to admit on first thoughts. If, then, we deduct from the statistics, which have been compiled on this point, the woman who had miscarriage in consequence of sneezing, we shall be induced to conclude that faradization, if it does not produce the poisonous effects of ergot, is scarcely more capable than ergot is of exciting abortion or premature labor.

It is fortunate that the faradization of a gravid uterus is not a cause of abortion, for it may serve as a means of correcting at the outset of a pregnancy, deviations which might become a cause of abortion and might jeopardise the mother more or less sensibly; it is, undoubtedly, the best method of preventing injury of the uterus which is sometimes the consequence of a retroversion. The following case seems to me as if it might be as an instance of the success of the practice.

Case.—Madame L., 25 years of age, lymphatic, but generally healthy, had always menstruated regularly in sufficient quantity and without pain, up to three years since, when she had a miscarriage at seven months. Two years ago fresh miscarriage, at five months. Since then she has always suffered from hypogastric and iliac pains on the left side, which disappeared in the horizontal position only to give rise to a sensation of weight and inconvenience. Six months since, after an interval of two months, the courses have returned, terminating by quite a loss of blood. Query: was not this a third miscarriage?

Although the appetite and sleep were good, the bowels always regular, the general state of health became impaired. Intercostal neuralgia of the left side on the 9th of June, 1870, I discovered a falling of the womb, with horizontal retroversion; retro-flexion and slight left lateri-flexion. The last courses ceased the 10th of August. Pregnancy appeared to me to be probable; but the previous miscarriages having possibly been assisted by the vicious position of the uterus, I determined to endeavor to readjust it sufficiently to remove all chances of uterine impaction.

On the 23d of June, after six sittings of uterine faradization,

cessation of the intercostal neuralgia and abdominal pains; walking easier. The 23d of June, the body of the uterus is more distinctly globular, the neck of the womb is softer and open; the flexion has disappeared, and what is more important, the retroversion has sensibly diminished. The readjustment seems to be sufficient to remove all dread of troublesome eventualities, and I sent Mme. L. home, begging of her to come to see me from time to time in order to watch her condition.

August 23d. The uterus well elevated, distends easily; impossible to discover any retroversion. Pregnancy goes on favorably, without entailing any inconvenience except general weakness and trouble in micturition which is followed by dull pains.

The 1st of December, 1870, Mme. L. gave birth, a little before time, but without previous suffering or consecutive accidents, to a well-formed child, which, without having been sick previously, succumbed rapidly, at three months, to a cerebral affection.

The 3d of May, 1872, Mme. L., gave birth to a nine months healthy child.

Three years ago, when a question of the police brought before the Academy of Medicine of Paris, gave rise incidentally to a discussion of the merits of ergot, many persons must have been greatly surprised, and the ideas of the mass of practitioners with regard to the indications for this drug, must have been singularly disturbed.

One might have thought, from the tones of the discussion that no one had ever thought of administering ergot during labor.

Now if we interrogate, on the point, the women who attend our dispensaries, we may see two out of three at least have taken ergot during the labor. In fact it is during labor specially that it is employed; but as it is administered rather in virtue of an old-established usage, than of a well-reflected opinion, they hesitate to acknowledge it the moment they are called on to justify this varial practice. Consequently, the prescription formularised by M. Blot, with regard to the administration

of ergot of rye during labor must have surprised everybody without arousing the slightest reclamation.

The administration of ergot during labor is then the rule not only with the midwives, who have been charged with doing so, but also with physicians.

It is this practice, as general in England as in France, that Radford had reference to, when in 1853, proclaiming the merits of faradization, in *The Lancet*, he established a parallel between it and ergot.

1. "Electricity, he writes, produces contractions more energetic than does ergot of rye. 2. It promotes the contractions instantaneously, whereas the ergot acts only after a longer or shorter period. 3. We can limit the influence of electricity better. 4. The contractions produced by electricity are normal and act more energetically for the expulsion of the child, whereas those determined by the ergot are less natural and might often bring on a contraction which would imperil the life of the child."

To these considerations Radford has added two, which present only a secondary interest.

6. "Electricity may be employed conjointly with any other therapeutic means."

On this point I must make a reservation: The effects of electricity are considerably lessened by the use of preparations of opium.

7. "Ergot of rye, may, according to Ramsbotham, Wright and Barnes, after its absorption by the mother, appear also in the circulation of the fœtus, and these authors, cite four cases in which, after the administration of ergot to the mother, the children died from muscular contraction several hours after birth."

This result has been contradicted; however, Denham, who three years was the champion of ergot of rye, in opposition to the Obstetrical Society of Dublin, considers it dangerous in cases of tedious labor, because it exposes the cord to prolonged compression. The experiences of the English practitioners have been repeated in France by St. Germain, on a large scale.

Every time (labor having begun, and the pains following regularly and periodically about every quarter of an hour,)

he would faradize the lumbar region by two poles; after a very short interval, he has seen fresh activity display itself in the uterine contraction, and the pains become rapidly more frequent. The artificial contractions were longer and more painful than the others. The dilation of the neck of the womb has appeared to progress rapidly under the influence of the faradization. In every case that had been noted, the expulsion of the placenta had followed immediately on that of the child. In no case had the child seemed to suffer from the effects of the electricity, although it had frequently by its movements proved its sensibility to the action of the currents.

All the women, in short, with whom this process has been employed have borne it admirably; these accouchements have been very rapid, have not given rise to any accidents, and the results were good. Although in the treatise which St. Germain has published of his experiences on this subject, he speaks of the *pole of the current* of *galvanization*, it is evident that it is to inductive electricity that he had recourse.

Before proceeding further, let us note the methods employed: Radford applies one pole to the abdominal wells, at the level of the base of the uterus, the other to the neck of the same, by means of a vaginal sound. Cleveland has applied the two poles externally on the abdomen. Barnes employs the same process. Mackenzie applies the positive pole to the back of the neck, the negative to the neck of the womb.

Applying the negative pole similarly to the neck of the womb, I place the woman recumbent on the positive pole, applied under form of a metal plate to the lumbar region.

St. Germain places both the poles on the loins.

The process of Cleveland and of St. Germain are the least well calculated to promote contraction. Can this serve to explain Cleveland's failure to produce a commencement of labor by artificial contraction, and the difficulty which Barnes has experienced sometimes in obtaining the results? I do not think that the process can be alone in fault, for I have not succeeded any better from seances, shorter in duration it is true, of immediate faradization.

To be continued.

VIII.—*Cranial Diagnosis by Electricity—another Delusion Exposed.* By J. H. KELLOGG, M. D., of Battle Creek, Mich.

QUACKS and charlatans are ever on the alert to discover some means by which they may deceive the people with a semblance of skill and superior wisdom, while utterly destitute of scientific knowledge. During the last summer I have had an opportunity of investigating and exposing a very ingenious device of this kind known as "cranial diagnosis." The honor of the "discovery," so called, is claimed by a Mrs. French, who visits the larger cities, and finds here and there a victim who has more cash and credulity than wisdom. Her fee for imparting her wonderful secret is the modest sum of $500, which must be paid invariably in advance.

I obtained a knowledge of this new method of diagnosticating disease from a person who had thus been victimized, with whom I frequently came in contact in practice. Having just returned from the discipleship of the wonderful Mrs. French, this individual was attaining considerable celebrity as the most accomplished electrician in all this portion of the country, claiming the power to diagnosticate disease with an accuracy impossible by any of the means known to the regu lar profession. Although the claim made was so immensely preposterous, the reputation of the individual for honesty leads me to believe that he was sincere in his claims, and really supposed that he was able to do what he claimed, especially as at this time he had little opportunity for testing the matter, scientific methods never having been brought to bear upon it.

As I frequently expressed decided doubts of the accuracy of this method of diagnosticating disease, an investigation was proposed. Before entering upon the details of the investigation, I will briefly state the claims and mode of proceedure of "cranial diagnosis."

It is claimed that there are upon the surface of the skull certain points, each of which is in such close relation with a remote portion of the body that the functional or structural condition of the latter is indicated by the condition of the former, and may be ascertained by marking the effect of electri-

zation of the diagnostic points, which are together known as "the spiral." Thus a point located at the root of the nose, is said to be the index to the condition of the genital organs; another point upon the forehead, to be that of the heart; another of the lungs; other points on the skull, of the stomach, liver, kidneys, and other portions of the system. Connected with each of these points there is said to be a certain set of sensations which are felt under the influence of a mild faradaic current, each of which is indicative of a particular condition. For example, absence of all sensation indicates torpidity; acute pain, inflammation, soreness, congestion, etc. It is also claimed that much is indicated by the direction in which the pain "runs," "pressure," and various other vaguely-defined sensations, many of which require a lively use of the imagination to be appreciated.

It is claimed that by means of the sensations named, with others, and by the various combinations of these sensations, both functional and organic diseases may be accurately diagnosticated without the aid of any further information than is derived from this source. It is also claimed that, so accurate and infallible is this new method, not only may actual changes of structure and departures from physiological action may be detected, but, the very smallest beginnings of organic disease and functual derangement, and even a predisposition to, or near approach of such disturbances.

It will thus be seen that if the claims of "cranial diagnosis" were true, it would be far superior to physical diagnosis, or any other known means of diagnosticating disease, with the possible exception of clairvoyancy, the claims of which rest upon a similar basis.

I have been unable to learn whether Mrs. French claims that the points upon the head are directly connected by nerves with the organs with which they are said to be in sympathy, or whether the sympathy is transmitted in some other way. I have been informed by a clergyman who studied medicine when young, that Mrs. F. is not, as she claims to be, the discoverer of "cranial diagnosis," since it was practiced by a certain Dr. Felch, of Boston, more than twenty years ago, in

connection with mesmerism. He gave good evidence that his statement was true.

The mode of proceedure is as follows:—

The patient is seated in a chair while the operator stands by his side. A battery affording a mild faradic current being near, the negative pole, a sponge electrode is given to the patient who is requested to clasp it between his hands, while the positive pole is held in one hand by the operator. The operator then moistens the end of the index finger of his disengaged hand, and applies it to the various "points" of the "spiral." As he applies it, he requests the patient to describe his sensation, constantly prompting him with expressions like the following: "Is there pressure? Does it feel sore? Does it sting? or burn? or run up? or run down? or shoot? or sprangle?" etc. etc. Electrical sensations being new to most people, they are unable to describe them in terms with which they are familiar; and, the imagination being greatly excited, they assent very readily to the suggestive questions put to them, often describing the same sensation in a half dozen different ways, thus leaving the operator to guess which is correct, or select the one which will best agree with the probabilities in the case. From "sensations" thus elicited, the operator makes up his diagnosis, or is supposed to do so. I was able to account for all the various sensations produced by the known laws of electro-physiology. Thus, a running, darting, or sprangling sensation, which are made very significant, always occurred when the operator placed his finger upon the main trunk of a nerve. A bony prominence always felt "sore," or "bruised." When the skin alone was acted upon by the current, the sensation might be compared to "stinging," "prickling," "smarting" or "burning." I fully satisfied myself by allowing myself to become the subject of "cranial diagnosis." I described my sensations in accordance with the above, to the evident disgust of the operator.

In selecting test cases for examination in the investigation of this subject, great care was taken to exclude all cases in which there was any room for doubt in respect to the real nature of the disease, and its precise location. Patients from a

distance were chiefly selected, to be sure that there was no previous knowledge of the case on the part of the operator with "cranial diagnosis." Two physicians beside myself were present at most of the seances. I think that at least one other was present in every case. The following is an abstract report of the several cases:

Case I.—A young man of twenty-four. Had a very distinct mitral regurgitant murmur, with considerable hypertrophy of the heart. Greatly troubled with palpitation. In all other respects he was in perfect health, and was remarkably robust in appearance. The following was the result of "cranial diagnosis:" Irritation of lower part of left lung, a little inflammation of the stomach, and torpidity of the liver. Heart perfectly sound! when attention was called especially to the heart, and the operator was requested to exert his utmost skill upon it, to determine if there was organic disease of the organ, he replied, that there was no organic disease whatever, but might be a "little sensitiveness."

Case I .—A man of middle age, a minister, suffering from cerebral congestion, from loss of sleep and mental anxiety. Believed himself healthy in other respects. Lungs and heart sound. By "cranial diagnosis" we were told that he had a "little inflammation of the stomach," a "little inflammation of the liver," and a "little inflammation" of the intestines, spleen, and all the abdominal organs, together with great sensitiveness of the heart, producing palpitation, a "tendency to consumption in the left lung," either constipation or diarrhœa, and piles. It was also stated that he had too much blood in the head (the scalp was hot, dry and congested). Examination and the patient's testimony showed that he had never had palpitation, indigestion or piles. Bowels were regular and normal. He had no knowledge of the "little inflammations" spoken of.

Case III.—Young man aged twenty. Had serious organic disease of the heart, as shown by mitral and aortic regurgitant murmurs, and great hypertrophy of the organ caused by rheumatic arthritis, from an acute attack of which he was just recovering. Also had serious gastric disturbances and spermatorrhœa, microscopic examination of the urine, showing al-

bumen and spermatozoa present in notable quantities. According to "cranial diagnosis," he had "little inflammations" of the stomach, liver, spleen, and intestines, with sensitiveness of the heart. No disease of the reproductive organs.

Case IV.—A man with granular conjunctivitis. Pronounced perfectly sound.

Case V.—A case of well-marked epilepsy in a man of twenty-five. "Cranial diagnosis" found no evidence of the disease.

Case VI.—A young woman of twenty, supposed to have lung disease. The operator was previously acquainted with the case; said the left lung was either atrophied, hepatized, or ossified (!), probably all three conditions existed together. Physical diagnosis showed that there was nothing more than slight bronchial irritation. The subsequent history of the case has confirmed this diagnosis.

Case VII.—A girl of eighteen, who had been ill for some months, giving evident signs of phthisis. Examination of chest, showed the presence of a cavity of considerable size in the right lung. The left was also greatly diseased. "Cranial diagnosis" declared that there was no organic disease of either lung. The patient died of phthisis six weeks later.

Case VIII.—A patient who was suffering from facial neuralgia, was pronounced entirely well.

Case IX.—A man of middle age, who was suffering from well-defined neuritis of the ulnar nerve, was pronounced well and sound.

Case X.—Of six cases of great seminal weakness and spermatorrhœa, "cranial diagnosis" found only one which gave indications of the disease, and he was one whose countenance and whole appearance betrayed his disease.

Several other cases might be cited; but as the results were uniformly the same as those already given, we will not present them. Without doubt the above will be considered amply sufficient to establish the fact that "cranial diagnosis" is utterly worthless and unreliable as a means of studying disease. It will be readily seen how a dishonest person of ordinary sharpness could practice very successful deception, especially re-

specting that large class of diseases which have their seat in the interior of the body; and it is, without doubt, a very excellent medium for the display of trickery, chicanery, and deceit. Crafty knaves will succeed in securing both the confidence and the money of the credulous, until the sham becomes so widely and thoroughly exposed, that deception is no longer possible.

"Cranial diagnosis" is now abandoned in this locality, as a worthless humbug, being neglected even by the person who introduced it.

I believe it to be the duty of the true physician to protect his fellow-men, so far as possible, from those voracious human sharks, which prey upon their pockets and their lives; and it is for the purpose of exposing one such that the foregoing has been presented.

IX.—*Obstinate Case of Hysteria in a Male.* By Geo. M. Beard, M. D.

The following account is given in the patient's own words. The case was remarkable for its obstinacy under all kinds of treatment, even when used with great perseverance. The case is remarkable also for the fact, very unusual in hysteria, that the patient is of good education, strong mental powers, and stands at the head of his profession. He wrote out for me the following graphic history, when he first came under my observation in April, 1874.

"*Hysterical laughing.* I cannot laugh loud and hearty, like other people; it comes in spasmodic chuckles involving a spasm of the diaphragm and intercostal muscles and produces great pain and exhaustion in the epigastric region. I do not laugh at anything particularly funny, but laugh spontaneously at anything a person may say, or at my own thoughts or something I may be reading. I check it by walking about, kicking, sticking my head in a basin of water, the object being to change the direction of my thoughts, often with the sole result of ag-

gravating the restless state which invariably reacts ultimately in the epigastric region.

"*Hysterical crying* I have never been able to produce. A pleasurable emotion, which fills the bosoms of other people with a sense of joyous gladness, reacts upon me with an anxious oppression in the chest and a feeling of constriction around the wind-pipe and gullet, so much so that I have to check it at all hazards, although that is easier said then done, as my will is practically powerless over these involuntary tortures.

"It is my constant aim to maintain my system in a state of perfect equanimity and indifference to outward influences, mental or bodily, but it is all in vain, not a day passing without some shock or disturbance of equilibrium, the mental predominating.

"A feeling of causeless anger often takes possession of my breast, and rages there, literally speaking, for hours, causing intense pain in the tissues lining the inner surface of the breast bone, and finally communicating its baneful influence to the stomach and liver, producing indigestion, colic and *agonizing flatulence.* My mind is powerless to reason me out of such a state, but an appeal to the affections is apt to be more successful; in other words I must be treated as a child.

"The most alarming of all symptoms, however, is an indescribable sensation at the pit of the stomach, extending partly under the ribs and sternum. It comes on after any slight over exertion of any kind, usually bodily, but sometimes mental. Its characteristic is that of instant dissolution impending over me, unless I stop at once and lie down to rest and take some stimulant. It is the apprehension of death expressed by my organic nature, not by my reason; it is anxiety, not fear. Within the last two months this feeling is accompanied by strong pulsations of the aorta, (?) continuing sometimes for hours, but not attended by any special acceleration of the pulse or unusual palpitation of the heart. This pulsation also attends the feeling of weight which I feel in the stomach region after dinner as if that organ were exhausted with the labor of stirring around the food. This feeling of weight is much more disagreeable than the acute pain which I formerly experienced

then; it has also become more general, being formerly either in the stomach alone or under the ribs alone.

"The desire to sneeze and tickling in the nose, is excessive, and cannot be checked by the usual expedient of pressing the upper lip. The act of sneezing jars the diaphragm.

"I yawn all the time without being sleepy. At the height of the yawn, when the diaphragm is relaxed, the latter trembles a little.

"My jaws work back and forth all night long, like a cow chewing cud. This has been the case for several years, and I remember that my mother did it. It is not attended by the swallowing of saliva or regurgitated food and commences as soon as I doze off.

"My abdominal muscles and diaphragm are usually in a state of strain, becoming painful unless relaxed by an effort of the will. As soon as I am off my guard, I find this state of tension commences, and that I am holding my breath and keeping the ribs in an expanded state and the stomach drawn in until the pain in the tired muscles reminds me of the fact and I try to assume a state of rest, an unknown state to me. This is attended by spasmodic efforts to expel my breath and ease the ribs, followed by deep drawn sighs. The expansive power of my ribs is slightly above the normal. My feet have a turn upward half the time, causing a crampy feeling in the calves. The thighs, arms and neck are unaffected.

"This abdominal tension is not recent. I have felt it for two years past, especially when exerting myself in a tired state and on an empty stomach. It was aggravated by hydropathic treatment of half-baths, and previous to that by unnatural strains induced by catheterism of the bladder which were very painful and attended by vomiting. The abdominal muscles in themselves are strong.

"Sleeplessness is a prominent symptom, produced either by bodily pain or mental emotion; a single cross word will rob me of my night's rest, the effect remaining in the epigastrum where it produces flatulence and a sense of distention which in turn appears to press upon the heart and diaphragm. Before I became seriously ill, I have often walked the floor night after

night in fits of passion, thus adding bodily to mental fatigue. But since I have become so debilitated the mere breath of suspicion upsets me. I am a mere shuttlecock between brain and stomach, hurled back and forth between, with equal force by each.

"Spasmodic jerks when dozing off to sleep add their horrors to subsequent nightmares. They come on immediately after closing the eyes, never in the middle of the night, and sometimes there are three in succession, always originating in the pit of the stomach. They have diminished in force with my bodily strength. I always die in such a jerk. The usual sensation is that of being cut in two by a sword, both halves falling on each side of the bed, my head mean time looking down on the bloody mess. This is agreeably varied by having my bowels torn out of the body at one grasp; a slight cold transfers the sensation to the chest and heart. I am drowned or hung, or worst of all, undergo instant annihilation without the preliminary process of death. There may be greater depths of misery than mine, but I cannot conceive of any.

"Chloral is almost useless in controlling such states. The inhalation of chloroform vapors quiets the tension of intercostal muscles and alleviates the spasmodic breathing, but cannot be continued on account of nausea; opium excites me. Morphine is a sovereign but of course temporary annihilator of all sensations.

"My first hysterical trembling fit occurred in Paris, last October, during a severe attack of gastralgia; it came on in full force without any premonitory local thrills. Then others followed at intervals of three to four weeks and less, until at one time, in March I had one nearly every day. The frequency diminished the violence. They come on with very little warning, and produce a prostration requiring weeks to recover from. The actual shaking given to a congested stomach, and to the serous membranes and viscera around it are the worst features of the case. If my organs were all sound, I do not think the tremblings would hurt me so much. In the last shake, I could with difficulty keep from biting my tongue, the jaws setting so tight. During the intervals between the more

violent paroxysms, there are local thrills every five or ten minutes in the epigastrium and right loin. These paroxysms are not the direct result of over exhaustion as is the case with the other violent symptoms before mentioned. The heart is also much more affected than the aorta. In one attack heart palpitation lasted all night.

"In looking back to see whether I have been hysterical all my life, I find that I have been so as regards my bladder. At the age of seventeen, I had an attack of incontinence of urine, cured by strychnine; at twenty, I strained my bladder at a public lecture, (could not get out). For fourteen years after that, I was troubled in that direction, and never went to any parties, church, theatre or even visiting. As soon as I saw that I could not urinate conveniently, the desire came, and great quantities of urine were secreted, but if conveniences were at hand, there was no desire. The urine was always limpid and colorless. I think this was a hysterical symptom, being caused by the will chiefly. Within two years this state has abated, and an opposite condition of urinating only twice a day set in. I attribute the change to that growing indifference to other people and surroundings, which comes with age, and a diminution of that false bashfulness with which younger men are afflicted, etc., etc.

"The sexual organs share in the general debility. For several years past there has been a morbid increase of desire, without corresponding increase in efficiency. The act itself I have abstained from for months. The terrible prostrations and palpitations of the aorta following almost killed me. At night I am tormented with persistent erections, which leave me in the morning with pain in the pulses, neck of bladder, with engorgement of scrotrum and testicles. This state has come on chiefly since my nervous dyspepsia has been fully developed and my whole system debilitated. But it is also due to a neuralgic state of these parts caused partly by an inflammation of the bladder, but principally owing to the long-continued irritation of the rectum by a fissure. While the fissure was in progress all erotic sensations were referred to the rectum and not the genitals. Have had no loss of semen. The urine in

the morning is scanty and high colored, irritating the urethra. During the day it is watery. The irritable qualities cause a contraction of the urethra. For three months after the operation for fissure I had spasms of the sphincter ani, but they are gone now.

"There are other symptoms referable to my general state of debility, cold feet, cold sweats, and very hot feet after being in bed some time; pain in eyes, photophobia, headaches, etc.

"Although I confess to strong neurasthenic diathesis, I do not think that I ever would have developed hysterical symptoms if I had not been prostrated by a succession of acute diseases. These commenced two years ago, being preceded by a life of harassing anxieties and responsibilities and bodily toil. Two years of compressed air, with its terrible prostrations, and final acute attack used me up completely. Next came mucous dyspepsia and diarrheas, winding up with a dysentery in August, '72. Its after effects were four months of neuralgia in the thighs and small of the back, followed by bleeding of the rectum, and inflammation of the neighboring parts, including bladder and prostate. Three months of this in bed, then a sea-voyage, with inflammation of the kidneys brought on by vomiting. Next a summer's pilgrimage among foreign doctors and water-cure establishments, and watering places. One Englishman dosed me within an inch of my life, with mineral waters, next my remaining vitality was douched out of me at Weisbaden, a violent cough of a week's duration strained either the diaphragm or some other membrane, leaving a soreness under the chest bone, which has not left me to this day. The fissure was now fully at work on my nervous system, every act of defecation attended with great pain, to ease it, you draw up the diaphragm and put all the abdominal muscles under a peculiar strain, which when continued for six months is simple murder; the reflex action of the irritation in the rectum destroyed the external sensibility of the seat and thighs. Three surgeons told me I had a simple congestion of the rectum. Took three months of water treatment to throw the congestion on the outer skin, with the sole result of making the fissure worse, and ruining my stomach, which had held out until then.

Every day the presiding jackass of the Institution drove me out to walk, saying that "Without motion, there is no life." Now came one acute attack of gastralgia after the other, my wife began to fear I would die on her hands, in a foreign land, so I was dragged 400 miles to the ship under the influence of opiates. The sea air revived me for a few days, but as soon as I came home I took to my bed, and for a long time it was a question whether I would rally at all.

"The operation on the fissure relieved all the immediate local derangements arising from it, but my nervous system is completely shattered. I refrain from detailing all the stomach symptoms. It remained for Brown-Sequard to announce that I had hysteria, and I was rather pleased to have a medical handle for my ailments. All that is left to me is a morbidly active brain, feeding on itself, and the pleasant recollection that when a man is sick, a doctor is sure to make him worse than better."

The above details are but the beginning of sorrows. The patient has kept a diary, in which is recorded from day to day his special and varying symtoms, mental and physical. These symptoms are not wholly or mainly imaginary, although they are, without question, made worse by constant introspection. In his case the nervous system appears to be in constant rebellion against the will, and all attempts at subjugation and the enforcement of order are failures. The patient is like one on a hight and fearful of falling, conscious that his fear is absurd, and that there is no real danger, yet as absolutely helpless as a child. At one time all his weakness concentrates on his eyes, and his photophobia will be fearful, and an ophthalmologist is at once sent for, who on ophthalmoscopic examination finds nothing; then the debility flies to the urethra, and evidences of stricture appear, and dilatation and division are talked of, and earnest enquiries are made for specialists in genito-urinary surgery; from the urethra an attack is naturally made on the rectum, great pain accompanies the act of defæcation, and an examination is urged, and there is no peace until it is made; the next point of attack is the stomach, and diaphragm, and the distress in these regions is terrific, and eyes, and rectum

and urethra are half, if not quite forgotten; thence to the back and back of the neck the transition is easy if not inevitable, and when I last saw him the demon of hysteria had taken up his abode in the cervical spine, but I doubt whether he remained there more than a month, if as long as that.

At one time and another, either simultaneously or in rapid succession the leading specialists of the world have seen him. He bears treatment well, and yields to it, especially to electrical treatment up to a certain point, but the slightest overexertion, or even the apprehension of it, a breath of excitement, a knock, a jar, bad news or no news, and he is again in the grasp of his enemy.

Cases of this kind often recover in time; and it is not improbable that a like good fortune is in store for the case here detailed.

X.—*Paralysis of Accommodation after Diphtheria.* By Dr. Wm. F. Mittendorf, Assist. Surgeon to the New York Eye and Ear Infirmary, etc.

The sequelae of diphtheria are so manifold in their character, that one must not be surprised to find now and then a case, which is so unique that it seems to be worth while to bring it to the notice of the profession, especially when the adopted plan of treatment has relieved or at least shortened the duration of the trouble.

It is by no means rare to find a paralysis of accommodation after diphtheria or any other debilitating disease, but as the principal cause seems to be more a general weakness of the system, and not a local lesion, the paralysis or paresis affects both eyes or a set of nerves of one eye, but in the case I am going to relate, the paralysis of Bruke's muscle was only evident on one eye, and all the other branches of the third nerve remained quite free of it. In fact, the other eye remained unaffected before, during and after the time the patient was under treatment.

I shall try to be as brief as possible, and let the case speak for itself.

The patient, Louise E., from Jersey City Heights, had been a perfectly-healthy child up to July last, before that time she had only a slight attack of scarlet fever, and of measles, of which she recovered completely. The parents were perfectly healthy, they had never been troubled with an affection of the eyes; and of her sisters, which are all very tall and thin, only one is affected with a hypermetropia of both eyes, of a slight degree. The patient herself had never any difficulty with her eyes, and has been at school for several years.

Early in July she was taken sick with an attack of diphtheria, and according to statements of the attendants, with a very severe one, in fact, she had to live on milk-punch alone for seven days. Of the local applications only the iron was used. During her recovery, which was very slow, she noticed that she was not able to use one of her eyes for near objects, whilst her far point seemed but slightly, if any, affected, and it was this that brought her to me, about September 15th.

Patient is a young girl of eight years of age, her constitution is rather delicate. She says she feels very weak, and is easily tired, one of her limbs, the right one, seemed to be slightly paralyzed, she drags it a little, but upon inquiry, her sister tells me, that this condition existed always, but that since her illness it is more apparent, and in fact her whole muscular system is greatly debilitated. An examination of her old shoes, worn before the attack of diphtheria, confirmed this, and she says that she never felt any peculiar sensation, like that of formication or tickling in it. But there is thickness and defect of her voice, which is quite striking, and on examination by means of the laryngoscope I found that the left vocal cord was relaxed, and did not show any motion when she attempted to say, ah. Also the left side of the soft palate seemed to be slightly affected, the uvula very large and relaxed, and the act of deglutition a little difficult. The tongue, however, is normal in its movements.

A careful examination of her eyes was made, with the following result. The right eye is not affected, it is an emmetro-

pic eye, with a vision of 20-xx. Fundus as well as pupil normal. On the left eye there is a slight mydriasis, but the iris is only sluggish and acts under the influence of light. The fundus is normal, but the vessels are rather thin, corresponding to the general anæmic condition of the patient. In the distance she reads 20-50, not improved by glasses, but she is unable to distinguish near objects, hardly counts fingers in 1 foot. She cannot read even very large print or sew with that eye. Testing the eye with a convex lens of six inches' focus, I found that she was able to read Jaeger 2 in five to six inches, but without the glass is not able to read Jaeger 15. Reading through a stenopæic opening improved her vision considerably. This would clearly prove the case to be one of paralysis, and not paresis or atony of the muscle, but whether it is due to some special and peculiar cause, or to a general constitutional weakness would be hard to decide. The fact, however, that the paralysis affects only one eye, would seem to favor the former view, and as none of the other muscles of the eye was affected in the slightest degree, the movements of the eyeball not being limited in any direction, and the constrictor pupillae, though weak and sluggish, acting under the influence of light, the lesion must have had its seat in the third nerve, and evidently in radix brevis ad ganglion ciliare. The treatment resorted to was the following. I placed the patient at once on a rich, nourishing diet, giving her of meat, eggs and milk as much as she could take, and gave her a tonic of the pyrophosphates of iron, quinine and strychnia, thus giving her 1-80 of a grain of strychnia three times a day, just before eating; had her whole body sponged with cold water, and rubbed every night and morning, and ordered as much out-door exercise as possible. This would undoubtedly have improved her condition in course of time, but it is especially to the application of electricity that I attribute the rapid improvement which followed. The first application of electricity was made early in October. I used for this purpose the faradic currents, applying the negative pole to the back of the neck, and the positive pole over the closed eye. After a duration of three minutes, I removed the negative pole to the left, and from there, after a

short time, to the right temple. In order to act also on the nerves of the larynx and pharynx, I applied the negative pole again to the back of the neck, and the positive pole to the outside of the different regions of the larynx. The whole sitting lasting about ten minutes.

The immediate effect was a more perfect contraction of the pupil, so that only a slight difference existed between that of the right and the left eye, and no unpleasant complications were complained of. Three more applications were made in intervals of two or three days, the patient steadily improving. On the 20th of October another application was made. By this time the general condition of the patient had improved wonderfully, she was bright in spirits, had a healthy color, and would play out of doors for hours, without complaining of fatigue. An examination of the eye was made, with the following result. She could read without glasses Jaeger 12 in six to twelve inches, and the difficulty of speech was hardly perceptible. On the 26th of October, she could read even Snellen No. 1 in six to sixteen inches, which indicated a complete cure of the paralysis, and for the distance her power of vision was also hardly affected, =20-xx(?) not improved by glasses. The vocal cord formerly paralyzed was moved almost as much as that of the opposite side, and only the soft palate seemed still a little relaxed.

I directed the patient to continue her medicine, and do everything in her power to become as strong as possible, by exercise and proper food. About a week after this she was brought to me again, because she could hardly read for five minutes, when the left eye would fill with tears, and she would be unable to read another word, even of larger print. In fact, she presented a true picture of asthenopia.

I gave her after this several applications of electricity, and continued the same treatment, consisting of tonics and hygienic measures, and told her not to read or sew or use her eyes for any small object, and had the satisfaction of seeing that on the 10th of November, she could read the finest print, Sn. 1, for ten to fifteen minutes, without complaining about any unpleasant symptoms, and on the 17th of November, when I saw

her again, I could not discover the slightest defect in either vision or voice, nor had she complained about anything for some time. So that I think I have ample reason to consider the affection completely cured.

As the paralyzed condition had existed for two months without the slightest improvement, according to the statement of the friends of the patient, I feel authorized to say, that although possibly in course of time, the affection might have been relieved even without treatment, that the cure was greatly accelerated by the above treatment, and it is especially to the applications of the electricity, that I attribute the relief of the paralysis of the accommodation, which I think ought to be applied in all similar cases.

XI.—*The Involuntary Life.* By George M. Beard, M. D.

Every human being lives two lives, the *voluntary*, in which he acts more or less under the control of the will, and the *involuntary*, in which he acts automatically, and over which the will has but a limited power, or none at all. The acts of both the body and the mind, may be involuntary as will as voluntary, and in both body and mind, the two lives are constantly blended. Involuntary acts are of two kinds, those which are *primarily* automatic, and those which are automatic *secondarily*. The primarily automatic acts are those which go on without any interference of the will, which are entirely independent of it; all functions indispensable to life, are of this character. Thus, few persons can by the exercise of will, stop, or greatly hasten the beating of the heart; or for a long time suspend respiration, or materially increase or diminish the secretions of the kidneys, liver, the bowels, stomach, salivary glands, or indeed, directly affect any of the great and constantly acting vital function of secretion or excretion, absorption or assimilation. All these functions are powerfully under the influence of the mind, but not of that faculty of the mind that we call the will; in order to influence these functions as it is constantly doing for

better or for worse, the mind must act automatically. It is clear then, that without automatism, man could not exist; when he ceases to be an automaton, he ceases to live. The acts of sneezing, yawning, laughing and crying, are also primarily automatic, since they are all performed without effort of the will, and indeed, oftentimes against the will, under appropriate mental or mechanical irritation. Within certain limits these acts can be restrained by the will; outward imitations of these acts can be excited by volitional effort, but they lack always, even in the best actors the spontaneity of these acts when performed automatically.

Secondarily automatic acts, are those which are performed at first under the direction of the will, but afterwards, go on independently, in other words become automatic, but can be suspended by an effort of the will. Walking is a secondarily automatic act; in learning to walk or in paralysis, an effort of the will is required at each step; when the art is fully learned or restored, walking becomes as much an unvolitional act as respiration, with this difference: that, while respiration can be only suspended for a moment, walking can be permanently suspended by the volition. As with walking, so with all other complex movements of the voluntary muscles that by practice become easy and rapid, running, dancing, writing, playing on musical instruments, sewing, operating on telegraph instruments, knitting, and various other arts and trades requiring manual expertness. All these acts are at first, volitional acts, and painfully, or at least, unpleasantly so; each movement is made as a result of a direct and special act of the will, a definate purpose to do just that act, and neither mind nor body can be directed to any other form of volitional effort, without causing immediate suspension or misdirection of this movement. When a person acquires expertness in any of these acts, there is no longer need for the constant exercise of volition; at most the will gives a kind of supervision, allowing the performer to proceed, and guiding or arresting it at pleasure; but the performer is not compelled to attend to what he is doing. Even in talking and singing, which are involuntary acts, the will, as Dr. Carpenter rightly insists, does not produce the effect

directly, but indirectly, through the complex, automatically working vocal apparatus. The act of vocalization, either in speaking or singing, is a very complex act, requiring the co-ordinated contraction of many muscles, none of which, or but few of which, are specially and separately under control. When the telegrapher closes the circuit of his battery, and allows the apparatus to get in motion, and send and receive a signal, he is to telegraphy, what the will is to conversation or singing; he simply directs what is to be done, and the previously arranged machinery, automatically does the work. The telegraph operator closes the circuit with each letter or sign, and thus sends an intelligible message, just as the will directs the vocal apparatus to continuous speech or song.

Dr. Carpenter* makes a distinction which, perhaps, is hardly necessary, between voluntary and volitional acts; the former being those acts which the will initiates, and can also guide or suspend, but which after they are begun, go on automatically, as walking, running, &c., while the latter are those acts which are called forth only by a distinct exercise of the will for a definite purpose, as speaking and singing. As we here see them in both classes of functions, the will has an influence, but its influence is limited, for in both, the work is done automatically.

The relation of the voluntary to the involuntary life is typically illustrated in the reproductive function. The reproductive act is, at first, under the control of the will, but becomes less and less so until the orgasm which takes place automatically, as does the act of swallowing after food has entered the esophagus, and from the moment of the beginning of the orgasm through all the process of conception, gestation, and even parturition, the will has no direct influence whatever.

Thus far we have been speaking of the involuntary life in healthy, intelligent adults; in childhood and infancy, the subjection of the will is far greater, and this subjection may be made more complete by disease, or a defective mental organization. Thus, the act of nursing in infants, is, at first,

* Mental Physiology, p. 16.

entirely automatic, as is shown by the fact that monsters born without brain, have survived several hours, crying and sucking: and new-born puppies, when deprived of all the brain, yet begin to suck, when a finger moistened with milk is put in the mouth. Sucking is, moreover, quite a complex act, including the grasping of the lips, the formation of a vacuum by respiration, and the process of swallowing. A new-born baby is a living machine, a breathing automaton. The precise moment when the will begins to operate, cannot be told, but in all children the will is a faculty of slow growth.

The phrase, "habit is a second nature," in the light of these facts, gets a heightened meaning. A habit is a course of action or conduct, which at first, more or less volitional, is pursued until it is performed automatically; it is called a second nature, because the instinctive or natural acts are all automatic.

The automatism of man, may be better understood by studying the automatism of the lower forms of life. In the Ascidians, which are the most elementary types of existence in which any nervous system can be traced, there is but one ganglion with various branches which extend to the orifices, through which, and out of which, flow the currents of water, by which the life is maintained. When any hard substance that would be injurious to the ascidian, touches the branches of the nerve that guards the orifice through which the water enters, a contraction of the whole body, and of the bands around the orifices, is at once excited, and the offending object is driven at a distance through the expulsion of the water inside. This is reflex action in its simplest form, and as Dr. Carpenter states, is analogous to the acts of coughing, swallowing, sucking in human beings, all of which acts take place without our will, and in spite of our will, and may also take place unconsciously.

In articulated animals the distribution of the nervous ganglia is such as to enable one to study automatic actions very successfully. When the head of a centipede in motion is cut off, the animal still moves, but mechanically, and there is no evidence of any directing will. The body moves only forwards, and when its forward movement is impeded, it goes sideways. If it meet an object not over half its height, it

climbs over it; if the object be equal to its own height, it stops, but the legs keep on moving. If the nervous communication between the anterior and posterior portion of the animal be cut off by severing the ventral cord, the legs of the posterior portion continue to move, though their movements are not controlled by will; they act only through their own ganglia, each one of which, appears to be independent of the other ganglia.

The *Mantis religiosa*, or praying insect, from the formation of its body, is enabled to rest on its posterior segments, while the legs of its anterior segments are uplifted as if in prayer; in this position it captures its prey as it comes within reach. If, while in this position, the head is cut off, the body remains *in situ*, resists attempts to throw it over, and if any thing is introduced into the arms, they close upon it. These acts are automatic purely, and the only difference between the act of standing and catching its prey when the head is cut off, and its natural state, is, that in the latter state, the ganglia within the head, guide the reflex acts of the ganglia of the cord.

In capturing their prey, these insects are as truly automatons as the insectiverous plants.

In all these cases, the stimulus that causes contraction, is some substance more or less hard, touching the ends of the nerves, but in water or amphibious animals, the stimulus of water will have the same effect. Dr. Carpenter speaks of a Dytiscus or water beetle, which, after the cephalic ganglia were removed, made no movement while on dry land, but as soon as it was put into the water, it swam with great vigor for half an hour.

If the stomach of a frog, from which the brain has been removed, be irritated, the hind legs will try to kick away the irritating object. If the inner side of the thigh be irritated by acetic acid, the foot of that side, will try to push it off: and if that foot be removed, some attempts will be made, followed by rest, after which the foot of the opposite side will make the same effort. If the anterior part of a frog's brain be quickly and skillfully removed, the animal may live in full vigor for months, if not for years, but it will keep always in the same

spot. It does not see nor hear; nor will it feed itself, unless food is forced into its mouth, when it mechanically swallows it. If irritated, it hops or walks; if tossed into the water, it will swim; in other words, it acts as many men and women act, when in a trance.

According to Prof. Huxley, "the most remarkable thing that it does is this; you put it on the flat of your hand; it sits there, crouched, perfectly quiet, and would sit there forever; then, if you incline your hand, doing it very gently and slowly, so that the frog would naturally tend to slip off, you feel the creature's fore-paws getting a little slowly on to the edge of your hand, until he can just hold himself there, so that he does not fall; then, if you turn your hand, he mounts up with great care and deliberation, putting one leg in front and then another, until he balances himself with perfect precision upon the edge of your hand; then, if you turn your hand over, he goes through the opposite set of operations, until he comes to sit in perfect security upon the back of your hand."

These movements are performed with the utmost steadiness and precision, and you may vary the position of your hand, and the frog, so long as you are reasonably slow in your movements, will work backward and forward, like a clock, and, what is more remarkable, is this, "that, if you put him on a table, and put a book between him and the light, and give him a little jog behind, he will jump, rather a long jump very possibly, but he won't jump against the book; he will jump to the right or to the left, but he will get out of the way, showing that, although he is absolutely insensible to ordinary impressions of light, there is still a something, which passes through the sensory nerve, acts upon the machinery of his nervous system, and causes it to adapt itself to the proper action."

In regard to all movements on the part of decapitated animals, it may be said, that none of them are any proof of consciousness: they are automatic, for they are called forth only by stimulus, like the contractions of the ascidian. Again, they are called forth when the spinal cord itself has been divided, and portions of it destroyed; the fore-legs may move

under stimulus, and so also may the hind-legs, but there is no harmony or correspondence in these movements; the hind-legs acting independently, as though they belonged to another body.

I have several times repeated these experiments of Pflueger on frogs, and have studied their movements when decapitated and when a portion of the spinal cord has been lacerated, and when the brain alone has been carefully removed. It is especially interesting to observe that after the animal is so far gone that it responds feebly to ordinary modes of irritation while lying on the table, it yet makes immediate and intelligent swimming movements when thrown into water, the contact of the water on the whole body acting as a powerful provoker of automatic motions. All these motions of headless frogs and other animals may be looked upon as the result of habit, (which in animals and in man is automatic,) that is, actions performed until we come to be unconscious of them, (for nothing is habitual which is the result of special and distinct acts of the will); and are similar every way to the performance of instinct, which has been well defined as "inherited memory."

The chicken that obeys the call of its mother, as soon as it has broken its way out of the shell, or runs from the scream of the hawk that it has never seen, really acts automatically, and so far forth without consciousness: but the most intelligent animal or man could not perform these actions any more intelligently with all the aid of reason and consciousness.

Any boy who has dug bait before going a fishing, has probably cut an angle worm into two or three pieces with his spade or hoe, and has seen that all parts live after this rough division, as indicated by squirming of a most active kind: and the vigorous movements of the headless chicken that has passed into a proverb, show that the brain is not only not essential to muscular activity, but probably inhibits it.

Those who have killed, or tried to kill, snakes of any kind, have observed that the body can live and move without the head, and that when irritated, a part of a snake may make very threatening motions, is a fact oftentimes unpleasantly forced on the attention of boys who think they have killed them. On alligators very many experiments have been made,

the result of which is to prove that they can make movements both intelligent and terrible, after their heads are removed.*

The higher we rise in the animal kingdom through the various grades of animals and men, the greater would appear to be the relative importance of the brain, and the more essential to the maintenance of the life of the body. To decapitate a man, is to kill him instantly; hence the guillotine is the most merciful means of execution. A headless man, is an impossibility, and human monsters living born without brain, die shortly after birth. Descending the scale, we find that fowls, frogs, snakes, alligators, and so forth, are not always killed by decapitation; that in these lower forms, life is less dependent on the brain and the spinal cord, and nerves are of a greater relative importance in the economy. Descending still lower among the mollusks, the relative importance of the head constantly diminishes. No one who is digging clams, supposes that he has killed those whose snouts he cuts off, as they are thrust out of the shells, and is not surprised that the bodies of the clams thus mutilated, remain alive as though they had been untouched.

The moving plant, *Desmodium gyrans*, the leaves of which are somewhat like those of clover, keeps moving up and down. Movements of a similar character are observed in the *Desmodium gyroides* and *Desmodium respertilionis*. The closing and opening of many kinds of flowers, what is known as their sleeping and waking, the folding and spreading of the leaves, and the movements of the aquatic plants, *oscillatoria*,† are illustrations of reflex, if not spontaneous, movements of organisms that are supposed to have no nervous system.

But by far the most remarkable illustrations of reflex actions in plants are found in the recent work of Mr. Darwin.‡

In a series of ingeniously devised and patiently carried out experiments begun in 1860, and continued for fifteen years, this extraordinary observer demonstrates that quite a large

* See note to Dr. Laws' article in the present number of this *Journal*, page 173.

† Grindon: Life; *Its Nature, Varieties and Phenonema*, Boston, 1866.

‡ Insectiverous Plants; New York, 1875.

number of plants have the power, when their tentacles or filaments or leaves are irritated, of contracting and enclosing whatever small substance may adhere, and if it be a digestible body, as a living insect, of digesting it; and the products of digestion or decay, are absorbed just as in animals. His experiments showed that these marvellous powers are possessed by the common Sun-Dew (*Drosera Rotundifolia*); the Venus Fly Trap, (*Dionaea Muscipula*,) the *Aldrovanda Vesiculosa*, the *Drosophyllum*, and other varieties of the *Droseracae*, and the *Piniguiculae* and *Utricularia* or bladder plants.

The most remarkable fact brought out in these researches, and one that could not be received on any but the highest authority, is that infinitesimally minute quantities of certain chemical substances cause deflection of the tentacles, filaments or leaves of these plants. Thus a particle of hair weighing only $\frac{1}{78740}$ of a grain, and supported by a dense fluid, the secretion of the gland, cause the tentacles to "sweep through an angle of about 180°." Darwin* says, "we may conjecture that it (the pressure of the fluid on the gland) could hardly have equalled the millionth of a grain." It was also found that less than a millionth of a grain of phosphate of ammonia in solution, acts on the gland when absorbed by it, and causes movement. A bit of hair $\frac{1}{50}$ of an inch in length, and much longer than that which was used in these experiments, could not be felt on the tongue, and probably would not be felt by even the most hyperesthetic nerve.

Indeed it was clearly found that $\frac{1}{1976\frac{1}{1000}}$ of a grain of phosphate of ammonia, or in round numbers, one twenty millionth of a grain (·0000033mg.) showed inflection; but as this salt contains 35-33 per cent. of water of crystallization, "the efficient elements are reduced to $\frac{1}{3055\frac{1}{5}\cdot 26}$ of a grain, or in round numbers, to one thirty millionth of a grain, (·00000216mg)."

Well may Darwin remark, "hardly any more remarkable fact than this has been observed in the vegetable kingdom."

Under the weight of these experiments, it will be seen at once that the distinction between animals and plants breaks

* Op: cit: p. 33.

down entirely; these plants can do all that animals can do in the way of catching, digesting and absorbing food, and are more sensitive than the majority of animals.*

Now, no one would suppose or suggest that these plants are conscious of these movements; and yet these movements are, in their way, fully as intelligent as many of those which take place in animals and men. The plants that display these wonderful feats have no demonstrable nervous systems, and we have no more deductive or inductive reasons for supposing that they are conscious of these reflex actions than that crystals are conscious of the orderly aggregations of the atoms of which they are composed; and reasoning upwards to higher forms of life, we may infer that the movements of the mutilated frog, on the table or in the water, the squirming of the divided worm, or the threatening motions of the headless snake or alligator, are entirely unconscious, although it is entirely conceivable that consciousness might exist in the spinal cord, and might be capable of division as much as the nervous substance on which it depends.

In active, waking hours, the voluntary life is most conspicuous, but it by no means always prevails; indeed, the volitional activity makes up but a fraction of our existence, and in those hours when the will seems to be supreme, the elementary fact, that the great vital functions of respiration, circulation, digestion, absorption, secretion, excretion and generation, are involuntary functions, on which the will has but a trifling or momentary influence, is everywhere known; but it is not so well known that over the so-called voluntary muscles, the will has but limited control: that frequently they do not move when ordered to move, or move but imperfectly, and not at all as the will commands, as is seen in the first lessons in dancing, billiard-playing, playing on musical instruments, and allied arts; or what is not so often considered,

* Mr. Darwin remarks, however, very justly, that the olfactory sense of dogs must appreciate even more minute particles than these.

According to the experiments of Donders and Dr. Reuyter, less than one-millionth of a grain of sulphate of atropine, extremely diluted, applied directly to the iris of a dog, causes paralysis of the muscles of the organ.

that they cannot keep perfectly still, even for a short time. Let any man hold out his hand at arm's length, bringing the end of one of the fingers against some accurate landmark, as the sharp blade of a knife fastened in the wall, and he will find that however zealously he may strive to avoid trembling, he cannot do so, and that the end of the finger will describe an arc of all the way from one eighth to one quarter of an inch, and that very soon he will become so wearied, that the position will become most painful to him. Cruel teachers have a practical, if not a scientific knowledge of this fact, and utilize it as a means of punishment. As with the muscles of the arm, so with the voluntary muscles of the whole body: none of them are wholly and absolutely voluntary, but only partially and relatively so: but a fraction of the movements of the muscles of the face, arms or legs, are voluntary movements, they are spontaneous, automatic: the result of habit, and cost no special effort of the will. The facial expressions especially, are but partially under control of will, as is powerfully and painfully realized when one essays to look composedly for a few seconds, while sitting for a photograph; the eyes and eyebrows are never still, yet but rarely are their movements voluntary, and when the lips open to speak or to smile, the volition has little influence, and sometimes all its utmost effort to prevent either speech or laughter, is useless.

In the first lessons on the piano, every movement of every finger, costs a conscious effort of the will, and what horrid music is the result! But now comes a master, like Rubenstein or Von Bülow, sweeping all the octaves with infinite rapidity and infinite ease, bringing out harmonies that thrill vast multitudes.

How awkward the conscious gestures, conscious emphasis and conscious postures of the school-boy speaking his first piece! If he should ever become an orator, he will not know whether his position on the stage is awkward or graceful, and both his emphasis and his gestures will be automatic.

And thus, in every direction, unconsciousness, or at least, involuntariness, is one mark of the highest forms of activity. Acquisition of knowledge or skill is always conscious, hence, it is wearisome and costly. Dancing for the expert, is easy;

for the learner, hard and exhaustive, for the will must be constantly driving the muscles. Any thing that is done with great difficulty, is badly done; nothing in thought or deed can be of the highest, unless it be easy, and more or less spontaneous.

Experiments in the electrical irritation of voluntary and involuntary muscles, are also quite suggestive here, since they show that the functional difference between the two classes of muscles, is one of degree, rather than of kind. When a voluntary muscle is acted upon by an interrupted galvanic current, quick contraction is produced, which, as soon as the stimulus is withdrawn, is at once followed by relaxation. When an involuntary muscle is acted upon in the same way, slow contraction is produced; a general drawing together, like the closing of a woman's work-bag; and when the stimulus is withdrawn, there is a slow and gradual relaxation. This electro-irritability of muscles is retained for some hours after the death of the animal, but in the voluntary muscle as it dies, the reaction under the electric current, resembles the reaction of involuntary muscle; the contraction takes place slowly and gradually, and more slowly and more gradually, as it approaches death, with a corresponding slow and gradual relaxation.

We now know why it is that all thought tends to express itself by some kind of muscular action, for the same region of the brain that originates a thought, also originates the outward muscular expression of that thought; to will and to do, proceed from the same cerebral centres.*

When we think intently on anything, and especially if we at the same time look at it, our impulse is to go for that very thing. This tendency is frequently so strong as to be irresistible and unconscious. Illustrations without number crowd upon us, from every day life. When we are much excited upon any subject, our impulse is to rise and walk the floor: we are walking leisurely along the street, and in no hurry to

* I here refer to the recent experiments on the electrical irritation of the cortex of the brain.

reach the end of our journey; suddenly a thought strikes us, our feelings, perhaps, become much aroused, and at once we find ourselves on the run; as soon as the temporary excitement of the thought is over, we return to our normal gait; this is the experience of many nervous, excitable organizations. If the thought be continuous and dominant for a long time, we may keep on the half-run during the whole of our journey even when there is not the slightest cause for haste.

Life is largely made up of outward expressions of the emotions, and such expressions are instinctive, habitual and almost entirely automatic, so much so, indeed, that to analyze them by the laws of hereditary transmission, or of antithesis or of serviceable habit, as Mr. Darwin has attempted to do, requires the closest study and observation, and some of the expressions thus far defy all analysis. It is well nigh impossible to speak, to feel or to think, without giving some outward expression through the muscular system, of our words, feelings or thoughts. The infant, learning to talk, can hardly say, "papa" or "mamma," without a toss of the head, if not a movement of the whole body; and any educated adult who attempts to utter a long sentence, even alone, without any audience, without moving any muscles, save those required in speech, will find he has undertaken a hard task.

The scratching of the head, when puzzled over a problem; the shutting of the eyes, and turning them away when anything disagreeable is presented; the nodding of the head, and opening of the eyes widely, when anything pleasant is offered; children thrusting out their tongue and drawing down the face when learning to write; the habit of moving the jaws at the same time with the movements of the blades, while cutting with a pair of scissors; special peculiarities of gesture, as in the case noted by Galton, of a man who had an intermittent trick when asleep, of raising his right arm in front of his face, and dropping it on the bridge of his nose, which trick was transmitted to his son and granddaughter; the sudden starting on hearing a noise, and fearing danger; the turning round and round of dogs before lying down to sleep, as their ancestors did when making their bed among the leaves of the forest;

cats alternately pushing their fore feet on the rug, as though pressing on the breast in the act of nursing; the various and opposite acts and attitudes of animals when moved by kindness or anger, as observed in crouching, raising the paw, putting back the ears, elongating the eyelids so as to make the eyes look large, the uncovering of the canine teeth, the erecting of the back, the dropping of the tail and the flexures and many movements of the body; the trembling of the muscles, and violent beating of the heart, under terror or excitement; the shivering and crawling sensations up and down the spine, and over the body that many nervous persons, and especially women experience when hearing fine music or superb oratory; the writhing and contortions of the face and body, and profuse perspiration under great agony; the reddening of the face heaving of the chest, and dilatation of the nostrils in rage; screaming, crying, shrieking, bleating, roaring, snorting, puffing, bellowing, muttering, chuckling, growling, grunting, snarling, hissing, purring, barking, howling, yawning, smiling, laughing, frowning, sighing, sobbing, the erection of the hair, feathers and tail under fear or other emotion; the inflation of the body, as seen in amphibians and reptiles; the rubbing of cats against their mistress or the legs of a table or chair; the licking of the hand, or the whole body by which cats, horses, and cows evince their kindly feelings towards their young, their masters or each other; fondling, embracing, hugging; the pawing of the ground of enraged bulls; drooping of the eyelids, flaccidity of the facial muscles, and general lengthening of the features in anxiety and lowness of spirits; the obliquity of the eyebrows, and depression of the corners of the mouth under suffering, and the smoothing of the brow, and raising of the eyelids and nostrils, and general expression of the face under the influence of joy; the uplifted eyes and clasped hands of devotion; the vacant stare of one absorbed in thought, and the firm compression of the lips when the mind is moved by a strong resolution; the hurried respiration, erect position, flashing eyes, elevated fists, and ugly gesticulations, the squaring of the shoulders, the stamping of the feet, the pallor and the redness of the enraged man; the upturning and aversion of the face,

in defiance or scorn; the slight contraction and wrinkling of the nose, the half closing of the eyes, the derisive smile, and turning away of the face or body, with snapping of the fingers, or gestures of aversion under the influence of contempt, disdain and disgust; the askant look, restless eyes, and lowered eyelids, by which conscious guilt is recognized; the turning of the eyes to one side, by which shyness is indicated; the erect position and constrained manner of pride; the shrugging of the shoulders, raising of the eyebrows to express doubt or helplessness, a habit more observed in the East than in Europe and America, less common in America than in Europe, and in Europe more common among the demonstrative French or Italians, than among the cooler English or Germans; the raising of the shoulders in sulkiness or obstinacy; the placing of an open hand over the other, or the lower part of the body, and slight lowering of the head to one side in resigning oneself to the inevitable; the sly look of coyness; the nodding of the head in affirmation, and moving it from side to side in negation or refusal, the jerking of the body from side to side, and general muscular agitation of impatience; the widely opened mouth, dilatation of the pupils, raised eyebrows or uplifted hands of surprise; the opened mouth, wrinkled forehead, and contracted platysma myoides, the bending of the arms and pressing them against the body, with raising of the shoulders and shuddering, by which horror and agony are expressed; the peculiar and indescribable leer of sensuality, and the placid countenance that betokens calm meditation; all these varied and complex expressions of the emotions in men and in animals, are almost always involuntary and unconscious.

All these expressions of the emotions take place not only involuntarily, but only to a limited degree, can they be restrained by the will, even when the desire is strongest to do so.

The mischievous boy in church, on seeing something funny, finds it harder to keep from laughing, than if he were all alone; the effort to avoid laughing increases the tendency, and makes his task a hard one; even the fear and sure promise of a whipping is oftentimes powerless in such cases. Likewise

tears flow unbidden at times and in places where we do our utmost to restrain them, and under circumstances which would not of themselves suffice to make us weep, if the thoughts of what others would think, could be kept from our minds.

The tyrannical power of habitual reflex actions, was illustrated by Darwin, who put his face against the thick glass plate of the cage containing a puff-adder, firmly resolving not to move if he struck toward him, but as soon as the blow was struck, he jumped backward immediately. Probably very few, if any persons, could stand such a test as that, at least without long and special practice.

Conversely, the attempt to perform an act which is usually reflex and automatic subsequently fails, and the failure will be all the greater, the stronger the desire. The awkwardness of forced sneezing has already been referred to. Artificial smiles and laughter and "crocodile tears" always reveal their heartlessness.

Darwin states that one time he made a small wager, with a dozen young men, that they would not sneeze if they took snuff. They all declared that snuff invariably made them sneeze, and accepted his wager; and all took a pinch, but so much did they wish to succeed, that they failed; although their eyes watered, none of them sneezed, and all without exception were obliged to pay the wager.

On this subject, Sir Henry Holland has remarked that attention to the act of swallowing interferes with the power, hence the difficulty of taking pills.

In sitting for a photograph, those who strive to look smiling and pleasant, often succeed in looking very silly; and the extemporized sweetness of countenance under which the victims of a formal and fashionable party try to hide their misery, is familiar to every one, and is so common on such occasions that it does not often excite comment. When a man pretends to be angry, he never frightens any body, even though he be a good actor. Acting is literally *acting*, it is not *being*, hence the stiffness, frigidity and mannerism of the stage everywhere and in all ages. The very greatest actors, those who really move audiences, became so by their power of identifying them-

selves with the characters, so that they do not act, but *are*, for the time, what they assume to be. I have never seen an actor from Booth down, who could make love on the stage, in any other than a bungling and awkward style, which in real life would be pretty sure to fail of its purpose.

It is very hard for a man to pray with unction, who does not feel his prayer; eloquence of thought or word or manner is not sufficient, as was shown in the case of Edward Everett, of whom it was said that his "prayers were the most eloquent ever offered to a Boston audience."

Long and special practice, however, enables one who has the gift of acting, to, so to speak, be a character all through life. Successful impostors oftentimes habitually imitate in their words, manner and constant expression, the appearance of modesty and virtue, and the counterfeit so closely resembles the original, that the most expert examination may fail to detect it.*

Many of the so-called hypocrites, who are especially earnest in their manner of speech, are truly sincere for the time, however inconsistent their lives may be.

The sexual power in man, as we all know, may suddenly fail when the necessity of accomplishing the end is especially urgent. Thus young men who imagine they are impotent, experiment with a woman to find out, and can do nothing; if they were indifferent to the matter their potency would be perfect; excess of desire takes away the power. Disappointments on the first few nights of marriage, that have been known to lead to insanity and suicide, are similarly explained.

The phenomenon of blushing is a beautiful example of automatism; it is caused always by the reflection of what others may think of us, and it is not always confined to the face, but may affect the whole body.†

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* The best illustration of this, that I have ever seen, was Brown, the "mind reader."

†. Moreau (quoted by Darwin,) says, that a painter informed him that a girl, who unwillingly served as a model for him, when her clothes were first taken off, turned red all over her body.

The act of blushing, like all acts which take place through the vaso-motor system, is automatic; the will can neither bring it on, nor keep it off: and the greater the effort to subdue it whenever it has started, the more vigorously it rises, and the longer it stays. The greatest blushers, are those who are most annoyed by it; their very sensitiveness to observation makes them try to repel every blush, and this effort, as in the case of mesmerized subjects, makes them do the very thing they wish to avoid, and the face becomes all the redder and hotter. The way to cure it, is not to care whether you blush or not. Blushing is excited by trifles more than by serious sins. Conscious guilt, even of the most heinous character, does not usually cause a blush unless we are of the opinion we are, or fear we may be, in the presence of those who know or suspect it; on the other hand, one may blush deeply when accused of a crime, although innocent.

Blushing is oftentimes accompanied by blinking of the eyes, smarting or stinging of the eyelids, twitching of some of the muscles of the face, confusion of mind and stammering speech which, like the reddening of the face, are beyond the control of the will. Infants under one year never blush, for they do not feel that sensitiveness in regard to what others think of them that is needful to excite blushing.

Some of the peculiarities of blushing are very interesting. A lady patient of mine, who is of a very sensitive organization, tells me that when she blushes, little red spots resembling measles, first appear on the cheeks and then extend down over the neck; in a moment these coalesce into a diffused redness.

Sir James Paget, while examining the spine of a girl, noticed that a big splash of red appeared on her cheek, this was followed by others over her neck and face. On questioning her mother in regard to it, she said that the peculiarity was inherited from her, and in the act of answering this question, she blushed like her daughter.

Even the anticipation of some important event or undertaking, strives to express itself in some form of muscular movement; thus, of a certain orator in Parliament, it is said, that his friends could tell for half an hour beforehand, that he was

to make a speech, by his persistent fumbling of his watch-chain. Any public speaker, who is at all nervous, prefers to walk or move about before he begins his speech; and when we say of any woman who is waiting for the hour of a wedding, or party, or funeral to approach, that she is nervous, we mean that the excitement of the mind will not allow her muscles to keep still.

The school-boy, fingering the corner of his coat while he is reciting, or trying to recite his lesson; or scratching his head as he puzzles over a hard sum; or swinging his feet backwards and forwards as he memorizes from his spelling-book; or keeping his lips moving, audibly repeating to himself the words of his task; the timid young man of society, thrumming on the table, or playing with his pencil-case, as he converses with the ladies; all the natural action and gesticulation of conversationalists, orators, actors and singers,—all these are so many phases of involuntary muscular movements, corresponding to, and depending on cerebral action.

It is said of Sir Philip Francis, that when in pursuit of a thought, he would pace rapidly up and down the room. In a moment of special excitement, when the thought, so to speak, was just within his grasp, he would turn quickly round, draw himself up to his full height, and repeat some well-expressed sentence. Visitors in the house and members of the family, were sometimes startled by these sudden outbreaks, the noise of which, reached other rooms.

George Eliot, thus describes one of her celebrated characters, Felix Holt. "His small, nervous body was jarred from head to foot by the concussion of an argument, to which he saw no answer. In fact the only moments when he could be said to be really conscious of his body, were when he trembled under the pressure of some agitating thought."*

Those who wish for illustrations of the involuntary life, need go no farther than the nearest school-room in which children are learning their first lessons in reading. They will see that it is only by reading aloud, by allowing their thoughts to

* Tuke's Influence of Mind and Body, p. 68

be expressed, that they can be taught their letters and their combinations; with a child, to think is to speak; to read, is to use the vocal apparatus in harmony with the reading; to study, is to move the lips as the ideas enter the brain. Hence the difficulty of keeping children from studying aloud, or from making the lips go, or from whispering to each other in school-hours.

In the second childhood of old age, or in certain diseases of the brain, men return to the habit of youth, and mutter as they read, or simply move their lips without audible sound. The self-restraint that enables one to overcome even in a limited degree, this automatic tendency of the thoughts and feelings to express themselves, by muscular movements, the ability to be sad without crying, mad without pouting, glad without laughing, only comes after many years and long experience.

Involuntary muscular motion, and imperfect volitional control, are seen in handwriting; the process of learning to write, is a volitional process demanding constant attention that is highly fatiguing, but to the long-practised writer, the process of forming the letters is entirely mechanical. One can write while thinking of something far away, or, as is often the case, of words that are next in order. With a nervous and active-minded person, the two processes, writing and thinking, may go on independently of each other; the pen frequently outstripping the thought, and the word that should be written is skipped, and one that is in the mind of the writer, but properly belongs to the next line, is written; a writer who has this habit, must constantly make erasures.

The effect of mind over body can be studied at great advantage in the comparison of the handwriting of different persons or classes, or of the same nervous person in different moods. Handwriting is the expression on paper of thoughts that arise in the cerebrum and as the centres of motion, for the muscles of the arm and hand and the centres of language, are, probably in close proximity, ideas, when the pen is in hand, tend to flow into written words, and the more intense the thoughts, and the more rapidly they succeed each other, the more rapid

and nervous will be the chirography, the other faculties on which the capacity for writing depends, being the same; hence the paradox, which has never been explained, that educated and professional men write more illegibly than mechanics and laborers. It is not because of the amount of writing that literary and professional men do, that it is so hard to read what they write, for bookkeepers, copyists and stenographers do vastly more. It is that the writing of the former class, expresses the original thoughts and feelings of the author, while in the case of the latter class it is a matter mostly of routine, not representing or depending on activity of the thought-evolving faculties.

A fact I have often noticed in my own experience, may be of interest in relation to this subject. My average chirography is unusually illegible, and, in original composition, it is almost always so, and the illegibility is greater, the more I feel like writing. When mere routine work is to be done, involving no thought or feeling, but the simple mechanical labor of forming the letters, I can write with fair legibility. In begining an essay, before becoming warmed with my theme while the ideas and words come hard and slow, the letters will be comparatively round and full, but in a little time, the usual irregularity and illegibility appear, in spite of all effort on my part, and grow worse and worse, as the heat of composition increases.

So uniform is this correspondence between the thinking and the writing, that when, on looking over a page of composition, I find that it is specially legible, I know by that sign alone, that, the mood of composition is not upon me, and that, when printed, it will be less worth reading, than if it were written so that it could not be read.

School-boys and laborers and all persons who write but little and do no thinking of their own, almost always write legibly, though often awkwardly, and thus it is, that plain handwriting is the rule in business and in society, for very few people are capable of thinking, while the great majority can write. Genius, it is often said, may be known by its bad handwriting, and the case of Choate is continually

cited. This, however, is true only in part, applying mainly to those whose genius consists in originating and expressing thought, whose natures are very intense and whose imaginations are fertile. Great engineers, merchants, surgeons, judges and teachers, usually write legibly.

One of the very best illustrations of the limitation of the will, and its relation to the involuntary life, is found in sleep. The strongest wills and the firmest nerves can keep awake but a few consecutive hours, provided there be no disease causing sleeplessness, and no unusual excitement or influence; any one accustomed to sleep soundly and regularly every night, will find it well nigh impossible to sit still with nothing to do for twenty-four hours and avoid nodding; even the responsibility of watching with the sick, is not usually sufficient to make the task of keeping awake all night, an easy one; even those whose rest at night is unbroken, find it beyond them entirely, to keep their eyes open in church, or at a lecture, although they are greatly mortified at the public display of this weakness, and there are many who cannot read of an evening for half an hour, without going to sleep.

The act of falling to sleep under any circumstances, is simply a contest between the voluntary and the involuntary life, in which the latter gains the victory. The will can elect when to get into the recumbent position that favors sleep, and can, in a degree, regulate the surrounding influences, whether of excitement, or of stillness, but after the contest has once begun, the defeat of the voluntary life is but a question of time, and unless the feeble will be re-inforced by distracting thoughts or cares, or by disease, the time will not be long. Sleep, whatever its exact physiology may be, is an automatic process; no man can will himself to sleep by a direct act of volition, any more than he can will his heart to beat, or his liver to secrete bile; the will can delay the coming of sleep, as it can delay the act of breathing; but the delay at best, is temporary, and the will yields. Sound sleep is the temporary triumph of the involuntary life. A dream is wholly automatic; in going to sleep, one feels the thoughts slipping from the hold of the will, as the reins drop from the hands of the driver; as one awakes,

there is sometimes an intermittent seizing and slipping of the reins, until full hold is obtained, and we are fully aroused.

J. Stanley Grimes, in a recently-published work,* has called attention to the fact that accent and pauses in reading and in speech are involuntary, and that there is a relation between accent and pauses, and pulsation and respiration.

Accent, as Mr. Grimes contends, is not usually a matter of volition, for although we can for a limited time, and by special effort avoid accenting as we read or speak, or place the accent on unusual places, yet this process is as tiresome as it is unnatural; when we read or speak naturally we accent involuntarily, the accent being regular and corresponding to pulsation, the pauses being also regular and corresponding to the respiration. The proportion of the pulsation to respiration is about four and a half or five to one, the average pulse in health being from seventy to eighty, the respiration in health being from fifteen to twenty-four. Pauses like accents can be controlled in a degree by the will, but practically they are made without volitional interference, and automatically, according to the respiration.

The involuntariness of accent is shown by the fact that it is common to children and savages, before they are taught the accepted methods of accentuation. The popular notion that the French language has no accent, is only true to this extent, that the accent is less marked in that tongue.

But accent is both involuntary and regular, as we can demonstrate by a simple experiment. Let any one try a single sentence and see if it be possible, without great effort, to avoid regular accent. Take the following from the introduction to Webster's speech on eloquence. "When *pub*lic *bod*ies *are* to be ad*dressed* on mo*men*tous occ*a*sions, when great *in*terests are at *stake*, and strong *pas*sions exc*i*ted, there is *noth*ing *val*uable in *speech* except so *far* as it be con*nec*ted with *high*, intel*lec*tual and *mo*ral en*dow*ments." If read naturally and deliberately, the accent will come on the italicised portions; let any one

* Mysteries of the Head and Heart, Chicago, 1875, p. 244.

try to read it without any accent in an exaggerated school-boy style, and he will find it almost impossible to do so.

If we try a sentence composed wholly of monosyllables we shall find that they, also, are accented. Mr. Grimes gives the following illustration, "*Take* my *yoke* upon you, and *learn* of *me*, for I am *meek* and *lowly* of *heart*," in which the italcised portion represent the normal accent.

In rapid reading the accents are the same in time, but a greater number of syllables are crowded in between them. The sense usually requires frequent accents, hence good elocution is slow.

The sound of a single word may be so prolonged that the middle portion is accented as though it contained several syllables. Any one who will try the experiment of reading a language with which he is not at all familiar, and of the accents of which he knows nothing, will find himself involuntarily making accents, whether right or wrong is of no consequence.

Pauses are to accent, as about one to four or five. On the relation of versification to respiration, Dr. Oliver Wendell Holmes has published a suggestive paper.*

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* Physiology of Versification, Boston Medical and Surgical Journal for January 7th, 1875. In the leading idea of the relation of pulsation and respiration to metrical composition, Dr. Holmes was long ago anticipated by Mr. Grimes, who called attention to this subject thirty-five years ago; but failed to excite any interest in the subject among physiologists.

Dr. Holmes speaks of the "fatal facility" of the octosyllabic measure, such as is represented in "In Memoriam," in "The Lay of the Last Minstrel," and so forth, and says that eight syllable verse is easier to read than any other because it follows more exactly the natural rhythm of respiration. On the average, about twenty lines will be read in a minute; that is one line to each respiration. The cœsura of the ten syllable line, like that of Pope's Homer is really a "breathing place." A twelve syllable line is too long for one respiration, but not long enough for two; hence it is but rarely used, being avoided instinctively.

Much depends on the temperament of the poet. "One can hardly doubt that Spenser breathed habitually more slowly than Prior, and that Anacreon had a quicker respiration than Homer."

In the eight syllable line there are four accents, corresponding to the pulsation.

It is possible also, as I have often thought, and as Dr. Holmes has suggested that there may be a relation between walking and pulsation. It is certain that the rate of step in armies has been found to be a matter of great practical importance; certain rates are much more fatiguing than others. The French army has, I believe, made experiments in this department.

The Involuntary Life may be studied then, in these four relations.

1. Organic vital functions, or those operations of the human mechanism that are necessary for its existence, as sleep, respiration, circulation, deglutition, digestion, assimilation, absorption, secretion and excretion, all of which processes, including the various and complex chemistry by which they are evolved, are mostly automatic.

These processes, none of which can be suspended without immediate or gradual death, are none of them in any degree, under the direct control of the will, and none of them can be directly influenced volitionally, for better or for worse. The most that the will can do, is to affect the organs by which these functions are performed, and that it can do usually through indirection, and but to a very limited extent. One can abstain from eating, and thus keep the progress of digestion and all the processes that follow and depend upon it, in abeyance; but with food at hand, such abstinence cannot in health be prolonged, for hunger is stronger than the will. We can place ourselves under influences of climate or occupation, that will modify these vital processes, but such influence is only indirect, secondary and limited. We cannot, by a fiat of the will, stay for one moment the beating of the heart, the flow of the bile, the secretion of the saliva, or the oxygenation of the blood, but we can choose in a measure, what we shall eat and drink, when and how much we shall sleep, what clothing we shall wear, what sort of mental and moral influences shall surround us, and thus indirectly, act upon the intricate machinery of nutrition.

2. The reactions of body and mind. Under this branch, come the production and aggravation of disease, or conversely its relief and cure, by the involuntary action of the painful or pleasant emotions, of which the history of medicine and superstitions furnish so many illustrations. Muscle-reading, the use of the divining-rod, the swinging of suspended objects, table-tipping, (cases of trickery excepted,) the spelling out of names by passing the fingers over the letters of the alphabet, are all examples of mind acting involuntarily on body.

3. Involuntary mental action not affecting the body.

This includes all mental acts that are involuntary, whether conscious or unconscious.

4. Phenomena of disease. If pathology be, as has been said, but the shady side of physiology, then the morbid, like the healthy vital processes, should be largely automatic. All disease is either painful or disagreeable, and if human will could have its way, the whole world would be healthy.

The existence of disease, is a perpetual proof and sign of the automatism of man. Other forms of evil, as vice and immorality and crime, are, in certain stages and in some of their relations, agreeable to the lower nature, and the exercise of the will is, in many, required constantly, to keep us from indulging in them; but disease, from first to last, in all its relations, is something that we get rid of when we can: and the only control that we have over it, is through its prevention by sanitary and hygienic measures, and its relief and cure by various treatments; but both prevention and treatment, when successful, (as is the case only in a narrow range,) are brought about almost always indirectly, and rarely indeed by a special action of the will on the morbid state. It is true, that a man of strong will, may recover from a disease, under which a weak nature would sink, and it is a law which I have elsewhere enforced,* that firmness favors longevity, but indirect, not direct, action produces these effects; the will is simply a gardener, who, by careful culture and vigilance unceasing, improves the quality of the fruits and flowers, saves them from many noxious insects, and forces the growth of some by artificial heat, and protects all, in a measure, from prostrating tempests, but cannot change the original nature or the habit of a single plant, or tree or flower; the apple will still be an apple, the peach a peach, the rose only a rose.

When the system becomes weakened by disease, the influence of the will, still further diminishes; not only in the exhaustion of acute affections, as fevers and inflammations,

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* Longevity of Brain Workers. Transactions of Am. Public Health Association, Vol. 1.

but in a vast range of nervous diseases, as hysteria, chorea, epilepsy, cramps and so forth, the control over the muscular, and even the mental operations, is oftentimes reduced to almost or quite, zero; for in all these disorders, not only do mental and muscular actions take place spontaneously, without the command of the will, but against its commands, and even when such actions are accompanied by agonizing distress. The inability to stop a train of thought, after the brain has been temporarily overworked, with unpleasant automatic activity of the mind on some one subject, and consequent inability to sleep, and subsequent exhaustion, is a very familiar experience; make this state a chronic one, and we have the helplessness of many of the hysterical and insane. Disease encroaches on the moral, as well as intellectual faculties; the patient may be as unable to do the right, and to eschew the wrong, as to walk when the limbs are paralyzed, or speak in complete aphasia; certain stages of inebriety are marked by the apparent impossibility of telling the truth, or keeping a solemn promise, as much as by utter helplessness in the presence of alcoholic liquors. Those who are timid about ascending great heights, and who, perhaps, turn faint at the very thought of making the attempt, and who know by frequent experience, how inert their own wills are to control this feeling, may gain some conception of the helplessness of the inebriate, the opium-eater, and many unfortunate victims of hysteria. In all forms of convulsive affections, of which chorea is a type, the involuntary muscles, so-called, are under not much better control, than the involuntary muscles; the movements of the arms or legs, are as beyond the reach of the will as the movements of the stomach or intestines.

Stutterers cannot usually stutter when they try to do so; the more they try to keep from it, the worse they talk, but when they attempt by act of volition, to show how they stutter, they generally fail. Thus, the disease is completely beyond the control of the sufferer, and it can only be helped indirectly, by acting on the nervous system.

In other forms of local chorea, besides stuttering, the same powerlessness of the will is seen; frequently I have asked

patients affected with spasms of the eyelids or of the face, to bring on an attack in my presence, and they usually, if not always, fail. A clergyman, who has been for many years a sufferer from spasms of the eyelids, once came into my office, and stated his case; I asked him to illustrate the spasm, he tried, and failed; his face was perfectly calm, although a few moments before it had been in violent agitation. Muscles that have long been in the chronic state, are as independent of the direct influence of volition, as the whole body may be when in complete or partial trance; the very effort to do a certain act, takes away the power of doing it. Thus, a horse caught on a railway crossing, as the engine approaches, may be so entranced through fear, that it cannot stir: and when the stables take fire, the terrified beasts are, for the same reason, got out with great difficulty, and, if left to themselves, are sometimes burned alive.

The feeling of helplessness, with a disposition to fall, that many experience when on a great elevation, I explain in the same way; the fear of falling, puts them into a stage of emotional trance, where the will, in that special direction, the maintenance of balance, has little influence, and the harder the attempt to keep from falling, the greater the failure, so that if there is no protection or assistance, they may be dashed to pieces. They fall, not because they are insane, nor because they wish to; they fall, because fear usurps the throne of will; they fall, through the intensity of their desire to keep from falling. Left to itself, the body will keep from falling through its automatic forces; but when the will, driven by fear, attempts to direct, the automatic forces are reduced in strength, and the body falls. A feeble horse that is just able to draw a heavy load, when interfered with, may stop entirely when an effort is made to guide or turn him by the rein or by hand.

In some forms of paralysis, the muscles respond automatically to the emotions, but fail to respond to the will. The so-called spinal epilepsy is a convulsive state of the lower limbs, brought on reflexly, through irritation of the extremities, and it is found in those cases where the spinal cord is diseased, and frequently so badly diseased, that the lower limbs are cut

off from the control of the will. In *paralysis agitans*, or "shaking palsy," a symptom that results oftentimes from sclerosis of the nerve-centres, the trembling may be excited by movements of the body, or by attempts at movement, while the will of the sufferer is unable to bring them on, or keep them off. In *locomotor ataxia*, or posterior spinal sclerosis, the distinctive symptom is impairment of co-ordinating power; the will can command the limbs to move, but cannot fully control them after the muscles are in action.

Long ago, Sir Charles Bell observed that in some cases of facial paralysis, the lids may close involuntarily, when any object is brought near them, although the patient could not close the eye by the will. A paralyzed muscle, which the will cannot move at all, may respond to the stimulus of electricity: and *vice versa*, there are paralyzed muscles that move more or less under the will, but do not react to electricity; and there are cases fully familiar to all medical electricians, where the paralyzed muscles contract under the galvanic current, but not under the faradic. In all these cases, the act of contraction, after the process has once been started by central or external irritation, is automatic.

A patient of mine, afflicted with syphilitic disease of the brain, said that oftentimes in attempting to do anything, however slight, his will would fail him utterly, and the harder he strove to conquer, the more complete his failure. He was conscious, as he expressed it, of two brains, one within his control, the other beyond it, and both striving for the mastery.

This powerlessness of will, he observed frequently, and especially in attempting to read even a trifling paragraph in a newspaper; his mind, so to speak, would fly away and leave him helpless. Experiences of this sort, in an acute form after exhausting labor of the brain, all of us have known; with my patient, they were chronically recurring.

The relation of volition to automatism is illustrated in ordinary speech, and in the disease called aphasia. The power of originating and remembering words, can be exercised volitionally or automatically; phrases, sentences, scraps of long-ago committed speeches or poems, portions of discourses heard

recently or perhaps in childhood, frequently arise to the consciousness, and obtrude themselves uncalled, and re-appear every moment, in spite of our efforts to repel them. These are extreme illustrations, but all speech is largely automatic, both in its mental and muscular relations; to think what to say in any emergency, is always painful, and the most we usually do, is to direct, in a limited way, the current of our speech, leaving the details to be spontaneously evolved by the mind, and automatically expressed by the vocal apparatus, after we have willed that apparatus to work.

In aphasia, there is the loss of the power of setting the machinery of remembering and expressing words, at work, so that speech is impossible, or there is a deficiency in the co-ordinating power, so that the wrong word is uttered, or comes in the wrong place.

Spectres and hallucinations are involuntary symptoms of various morbid states of the nervous system, and are of the deepest interest physiologically, pathologically and practically. That every thing which we see, or hear, or feel, may be subjective as well as objective: that the whole external world may be presented to our consciousness from within, through the representative power of the brain, as well as through the senses from without, has long been recognised among physicians, and any case that appears, does not, among medically educated people, excite amazement.

Every thing that distracts the brain, directly or indirectly, may give rise to hallucinations that annoy the subject and are beyond his control, and at times, may seem to him, real objects or existences. Hallucinations are among the many phenomena of trance, a state that is very easily excited in many persons through the emotions of wonder, reverence or fear; partly for this reason it is, that average human testimony in regard to reported miracles and wonders of any kind, is worth nothing and should receive no attention, except, as a study for physiologists. This element of error, enters into all history, and all the vast libraries of works on magic, witchcraft, alchemy, animal-magnetism and spiritualism, are made worthless by it.

The prominent effect of many familiar drugs, is to diminish

volitional control, and to make the automatic side of character more dominant. This effect is most quickly seen after the inhalation of anesthetics, as ether, or chloroform, or nitrous oxide; the leading action of these agents being upon the nervous system, and chiefly on the will and consciousness, which, for a time, varying with the dose and organization, are temporarily suspended. The cries and struggles of patients in anesthesia, which cause so much anxiety to friends, are entirely automatic and unconscious; they indicate reflex irritation, unaccompanied by any sensation, and on awakening, they have no more recollection of what has happened, than one who emerges from the deeper stages of trance.

Alcoholic liquors, even when they do not destroy consciousness, impair volition temporarily, while the effect of much debauchery endures, and the subject becomes an inebriate permanently. An inebriate is one who has lost his control of the appetite for drink. Alcohol acting for a long time, especially on a nervous system predisposed by civilization, induces a morbid state, probably functional in character, of some portion of the nerve-centres, that demands more alcohol, with a power and persistency, that easily over-ride the average will; and this morbid state is increased in proportion as it is gratified.

The following remarkable illustrations of the powerlessness of the will in inebriates, are mentioned in a paper on the *Insanity of Inebriety*, by Dr. George Burr.* Dr. Rush records a case in which he says, in reference to an habitual drunkard in Philadelphia, who, when strongly urged by one of his friends to leave off drinking, replied, "Were a keg of rum in one corner of a room, and were a cannon constantly discharging balls between me and it, I could not refrain from passing before that cannon in order to get at the rum." One of the cases described by McNeish, in his *Anatomy of Drunkenness*, as quoted by Dr. Ray, also illustrates this feature. A friend of the subject of it painted to him "the distresses of his family, the loss of his business and character, and the ruin of his health," to which he replied, "My good

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New York Psychological and Medico-Legal Journal December, 1874.

friend, your remarks are just; they are indeed too true; but I can no longer resist the temptation. If a bottle of brandy stood at one hand, and the pit of hell yawned at the other, and I were convinced that I would be pushed in as sure as I took one glass, I could not refrain." The late Professor R. D. Mussey, of Cincinnati, relates another case: "A few years ago a tippler was put into an almshouse in this State. Within a few days he had devised various expedients to procure rum, but failed. At length, however, he hit upon one which was successful. He went into the wood-yard of the establishment, placed one hand upon the block, and with an axe in the other, struck it off at a single blow. With the stump raised and streaming, he ran into the house and cried, 'Get some rum! get some rum! my hand is off!' In the confusion and bustle of the occasion a bowl of rum was brought, into which he plunged the bleeding member of his body; then raising the bowl to his mouth, drank freely, and exultingly exclaimed, 'Now I am satisfied!'" Dr. J. E. Turner relates a case of a gentleman, who while under treatment for inebriety, during four weeks secretly drank the alcohol from six jars containing morbid specimens. On asking him why he had committed this loathsome act, he replied, "Sir, it is as impossible for me to control this diseased appetite as it for me to control the pulsations of my heart."

The exaltation of the mental faculties produced by opium, is of an involuntary character, like the similar states that appear in the delirium of disease, and under the inspirations of genius; the brilliancy and beauty of the dreams of De Quincy, could never have been attained by any volitional exercise even of his rich and powerful brain; they could only be evolved automatically.

It is pretty hard to bring mathematics to bear on questions of biology; but it is surely natural to ask, what is the relative proportion of the voluntary and involuntary life? To this it would be safe to answer, that ninety-nine hundredths of human life is involuntary, spontaneous, automatic. When we cease to be automatons, we cease to exist. The power of the will is exceedingly limited, and yet, all the studies of all the ages have been

given to the voluntary part or the one-hundredth part of human life; while the ninety-nine hundredths, the involuntary part—man as an automaton—save in the lower vital functions, as digestion, secretion, and so forth, has been ignored. Consider what life would be if we were conscious, even for a single day, of every bodily function, and were compelled each instant to maintain it in all its manifold and complex relations by a special act of will. To order the heart to beat over sixty times each minute, and the vast armies of arteries, veins and capillaries throughout the body to dilate and contract in response to that beating; to preside over the varying and intricate details of digestion, from the manufacture of chyme through the churning chemistry of the stomach, to the absorption of chyle by the lacteals, to direct the minute processes of nutrition, through all the play and interplay of assimilation, excretion and absorption; to tell the lungs when to expand and when to contract, and to guide the interchange of atoms by which oxygen is retained, and carbonic acid exhaled; to provide, as an expectant mother, for the growth and development of the forming fœtus; to put each muscle under the special control, so that no movement shall be automatic, and every change of expression shall correspond to a distinct and decided fiat of the will; to think and plan for the eyes to roll, the iris to dilate or contract, and the eye-lids to rise or droop; more than all, and more difficult than all, to be forced to follow each thought in its pathway in the brain, and to note the force by which it is evolved, and the changes in the cerebral structure that it costs to record it; to direct, by special acts of will, these infinite varieties of movements, even if the system were constituted for that end, would make life a horrid task-master, and every man a hopeless slave. It is the involuntary side of existence that makes existence possible.

Some mathematical comparisons have been made between the amount of food required for voluntary and involuntary work. Various sources of error must enter into all calculations of this kind, but they are suggestive and not unworthy of consideration. Prof. Haughton has calculated that of the potential energy produced in the body 260 foot-tons are re-

quired for the action of the heart, the animal heat takes from 2000 to 2500 foot-tons or more. According to Helmholtz, five times as much energy is used in internal work, as in ordinary external productive work. The relative amount of volitional and automatic brain-work must be, for the present, beyond mathematical computation.

From all that we know of the involuntary life, it follows, that man, whatever else he may be, is a machine, differing from machines that he himself makes, in that he has life, which is a bundle of reflex actions, and will which is the co-ordinated action of all the mental faculties. The one event of life is birth; after that all else is a trifle; for then, are decided, beyond repeal, all the great facts of existence—where we are to be, of what race, color, sex, language, what mental or physical qualities, whether of health or disease, we are to inherit, amid what environment of wealth or poverty, of learning or ignorance, of culture or degradation, the strife of life is to begin—and indeed the fact on which all others depend, whether we are to be at all.

The recent studies of Galton have shown as strongly as a number of facts necessarily limited possibly can, that twins born every way alike, never diverge, however different their external conditions; that twins born unlike never approximate, even though they live under the same conditions; and that in some instances they think, talk and act similarly and simultaneously, not only generally, but in detail as though the two were really but one.*

* On this subject Mr. Galton remarks as follows: "In illustration of the extremely close resemblance between certain twins, is the similarity in the association of their ideas. No less than eleven out of thirty-five cases testify to this. They make the same remarks on the same occasion, begin singing the same song at the same moment, and so on; or one would commence a sentence, and the other would finish it. An observant friend graphically described to me the effect produced upon her by two such twins whom she met casually. She said; 'Their teeth grew alike, they spoke alike and together, and said the same things, and seemed just like one person.' One of the most curious anecdotes that I have received concerning this similarity of ideas, was that one twin A., who happened to be at a town in Scotland, bought a set of champagne glasses which caught his attention, as a surprise for his brother B.; while, at the same time, B., being in England, bought a similar set of precisely the same pattern, as a surprise for A. Other anecdotes of a like kind have reached me about these twins."

But although theoretically and abstractly man is simply a living machine played upon by myriads of operators, yet practically and concretely man is so far free that his will can and does choose, though within very narrow limits, it is true, what influences shall operate upon him; and in this very limited realm, where the will rules, and over which it is placed and kept by powers beyond its control, lies all human responsibility and all the vast influence of punishment and reward. Man, though a slave of many masters, has a feeble voice, though oftentimes unheeded, in their selection; while we are free, our freedom is that of the mole rather than of the eagle, of the bird in the cage, against the sides of which it beats its wings in vain.

The study of the involuntary life prepares us for the study of the trance, a state which has long been recognized, but only recently has been understood. In the ordinary, waking state, the will has ever a certain influence, though it be but feeble, in comparison with the automatic side of our nature. The trance, like sleep, is the temporary triumph of the involuntary life.

The study of the involuntary life, aside from its purely physiological interest, has an important relation to the great modern delusions, animal-magnetism, spiritualism, clairvoyance and mind-reading. It is indeed through these delusions, that the attention of physiologists has been called to the phenomena of the involuntary life, and but for them, and the public excitement they caused, these phenomena, or many of them, interesting and suggestive asthey are, would probably have eluded observation.

The reason why the delusions of modern times have taken refuge in the involuntary life, is because this is, to the majority of people, an unknown realm; until quite lately physiologists had done but little to explore it, and even now, the number of those who have become at all expert in this branch of medical enquiry, is very small indeed, and those few who are really masters of the subject, have not yet had time to diffuse their knowlege among the laity. The history of past and present delusions, shows that they have always been based on the popular ignorance of some one or several departments:

and that they have declined in proportion as these departments have been introduced into science, and their principles disseminated among the people. First of all, astrology sprang up, striking its roots ages ago, in the mysteries of the sky, and teaching everywhere the art of reading the fate of men and nations in the stars; then astronomy came, advancing slowly, through long centuries of thought and toil, beginning with Hipparchus, and reaching its early maturity in Copernicus, Galileo and Newton; what had been dark and mysterious, was, by this science of the sky, now made luminous and clear, and even the apparent caprices of the heavenly bodies, were found to be subject to the reign of law: the facts of gravitation became the possession of the people, and astrology passed away. Then arose alchemy, wherein philosophers sought for the elixir of life, and the art of changing base metals to gold, through endless experiments with chemical substances, in the pursuit of which, they stumbled upon many genuine discoveries, and the noble science of chemistry was evolved. The elementary substances were made known, and the laws of combination and decomposition; the elixir of life and the philosopher's stone, were now known to be but the dreams of ignorance, and alchemy passed away. Driven thus, from the science of the stars and the science of atoms, from the infinitely great and the infinitely little, driven indeed, from all inanimate nature, the laws of which had now become known, delusions were forced back on animate nature; the mysteries of the earth and sky, having been revealed, they must fly to the vastly deeper mysteries of life, the human body in health and disease; and thus it was, that alchemy and astrology, gave way to witchcraft, which, out of the now well-studied phenomena of insanity, hysteria and trance, evolved a system of terror and of blood, that for centuries dominated in Europe. During the past two centuries, at first very slowly, and now with rapidity, have arisen the sciences of Physiology and Pathology; life as well as death, it has been found, is obedient to law; health and disease are resultants of forces, that move as inexorably as light or gravitation; and although the phenomena of life are not like the phenomena of the inanimate world, made subject to

mathematics, yet just as clearly is it shown that they conform to the general law of the universe, and are orderly successions of results that correspond to complex causes and can well be explained, and in a general way, predicted, and before the advance of these sciences, crude and imperfect as they were, witchcraft has past away. During the present century delusions have been forced back still further, and have made their last stand in that region of physiology and pathology that science had not yet subdued, the inner citadel of the nervous system, wherein are hidden the secrets of the involuntary life. Under cover of the dense darkness that surrounds this shadowy realm, the four great modern delusions, animal-magnetism, clairvoyance, spiritualism and mind-reading, have strongly entrenched themselves, and by ceaseless sorties, and levyings and skirmishes, have kept the civilization of the nineteenth century, constantly harassed. But physicians and physiologists, not satisfied with the partial conquest of the voluntary life, the discovery of the laws that govern man as a creature of volition, have attacked the inner citadel itself, and have carried it; they have systematized some of the laws that govern man as an automaton. What was dark, is now sufficiently illumined, to make it impossible for these four delusions to longer hold their ground; their surrender is but a matter of time. When the knowledge of the involuntary life, now confined to a very limited number of experts, shall have been diffused among all thoughtful classes; when the nature and phenomena of trance, and the automatic reactions of mind and body, and the laws and phenomena of animal electricity and of nervous force, shall be taught in colleges and schools, and be incorporated in a permanent literature, as they are now talked of among the specialists who have mastered these subjects, the whole mystery that has enabled these delusions to live will vanish, and animal-magnetism, and spiritualism, and clairvoyance and mind-reading, will be relegated to the realm of alchemy, astrology and witchcraft: and the twentieth century will read with wonder and with shame, of seances and mediums, of magnetizers and second sight, of Katie King and the Eddy Bros., of psychic force and Brown the "mind reader,"

as we now read of old women carried on broomsticks through the air, of possessions of the Devil, and haunted houses, of the judicial massacres in Salem and the Cock Lane ghost.*

XII.—*The Newly-discovered Force.* By Geo. M. Beard, M. D.

Some of the more important facts in regard to the newly-discovered force, I have already several times briefly presented in the *N. Y. Tribune*, and other journals. In this paper I shall endeavor to systematize our present knowledge of this force, and with as much clearness as the nature of the subject will admit. It is all the more necessary to make this attempt, from the fact that in the letters to the papers, and in the reports of the lecture I gave on the subject, there were certain omissions and errors that were almost inevitable in the presentation of a new and difficult theme, and, furthermore, some of the more recent and important experiments have not yet been made public. I began to experiment with the new force as soon as the announcement of its discovery was made, and since that time have devoted to it many nights, and certain portions of my leisure hours by day. It is proper to state that I have studied the subject independently, suggesting and carrying out my own experiments, especially those of a physiological character, and have repeated the majority of those made by Mr. Edison. It is proper also to state that from the outset Mr. Edison and his assistant, Mr. Bachelor, have in every possible way, and with great enthusiasm and kindness, co-operated with me, freely contributing their apparatus, their time and their labor. I am under obligations also to Prof. J. E. Smith for kindly co-operating in some of the earlier experiments made at the establishment of Mr. Chester.

President Morton, of the Stevens Institute, Hoboken, also generously placed at our disposal, for experiment, the magnificent apparatus of that Institution, and personally aided us in some of the investigations.

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* The discussion of the automatic action of the brain and of the interactions of mind and body, want of space compels us to omit.

Method of Obtaining the Force.

All that is necessary to generate the force, is a galvanic current of considerable strength, interrupted by a telegrapher's key, and passing through a small coil of fine wire. In order to capture the force, a piece of iron or cadmium or carbon may be laid across the end of the coil, or within the coil if it be a single coil. To this piece of metal a wire of iron or copper, may be attached, and by this conductor the force may be led off to the gas-pipe or any other earth connection, or to a stove, or stove-pipe, or, indeed, to any thing that acts as a conductor. Mr. Edison is quite positive that cadmium gathers the force somewhat better than any other metal. I have not seen or made any experiments in the comparative conductibility of different metals.

A battery current of considerable strength is needed, 5, 10, 15 or 20 Bunsen's cells; the number varying with the coil of electro-magnet used, and with the size of the batteries, and with the strength of the solution. It is probable that the force is generated even when fewer cells are used, but not always in sufficient quantity to give a spark, and hence we have no way of studying it, or of demonstrating its existence. The spark has been obtained when but four or even two cells were used. The interruptions may be slow or rapid. When slow interruptions are used it is found that the spark of the force appears only on the *opening* of the circuit.

The above is probably the simplest method of obtaining the force, and least liable to error, and is therefore better adapted for experiments. Instead of a single coil without a core, there may be double coils with cores, and across the ends of these a piece of iron or cadmium may be placed. Small spools of fine wire seem to be preferable to large spools of coarse wire; and magnets with large cores do not seem to develope the force; at least our experiments with very large magnets thus far have been failures. From the immense magnet in Stevens Institute, Hoboken, we could get nothing. A number of physicists, in different parts of the country, who have attempted to obtain the force from large magnets or from magnets with large cores, have entirely failed. The very natural sup-

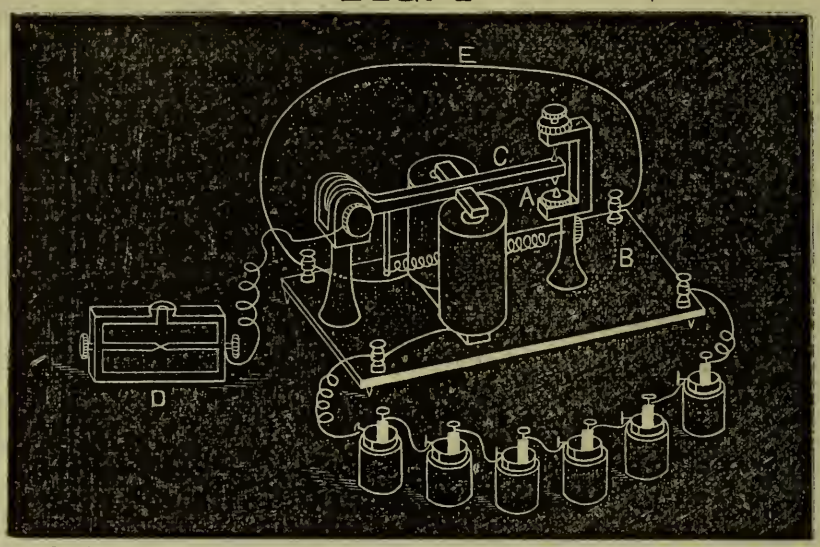
position that the larger the magnet the greater the amount of the force, is not sustained by experiment. The inconsistency is more apparent than actual, for in large magnets with large cores, the electricity, it may be supposed, is converted into magnetism instead of this force. A certain amount of suddenness of interruption is necessary to the development of the force, and in the large magnet of Stevens Institute, a number of seconds, about fifteen, according to our estimate, elapse after the closing of the circuit, before the magnet reaches its maximum, while on opening the circuit, the magnetism is undoubtedly retained in the magnet for some time.

In the small double magnet usually employed by Mr. Edison, the yoke is 2 inches long, and $\frac{3}{16}$ of an inch thick. The two cores forming the magnet, are $1\frac{1}{2}$ inches long, each, and $\frac{3}{8}$ of an inch thick; the coils are composed of 12 layers of No. 23 insulated wire. (*Fig.* 2.)

Another method of obtaining the force, is by means of self-vibrating electro-magnets of moderate size, the battery power remaining the same as by the previous method. In both methods the principle is the same, a strong interrupted galvanic current flowing through a small coil of moderately fine wire. In ordinary self-vibrating machines, used by physicians, the battery power is insufficient, and the core of the magnet is probably too large.

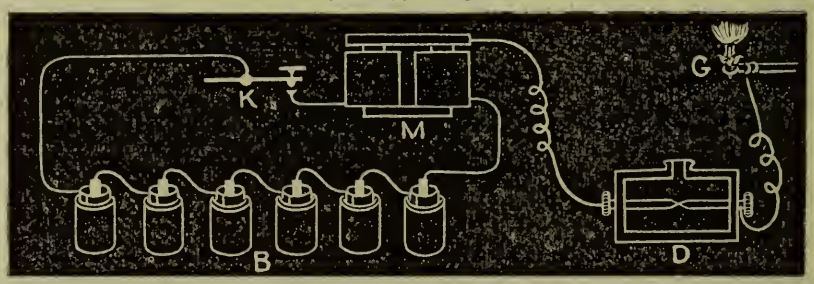
One of the most convenient methods for obtaining the force, is from an ordinary Telegraph "Sounder." (*Fig.* 1.) On most sounders the extremity of the lever plays between the points of two limiting screws. If the upper screw be insulated from the brass frame which holds it, and is connected to, say 10 cells, of bichromate of potash or Grove elements, the other end of which is connected to the lever of the sounder, the lever will at once be set in rapid vibration, like the magnetic interruption upon an induction coil. The spark can be obtained by drawing the edge of a knife lightly across the top of the lever or from the metal at the base. If a wire be connected with one of the binding screws the force will pass through it to any point, as the gas-pipe or dark box, where we can study it.

FIG. 1.



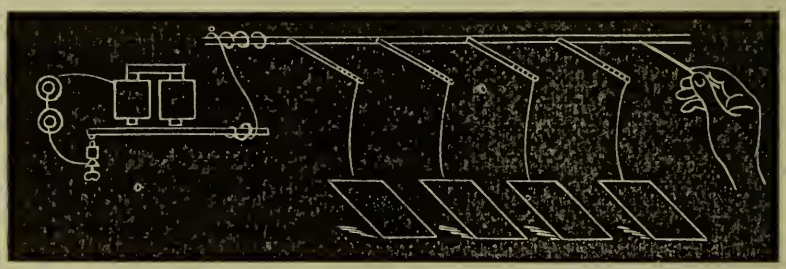
Force obtained from telegraph sounder converted into a self-vibrator. C, Lever. A, Screw with platinum point, insulated by ring of ivory or rubber. D, Dark box, containing pencil points. E & B, wires completing the connection.

FIG. 2.



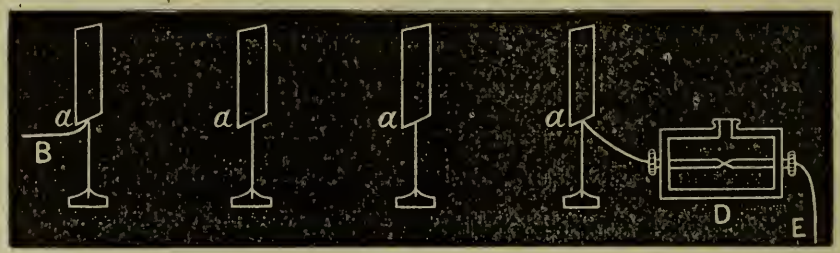
Force obtained from a small magnet, the interruption being made by a key. M, Small double magnet. K. Key. D, Dark Box. G, Gas-pipe or other earth connection, or any large body of metal.

FIG. 3.



Drawing off the spark after a number of connections with the floor have been made.

FIG. 4.



Force passing through the air. B, Wire conducting force. *aaaa*, Large pieces of tin-foil suspended on stands. D, Dark box. E, Earth connection.

The force may be increased by uniting a number of the sounders connected either with separate batteries or with the same battery. When the force is thus increased, it may be obtained *without metallic contact* with any part of the self-vibrating apparatus: there appears to be a certain area or field in the air through which the force flies away from the electro-magnet, and in this field it may be captured by any metal of considerable surface that is brought near, even when it does not touch the apparatus.

These experiments, together with others to be subsequently described, make it probable that only a very small quantity of the force is captured by the conductors thus far employed, the greater quantity being diffused through the air. Hence I have made the suggestion which in time will be carried out, to enclose a number of the vibrators with a metallic cone, covered with a layer of paraffine, which according to my experiments thoroughly resists this force, and connect the cone with wire similarly insulated.

The force can also be obtained from a Ruhmkorff's coil of moderate size, by drawing a knife across one of the posts near the end of the magnet. It does not seem to make much difference whether or not the outer coil be closed, the force depends wholly on the primary coil. The difficulty of experimenting with Ruhmkorff's coil, is that unless great care be exercised induction currents will be obtained. In all these experiments, the battery, the electro-magnet or coil may be thoroughly insulated, so as to exclude all possibility of currents of induction over the sides of the cells, and the completion of a circuit through the air. The force can be obtained just as well, however, even when no pains are taken with the insulation. In studying this force the dark box is almost indispensable. A small box of any kind from which the light is excluded, except through a hole at the top, will answer. The pencil points should be carefully sharpened, and should meet in the dark box just beneath the hole in the top.

These pencil points should be made to approach and recede from each other, a distance about equal to the thickness of tissue paper, a number of times when very weak sparks are to be

detected, but when the sparks are strong they may be adjusted to be almost in contact, the fine particles of carbon forming a chain from one pencil to the other. In careful experimenting when the force is passing or trying to pass through great resistance, it may be necessary to watch for the spark a number of minutes; varying all the while the adjustment of the pencil points. On the gas-pipe, or stove, or rusty iron of any kind, the spark can be obtained so as to be seen in daylight, provided it be somewhat shaded; on smooth metal it is difficult to get the spark.

Causes of Failure in Attempting to obtain the Force.

Those who attempt these experiments for the first time, may fail to see the spark from any one of the following causes.

1. The battery power may be insufficient.

2. The electro-magnet may be too large, or the core may be too large, or the wire may not be sufficiently fine.

3. Sufficient pains may not have been taken to darken the room. The strong sparks can be seen in full light of gas or day, but feeble sparks can be detected only in moderate darkness. The spark of this force is always comparatively weak.

A micrometer screw is of advantage in making the adjustment of the pencil points in the dark box. In the dark box a spark can be seen and studied when it cannot be readily seen outside. Very small iron wire and rusty tools give the spark better than copper wire or polished metals of any kind, the oxide of iron giving a more brilliant spark.

4. The person making the experiment may have connection with the conductor, and thus draw off a part of the force before it reaches the dark box or other point where it is studied. The body is a good conductor, and error from this source must be constantly guarded against.

Physical Experiments.

Out of a very large number of other experiments, I may mention the following: I stuck a penknife in a large block of paraffine, and connected it with metal conducting the force, as a gas-pipe or wire, drawing the blade lightly over the conduc-

tor. No sparks appeared. When a long file was substituted for the knife, sparks were abundant, and were kept up as long as the connection was made. In these experiments the force appears to pass into the metal, and thence is diffused into the air. I suspended by long pieces of silk rolls of wire of various sizes, and allowed them to strike against the connection. With small coils sparks rarely appeared, with the larger coils they were abundant. It would seem, therefore, that a certain size is necessary in the conductor in order to get the sparks. A short bit of wire wound round a glass rod, and held against the conductor would not get any spark; but take the same bit of wire connected at the other end with a spool of wire, or any large or long metallic surface, and the spark at once appears. A large surface of metal seems to attract the force better than a small surface. For this reason it is an advantage to connect the distal pencil point in the end of the dark box with the gas-pipe or other large metallic conductor; it is not, however, necessary to do so, for the spark will appear when the lead pencil is isolated. At one time I led the wire through a large vessel filled with water, and pieces of iron and bars of iron of various sizes were placed across its track and rested upon the wire, and the wire was wound round an iron press, and yet at the end the spark appeared. Mr. Edison took the wire out of doors, ran it along the ground and in a ditch on a rainy night, and brought it up-stairs several rods from the battery, and the spark was seen by him, by his assistant, and by myself in the dark box above described, but it was not constant, and required a nice adjustment of the carbon points to bring it out. The force, therefore, does not readily leave the metallic conductor, even when in contact with the earth, or passing through water, and the spark is seen when the end of the wire conducting the force is at a long distance from the battery.

Physiological Effects.

1. The force is conducted by the human body. This was proved by taking hold of the conductor—a wire, iron bar, or gas-pipe—that was in connection with the apparatus evolving the force by one hand, and with the other touching the blade

of a knife to a stove, or block of metal; sparks appeared, though somewhat smaller than when the force did not traverse the body. In some of these experiments, which were tried on several individuals, the body was insulated by a large block of paraffine six inches thick. When the distance for the force to travel through the body was reduced one-half by making the connection at the back of the neck or in the mouth a somewhat larger spark was produced than when the whole resistance of the body from hand to hand was included. It was clear, therefore, that the body conducted the force, though not so well as metals. A person standing on an insulator, with the conductor in hand, does not on dropping the conductor give any evidence of being charged; he can give no sparks to any other person or to any metal. I have also found it impossible to charge metals.

2. The force in passing through the body produces no demonstrable physiological effects. While we have the evidence of the sparks that the force is traversing the body, yet, wherever directed, it causes no sensation, not even on the tip of the tongue, no muscular contraction anywhere, no tremor, no erection of the hair, no flashes of light, no sour taste, no dizziness—in short, none of the usual physiological reactions of the different forms of electricity. Mr. Edison had supposed that in his own case contraction of the muscles of the tongue was produced when he applied the tip to the conductor, and his head did really move up and down as though the muscles were affected, but upon my breaking the connection unknown to him, his tongue kept moving as before, synchronously with the respiration. It was a case of mind acting on body; he expected some effect and unconsciously produced it himself. Mr. Edison and two of his colaborators were taken sick in various ways one night, and it was supposed that the illnesses were caused by the force, but in this also they were probably mistaken; mind acting on body or coincidences may account for their symptoms. It is certain that I have experimented many hours by day and by night with this force, and a considerable portion of the time it was passing through me or into me, and I was not unfavorably affected, nor were any of those

employed in the establishment, including Mr. Edison and the others who fancied their illness was caused by it. What effect the force evolved from a much more powerful apparatus, and passed through or into the body for a long time, may have primarily or secondarily, I cannot say. Some who tested the matter thought that a very slight tingling sensation was experienced on the tongue, but closer examination did not confirm this.

3. The force, when generated in sufficient amount, causes the galvanoscopic frog to contract. It is well known that the irritability of frogs varies with the season of the year, and also with other conditions; hence the galvanoscopic frog cannot be an absolute standard or measure for electricity. For this reason in all these experiments the irritability of the frog was tested by a galvanic current passing through definite resistances. We tested the frog used in these experiments and found it so sensitive that one electro-poion cell, placed in a circuit having a resistance of 400,000 ohms, or nearly 35,000 miles of telegraph wire, caused contraction, and yet it did not contract when this force was passed through it. That the force in these experiments passed through the frog (which was insulated) was proved by the spark that appeared at the distal end. In this experiment, the result of which was most remarkable and unexpected, all conceivable elements of error seemed to be excluded. Subsequently with a different apparatus, a Ruhmkorff's coil, a contraction of the muscles of the frog was obtained. The experiment was made at the establishment of Mr. Chester, and repeated in Newark.

In a subsequent series of experiments made with Mr. Edison, contractions were obtained in the frog's leg, although the apparatus was most thoroughly insulated. As galvanoscopic frogs are susceptible to mechanical irritation, it was suggested that possibly the vibrations, from the apparatus communicated through the wire, caused the contractions, and on using the key (*Fig.* 2,) instead of the self-vibrator the force caused no contractions. Returning to the self-vibrator, (*Fig.* 1,) contractions appeared. When the wire connecting the apparatus with the frog was shortened, the contractions increased

in vigor. That the frog was susceptible to vibrations was shown by striking a very large tuning-fork and touching it to the sciatic nerve, and sometimes contractions appeared when the vibrating fork did not touch the nerve, but was held at a distance of one-half or three-quarters of an inch from it. It was shown, however, by experiments on pith balls that electricity is generated by a vibrating tuning-fork, and this electricity which is probably the result of the impact of the steel against the air may possibly have caused the contractions in the frog. On testing this frog by the galvanic current it was found that one electro-poion cell, after going through a resistance of over one million ohms, or about 75,000 miles of telegraph wire, easily caused contraction.

In later experiments, however, made with Prof. Smith, I failed to cause any movement of the frog by mechanical vibrations alone, even when the nerve was held close to the self-vibrator; but when the force was allowed to pass through the nerve and muscles of the frog it contracted. When the key was used instead of the self-vibrator, the frog did not move even on the opening of the circuit. When the force coming from the self-vibrator was passed through several inches of water so as to eliminate the error of mechanical vibrations, the muscles of the frog contracted. It is probable, therefore, that when developed rapidly and in large amount, as in the self-vibrator, this force causes contraction in the galvanoscopic frog.

The presence of electricity, in its different forms, is determined by the electroscope, the Leyden jar, the galvanometer, the electrometer; electrolysis or electro-chemical decomposition, by physiological effects, and by light, heat or ozone produced. This force, as thus far studied, does not deflect the leaves of the electroscope, nor charge the Leyden jar, nor move the needle of Thomson's delicate reflecting galvanometer or electrometer, nor decompose iodide of potassium, nor produce any demonstrable physiological effects on the nerves of motion or sensation, or speech, or on the muscles or other tissues, nor does it under all conditions always affect even the galvanoscopic frog, the most delicate of all tests of electricity.

On the different forms of calorimeter it has not been fully

tried. I have convinced myself that, like electricity, it is resisted somewhat by platinum wire, and it is possible that in passing through platinum a portion of it may be converted into heat, as is the case with electricity; and if so a delicate thermometer, the bulb of which is surrounded by platinum wire through which the force is passing, would be affected. The heating power might be tested by the thermo-electric pile and galvanometer, or by the differential electro-calorimeter: experiments of this kind, however, whatever the results, would do but little toward solving the problem of the nature of the force. The odor of ozone, that is observed from the spark of dynamic electricity, I have not been able to obtain from this force.

It appears then that the light, as seen in the spark, and the contraction of the frog are the only evidences we have of the presence of this force in any conductor. It is changed into light as is electricity in passing from one metallic conductor to another. This spark has yet to be exhaustively studied by the microscope and spectroscope. It is possible that it may affect some of the chemical substances chemically or thermically.

Non-Polarity of the Force.

The apparent non-polarity of the force appears in all its phenomena. Although, like light and heat, it may be capable of polarization, yet, practically in the ordinary phenomena it is apolar, like those two forces, and as such it may be regarded. The idea of a circuit is not suggested by anything that is done with the force. We draw it off from the conductor as we draw off water from a spout, gas from a pipe or heat from a stove. It has no tendency like statical electricity to distribute itself through the earth any more than any other conductor. When a direct passage to the earth or the walls of the room is established by a gas-pipe, for example, it can still be drawn off from any branches of the pipe between the apparatus and the floor. It is captured by any good conductor, as metals or the human body, that is brought near to or in contact with a metal already conducting it.

With all the known forms of electricity, however they may differ in their special phenomena, the fact of polarity is inseparably associated; and it is by virtue of its polarity that electricity accomplishes work. Take away from the different forms of electricity their polarity, and you take away all their practical usefulness in telegraphy, in electro-plating, in signalling, in medicine or in surgery.

Conceivable Sources of Error.

The presumption against the actual demonstration of the existence of a new force, is very great, and can only be overcome by evidence of an overwhelming character. The experiments must be repeated with substantially similar results at various times, and by different expert observers. When, however, the phenomena are admitted, and when it is admitted that they cannot be explained by laws of electricity as known to experts in that branch of science, the burden of proof is shifted, and the presumption is against the claim that these phenomena represent some known phase of the electrical force.

Mr. Edison and myself and a number of physicists, who have thus far studied the subject, have made earnest and sustained efforts to prove that some known form of electricity would account for all these phenomena. Four theories of electricity have occurred to us, and by all of them these phenomena have been tested.

First. Creeping electricity which passes over the sides of the cells and completes the circuit through the earth and air. This is the theory that would naturally occur to any physicist on first examining the phenomena. Besides the general fact that this force does not respond to the ordinary tests of induced electricity, this theory is met by two facts, either of which seems to be sufficient to overthrow it.

1. The phenomena of the force appear just as well when the cells of the battery and the entire apparatus are most thoroughly insulated. In one case the insulation was so complete that when the entire apparatus on the insulating stands were charged by statical electricity, the charge was retained for a

long time, so that sparks could be taken from it; and yet the force appeared fully as strong as when there was no insulation.

2. In order to complete the circuit, it would be necessary for the induced electricity to traverse immense distances in the air; and at the same time have sufficient strength to give a decided spark. This is inconceivable; and further it is shown by direct experiment that this force, though it can go through the air when the surfaces at the ends of the conductors are sufficiently large, yet only for a few inches or a few feet at most, and when the ends of the conductors are small wires, the force will not pass any long interval, at least, in sufficient quantity to produce a spark on the other side.

Secondly. The Extra Current under ordinary Conditions of a Circuit.—It has been suggested that the force might be the extra induced current, but that current, as is well known, obeys all the laws of the other forms of induced electricity, produces decided chemical, and physiological effects; causes a deflection in the needle of the galvanometer, every where gives constant evidence of polarity, and, so far as is known, cannot exist without a circuit. The spark of this force does not scintillate as much as the spark of the extra current. Nothing is easier than to prove the presence of the extra current; whatever this force may be, it cannot be that current in ordinary circuit.

Thirdly. Statical Electricity of High Tension.—High tension statical electricity, such as is obtained from statical machines, gives a jumping spark; its physiological effects are very powerful, and even dangerous; it can charge bodies and things; and when connected with the earth by a good earth connection, it at once disappears. The spark of this force is scintillating, not jumping, requiring light contact to obtain it. Examined under the microscope even, it does not appear to jump any more than the spark of dynamical electricity. Moreover, this force has no demonstrable physiological effects, cannot charge persons or things, and when connected with the earth or floor by the best possible connection, it can still be drawn off from the conductor.

Fourthly. Statical Electricity of Low Tension.—Low tension statical electricity obeys the laws of statical electricity of high

tension in this respect, that it totally disappears when connected with the earth or with the walls of the room which are supposed to become polarized by it. Again, low tension statical electricity affects the electroscope and electrometer, and ought to charge the Leyden jar. Thomson's quadrant electrometer which this force thus far has not affected, is a very delicate test for low tension statical electricity.

Mr. Edison has found that low tension electricity, such as is obtained from the free poles of a single galvanic cell, does not behave at all after the manner of this force. When the tension is increased up to 65 cells, and is further increased by employing a condenser composed of numerous sheets of tin-foil separated by paper dipped in paraffine, and having a capacity of 34 microfarads, yet when connected with the earth, the electricity at once and entirely disappeared, and could not, like this force, be drawn off from the sides of the conductor.

Theories of the Force.

The theory which Mr. Edison favors, is that this spark indicates a radically new force, to which he has given the provisional name "Etheric," from its tendency to diffuse itself in various directions through matter. This theory would regard this force as distinct from any form of electricity, as light or heat, and would, indeed, bring it nearer to heat than to electricity, or would make it a kind of intermediate between those two forces. In the ultimate analysis there is probably but one force, of which light, heat and the different kinds of electricity are modifications—modes of motion, differing in the nature of their vibrations, correlated to and capable of being transformed into each other. The old-fashioned fluid theories of electricity, although they still hold ground in school and college text books, have been long since abandoned by physicists, and in their place the theory that it is a mode of motion of the ether and of other matter through which it circulates, is more in harmony with recent science. Already several varieties of electricity have been discovered, as follows:

Frictional or statical electricity.

Dynamical or current electricity, (including galvanic, induced and thermo electricity).*

Induced electricity is farther subdivided into primary, extra, secondary and tertiary currents, which differ from each other in quantity, tension and in physiological effects. The tendency is for these different forms of electricity to approach to and actually run into each other.

An electro-magnetic apparatus is a reservoir of many forms of force—galvanic and induced electricity of various orders, magnetism, statical electricity, light and heat. A source so rich in forces might give us at least one more; it is possible that one more has been here discovered. When a strong galvanic current connected so as to flow through a coil of wire is closed, a magnetic field is evolved, in and near the coil, and at some distance from it, the electricity being converted into magnetism; when the circuit is open, the electricity, it has been supposed, is converted into heat; it is probable that some of it is converted into this new force.

In suggesting the theory that this force might be allied to electricity by supposing it to return after the manner of the shuttle, to the source whence it is generated, I did not by any means commit myself to it; on the contrary, when all the known facts and phenomena that relate to the subject are carefully balanced, I find it as yet impossible to disprove the theory that *this is a radiant force, somewhere between light and heat on the one hand and magnetism and electricity on the other, with some of the features of all these forces.* But this claim is stupendous.

Experiments of the following kind are suggestive to enquirers in this department of research. When the wire conducting the force from the battery to the dark box, is divided in the air and the ends are separated even a sixteenth of an inch, no spark appears in the dark box. Lay these ends of the wire on a semi-conductor as wood, and the force will pass even when they are separated a moderate distance. Place small pieces of tin-foil about these ends as they are again suspended in the

* The statement recently made that thermo electricity differs radically from any other form of electricity is incorrect. Thermo electricity obeys the laws of dynamical electricity however obtained.

air and the force now passes an inch or perhaps several inches through the air. Place pieces of tin-foil of large surface about these ends and the force will pass a longer distance. Make the surfaces of tin-foil larger still, until they are a foot square or more, and the force will travel several feet through the air.

Prepare three large pieces of tin-foil, place one piece at each end of the divided wire suspended as before, and the other piece about equal distance between them; and still the spark may be seen faintly though irregularly in the dark box. The force must go by induction or radiation from the piece of tin-foil to the middle piece, which acts as a kind of resting place, and thence to the piece at the other end of the wire. The spark has been obtained, though with difficulty, and only after very nice adjustment of the pencil points in the dark box after having passed through four pieces of tin-foil, the distance from the first to the last being *eight feet.* (*Fig.* 4.) The highest tension statical electricity, as generated by Holtz's machine, could not do this except by induction, and withal would require insulation.

When a number of Leyden jars are substituted for the pieces of tin-foil, the result is the same; but Leyden jars are insulated. In these experiments insulation is not required, as is shown by the following experiments.

A large surface of tin-foil (6x6 or 12x12 in.) was connected with one end of the divided wire and laid on a table. Over this were placed broad pieces of rubber, glass or paraffine and on the top of them was placed a similar piece of tin-foil connected with the other end of the divided wire, through which the force was conducted to the dark box. In this way I proved that the force could pass through $2\frac{1}{4}$ inches dry wood, two plates of glass each $\frac{1}{4}$ of an inch in thickness, $\frac{1}{4}$ of an inch of hard rubber, $\frac{1}{4}$ of an inch of solid paraffine, and 5 layers of paraffine paper. When the surfaces at the end of the wire were reduced in size or when the tin-foil at one end was removed the force passed less easily. When the tin-foil at both ends was removed, and only a few inches of fine wire constituted the surface, the force passed through only thinner resistances, and when *only the terminals* of the wire were applied to the surface

of the resisting body, the force would not pass at all, or but a very slight distance. The force passed through twenty inches of water in a small tube, and was apparently but little diminished even when the surface at the terminals was but the diameter of a small wire.

When a number of "sounders," are in action near together and connected with the same or different batteries the force can be captured by a piece of wire a few inches long, connected with the dark box, and held at a distance of several inches from any of the sounders. This is, however, no exception to the law that the force passes resistance by surfaces, for the sounders here constitute one surface and the few inches of wire the other, making a condenser or Leyden jar.

Some of the early experiments with this force, gave erroneous or unsatisfactory results, because it was not known or suspected that with surfaces at the terminals it would pass through bad conductors even when the apparatus was not insulated.

In experimental researches we may learn oftentimes more from our blunders than from our successes. In studying the passage of this force through glass, the mistake was made of overlooking the conductibility of the air and the human body. On a long glass rod held by a stand, were wound the terminals of the divided wire through which the force was passing. Before the rod stood one of the experimenters, placed his hands on the ends of the wires and pushed them an inch apart, and the spark appeared in the dark box. He pushed them several inches apart, still appeared the spark; yet farther, the entire length of the glass rod, two feet or more, yet the spark though fainter was easily seen. The inference, which for a number of days was unchallenged, was that the force passed through the long glass rod though somewhat resisted by it. This inference was wrong. We afterwards found out by a combination of accident with closer observation and a better knowledge of the conductibility of the air and the body, that the force in this experiment was all the while passing not through the glass rod at all, but through the body of the person adjusting the wires, or through the air from between the surface of his hand and the terminal; with one hand on one terminal and the other brought

within a foot or more from the other terminal the spark appeared.

Mr. Edison suspects, and he may be right, that in certain barometric and hydroscopic states of the atmosphere the force may pass through long rods of glass; but in the many experiments that I have made since the discovery of this error here noted, I have never been able to see the spark when any considerable length of glass or rubber or shellac was interposed between the terminals, excepting when there was at one or both of the terminals a large conducting surface.

Phenomena of this kind suggest magnetism more than inductive or dynamical electricity, but this force does not respond to the test of magnetism, the power to attract iron, and moreover exhibits phenomena that do not belong to magnetism. This force is attracted by iron and other metal as conductors but it does not appear to attract iron.

The points which favor the theory that this force whether electrical or radiant, is yet something new to science, may be thus recapitulated.

First. It does not respond to any of the physical tests of electricity, except the spark.

Second. It produces no perceptible or demonstrable physiological effects like electricity, save on the frog.

Third. It gives no evidence, in any of its phenomena, of polarity.

Fourth. It passes through the air and other resistances by large surface at the terminals even when the apparatus is not insulated.

Fifth. When connected with the earth or walls of the room it can yet be drawn off from the conductor.

Any known form of electricity giving a spark like the spark of this force, would respond to some of the physical tests of electricity; would produce readily perceptible physiological effects, and would in its phenomena suggest polarity, even if rapidly reversed.

Again, the four facts regarded by me as favoring the theory that this force is allied to electricity, are when severely analysed not so convincing as they might at first appear.

The spark of this force resembles the scintillating spark of

dynamic electricity, but also do sparks produced by combustion. The velocity of this force is great, but so is that of light. This force is best conducted by metals, but so also is heat.

This force is resisted by non-conductors, but heat is similarly resisted, and both to a less degree than electricity. If it be as I have suggested, a form of electricity which is so rapidly reversed as to be practically depolarized, it would yet be electricity under very different conditions from those under which we are wont to consider it, and would be really a new force. The more I experiment in this department, and the more closely I reflect on the results of experiments, the farther I seem to be driven from the electrical toward the radiant theory of this force; in either case there would appear to be no ready escape from the acceptance of the conclusion that we have here something radically different from what has before been observed by science.

The relation of this force to the other forces may be thus represented.

Light, Heat, . . New Force, ... Electricity, Magnetism.

The above would represent Mr. Edison's theory of a radiant force, nearer to light and heat than to electricity or magnetism.

The theory I have suggested would ally the force to electricity or magnetism more than to light and heat, as follows,

Light, Heat, ... New Force, Electricity, Magnetism.

Presumption against the Validity of the Claim.

But it is yet too early to accept either theory. Although in the abstract there is no reason why a new force, or several new forces might not exist in nature, the phenomena of which should be revealed by chance or otherwise, and which are now unknown and unsuspected, because we have no way of knowing the conditions necessary to produce them, yet practically and in the concrete the presumption against the validity of any claim to the discovery of a new force is in the first instance enormous, and can only be overcome by an enormous amount of expert evidence. Science it is said is skeptical; it ought to be skeptical. The sources of error in studying phenomena believed to be new, are so

numerous that the statements of the first experimenters cannot be accepted, and ought not to be accepted, until they have been confirmed again and again by competent experts.

Previous Attempts to find a new Force.

During the past forty years strenuous efforts to discover a new force, have been made by scientific men all over the world. Mr. Edison himself, so he informs me, has made a series of elaborate experiments in this direction. In several instances men have fancied that success had crowned their efforts; hence have arisen the delusions of odic force, started by Reichenbach, with which this discovery of Mr. Edison has been absurdly confounded, of psychic force introduced by Mr. Crookes, and of mind-reading or the power of conveying thought from one brain to another without the aid of the ordinary senses, as recently announced by some of the scientific professors of America.

For three reasons all these claims have been rejected by the scientific world. First, those who made them were not authorities on physiology, to which department their alleged forces belonged. Secondly, the experiments supposed to prove the existence of these forces, if we may accept the accounts given by the authors, were complicated with numerous and fatal elements of error, chiefly coincidences, mind acting on body, and trickery, any one of which would destroy the value of any scientific experiment. Thirdly, the alleged results have in no instance been satisfactorily confirmed by any expert in experimental physiology.

The claims of this newly-discovered force relate both to physics and physiology, and it is by physicists and physiologists, who are trained to habits of experimental research in their respective departments, that it should be studied.

The question whether there is in the human body any form or manifestation of force differing radically from those already known, I had already thoroughly investigated, and had reached long ago the decided conclusion that there was no evidence or suggestion of evidence of the existence of such a force.

Relation of Accidents to Discovery.

Into this and previous discoveries of a similar character, the element of chance has largely entered; that is, fortunate accidents have occurred to experts capable of appreciating their meaning.

It was by accident that Galvani observed the twitching of the muscles of the frog, but for twenty years prior to that observation he had been studying the phenomena of electricity; it was by accident that Oersted discovered that a needle in the neighborhood of a coil in which a galvanic current was circulating, was put at right angles to the coil, but for fifteen years he had been seeking to accomplish this object. The spark of this new force coming from the core of a small magnet was accidentally discovered by Mr. Edison on the night of November 22d, of this year; it has been often seen before by practical electricians and by others, and it had been assumed to be inductive electricity; it had been seen before by Mr. Edison, and had been unnoticed, but here as everywhere it was proved that the eye sees what it brings the means of seeing, that it is not the eye, but the brain behind the eye that sees; for this time the spark was observed by one made specially alert by long practice in original experimental research in this department of enquiry.

If these experiments shall be so far confirmed as to become accepted by those physicists and physiologists who are competent to deal with questions of this nature, the discovery must assume great importance. It is forty-five years since any force has been introduced into science; the discovery of induced electricity by Faraday, dating from the year 1830. It is eighty-nine years since the discovery of galvanism; seventy-six years since the invention of the voltaic pile; one hundred and twenty-three years since Franklin by his kite experiment showed the identity of electricity and lightning; one hundred and thirty years since the discovery of the Leyden jar; and two hundred and seventy-five years since the publication of Dr. Gilbert's *Tractatus de Magnete*, that marks the birth of the science of electricity.

Questions of Priority.

Close on the heels of every alleged discovery, follow questions of priority. Already it has been claimed that the experiments of Riess, the great German authority on statical electricity, in obtaining weak sparks from the Leyden jar and Holtz machine, had really anticipated the experiments recorded in this paper. It is just to say that no such claim has been made or would be made by Riess himself, nor indeed by any one familiar with both series of experiments. The weak sparks of Riess were sparks of statical electricity; they exhibited polarity, and in other respects conformed to the laws of that form of electricity; he did not perform and did not attempt to perform with these sparks any of the physical or physiological experiments here recorded, nor did he claim to have discovered any new force, or any new form of electricity.

The coincidence in time between the publication of the abstract of Riess' experiments, and the announcement of the discovery of the new force, is admitted, and if the series of experiments were identical there would perhaps be a just reason for raising the question of priority.*

Practical Value of the Force.

The practical value of this force it is yet too early to discuss. There is no evidence, as yet, that the spark can be seen after the force has traversed very long distances, beyond a quarter or a half a mile. It is conceivable that it may yet be generated in sufficient quantity to send a spark through the outer wires of the Atlantic cable, and thus it may expedite ocean telegraphy; but there is as yet no proof that it can be utilized in that way or do any important work whatsoever.

It is entirely possible that it may produce important physiological effects, although such effects have not yet been demonstrated. If it be a radiant force, analogous to light and heat, it may, like those forces, affect the system radically, with-

* The paper of Riess was published originally in Poggendorff's *Annalen*, and the abstract referred to appeared in the *Electrical News*. Nov. 15, 1875.

out giving rise to any sensation. Light is important, even indispensable for healthy life, yet its influence is never immediately or directly felt save on the eye; and heat of a moderate intensity the body may receive unconsciously.

For the present, then, the question in regard to this force, is primarily one of science, and it is to be studied by scientific more than by practical men, belonging rather to physicists and physiologists than to telegraphic engineers or physicians.

Time and many experiments may be needed before we shall be enabled to so increase and control this force as to make it supersede or supplement any of the ordinary uses of electricity. The history of electricity shows that long intervals often occur between scientific discoveries and their practical applications. Thus galvanism was discovered thirteen years before the invention of the voltaic pile; a number of years more passed before the pile was utilized in chemistry in 1807. Induction, discovered by Faraday in 1830, was not utilized in telegraphy for a long time, and was not formally introduced into medicine by Duchenne until after the lapse of seventeen years.

But even though this force shall never be used in the arts, or applied to any commercial purpose whatsoever, it must be, if its existence is established, of the highest scientific interest.

Every new fact or thought, is, of itself, a positive addition to the world's wealth, and however isolated at first, must in time affect both the past and the future, illumining the one, and guiding the other.

Whatever the conclusion of physicists in regard to these alleged phenomena may ultimately be, the discussion of the subject cannot fail to be of interest and of value to the student of electrology, and for the reason mainly that it compels a reinvestigation of the laws and phenomena of the different forms of electricity, in the light of the most recent theories of that force. A knowledge of electro-physics is indispensable to a thorough knowledge of electro-physiology or electro-therapeutics, medical or surgical; the value of many experiments in physiology, those of Ferrier, for example, are seriouly inpaired for want of such knowledge. If it should be proved to the unanimous satisfaction of competent judges,

that these phenomena, so far as they are genuine, simply represent some well-known form of electricity, the labor and the time given to the subject, will yet have been well spent.

For my own part, while I have all along inclined to the conservative view, that this spark indicates some form of electricity, and by that theory was first drawn to the study of it, I have yet been unable to prove this, or to obtain such proof from any source. Among the physicists who have given thought to the subject, and with whom I have conversed or corresponded, there is a wide diversity of opinion. Some men of ability and reputation have found great difficulty in getting the spark at all; others of equal ability and reputation have obtained the spark, and have satisfied themselves that it is merely the spark of the extra current of induction; others still are positive that it is statical electricity of low tension. No one, however, so far as I know, has published any facts that explain these phenomena by the unanimously admitted laws of any form of electricity; and no one, so far as I know, has yet repeated all the experiments here recorded.

Thus far those who are familiar with the technique of electrophysics, and who have the sounders and small magnets at hand, as telegraphers and telegraphic engineers, have been more successful in obtaining the spark, and are more nearly unanimous in the opinion that it represents something that cannot be explained by known laws of electricity, than professors of theoretical physics.

In conclusion I may say that although I originally suggested the hypothesis that this force might be electricity so rapidly reversed as to be unable to respond to the usual tests, and, therefore, practically depolarized, and without a circuit in the ordinary sense of that term, and have kept that theory in mind in all my investigations, and hence would not unnaturally be pleased to have it proved to be the true solution of these phenomena, yet I cannot blind myself to these serious difficulties in the way of its acceptance.

1. This force, when key is used (*Fig.* 2), and the interruptions are made slowly and carefully, appears only on the *opening* of the circuit. Where then is the opportunity for

rapid reversals? Besides, induced electricity, even when very rapidly reversed, affects delicate galvanometers.

2. The physiological experiments are not fully accounted for by this theory. Any form of rapidly reversed electricity in an ordinary circuit, giving a spark like the spark of this force, is felt on the tongue and lips, and in the inner corner of the eye, and indeed on less sensitive parts of the body.

The galvanoscopic frog ought to contract even when the key is used with slow interruptions.

3. The passing of this force through great resistances of air, and solid non-conductors when large surfaces are at the terminals (*Fig.* 4,). In these experiments these resistances may be supposed to act as dielectrics, and the whole arrangement may be regarded as analogous to a Leyden jar, or the condenser of a Ruhmkorff coil; but the extra current, as it passes through a condenser, is in a circuit; here there is no demonstrable circuit, and, furthermore, the dielectrics in the condenser are trifling in extent compared with the extent of air, and thickness of resistances in these experiments. According to this hypothesis of rapidly reversed currents, induced electricity, when it reaches the large terminal, is changed into statical electricity, and at the distal large terminal is changed back into induced electricity, and through all these varying conditions the electricity is going backwards and forwards so rapidly as to be unable to respond to the usual tests. Is this demonstrable?

These objections may not be fatal to this working hypothesis, of rapidly reversed electricity but they must be met and fully considered by those who are inclined to favor it. It is the more important to insist on these difficulties, because a number of observers who have repeated some of these experiments, and admit the phenomena, or some of them, are taking instant refuge in this theory as though that solved the whole mystery.*

* Prof. Houston, of Philadelphia, among others has repeated some of these physical experiments, has adopted in full, and after but a partial study of the subject, the hypothesis of rapidly reversed electricity as suggested in my letter to the *Tribune* of Dec. 9th, and further

Both theories, that of a radiant force, and that of rapidly reversed electricity are radically new suggestions, and neither of them can be or will be or ought to be accepted except under the pressure of long accumulating evidence.

Meanwhile it should be borne constantly in mind as a principle of evidence that for those who admit these phenomena, and who assert that they indicate some known phase of elcetricity or magnetism, the burden of proof in that issue rests to make good the claim by positive proofs. Until such proofs are obtained the scientific mind can maintain a position of neutrality, or can consider the relative value of the two theories here suggested. Either course would be consistent with the scientific spirit. The theory of rapidly reversed electricity apparently accounts for but a part of the phenomena, but it has this advantage over the radiant theory that there is less presumption against it. If we could suppose a phase of statical electricity of low tension and considerable quantity, which, for some reason, is unable to respond to most of the electrical tests, these phenomena might perhaps be explained; but such a supposition really begs all the questions at issue.

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claims priority of discovery, because he observed the spark of this when experimenting with a Ruhmkorff coil four years ago. To this claim, if it be seriously entertained, the obvious reply is, that thousands of persons, probably, had seen this spark before it was *discovered* by Mr. Edison; it had been seen by Prof. Nipher, who supposed, and still supposes it is the spark of the extra current; it has been seen by my friend, Prof. J. E. Smith, who assumed, as he tells me, without examination, that it was inductive electricity breaking through bad insulation; it had been seen, as has been stated, by Mr. Edison many times before he thought it worthy of study; it was undoubtedly seen by Prof. Houston, who like so many others failed to even suspect its meaning, and thus missed an important discovery. The honor of a scientific discovery belongs, not to him who first sees a thing, but to him who first sees it with expert eyes, not to him even, who drops an original suggestion, but to him who first makes that suggestion fruitful of results. If to see with the eyes a phenomenon, is to discover the law of which that phenomenon is a part, then every school boy who before the time of Newton, ever saw an apple fall, was a discoverer of the law of gravitation. Prof. Houston's account of his repetition of some of these experiments, was published in the Journal of the Franklin Institute for Jan., 1876; and the article in which he incidently mentions sparks that he now rightly recognizes as the spark of this force, was published in the same Journal, June, 1871.

MISCELLANEOUS NOTES.

*The Scientific Character of Duchenne.**

The leading external facts in the life of Duchenne, may be briefly told. That he was born in 1806; that he graduated in medicine at Paris, in 1831; that for a time he practiced in Boulogne; that between 1842 and 1845, while between the ages of thirty-six and thirty-nine, he established himself in Paris; that he died a few months since, at the age of sixty-nine; and that he made his first publication on the subject of localized faradization, in 1847 (in a note addressed to the Academy); that his larger work on localized electrization, was published in 1855, and has now passed to a third edition; and that he was also the author of works on the "Physiology of Movements," "Mechanism of Human Physiology," and "Researches on the Muscles of the Feet," besides many other articles and monographs, these facts are quite familiar to us all.

The scientific life is usually uneventful; it is not marked by striking external phenonema, on which the biographer can seize, and out of which huge volumes can be made. To this general law, the history of Duchenne well conforms.

In Electro-therapeutics, the researches of Duchenne were confined mostly to the local use of the Faradic current in paralysis. He was not the first to use faradization in paralysis; both in this country and his own, this method had been used before he wrote upon the subject; but he was the first to give it a scientific basis, and to introduce it to the profession; most justly, therefore, he is regarded as the father of this method of using electricity.

If he was not exactly the discoverer of the disease, locomotor ataxia, he was, at least, the discoverer of the one distinct fact

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* Read before the N. Y. Society of Neurology, Dec. 20th, 1875.

of the disease, namely that the peculiar gait, by which it is now recognized, is not a true paralysis in the ordinary sense of that term, but incoördination. He showed that in this disease the muscles individually may be very strong, that they may respond well to faradization while their combined action was irregular and inharmonious. Previous to his time, the disease had been studied by Romberg, and since that time its pathological anatomy has occupied the attention of various pathologists.

He discovered also the disease known as glosso-labial paralysis. Pseudo-hypertrophic paralysis also he introduced into science, and he made important researches in progressive muscular atrophy, and in the spinal paralysis of infancy. Furthermore, physiolgists, physicians and surgeons, should not forget that the researches of Duchenne on the muscles of the hands and feet, have changed, in some respects, the accepted ideas in regard to the action of some of these muscles, and thus have been of practical service for all those who treat deformities of these parts, mechanically or surgically.

The field of electro-therapeutics that he cultivated, was narrow as compared with more recent explorations; but at that time it was novel, and it required a brave, strong man to explore its mysteries, and make the profession follow him.

Duchenne was an original genius, but not, perhaps, of the very highest order. With all his patience and precision and acuteness and vast analytic skill, he was wanting, not only in generalizing, but in systematizing power, hence it is that his work on Electricity, with its mass of facts, thoughts and observations, is a marvel of disorder; of the various treatises on the subject that have appeared, few are so ill-adapted for the learner as "Localized Electrization," even in its latest edition.

The power of rigidly separating the sheep from the goats, the wheat from the chaff, and of combining and presenting in a systematic whole, the results of minutely detailed observations, he seemed never to have possessed in any marked degree; certainly his reflective faculties were in no way proportioned to his faculties for observation and analysis. Truly says Buckle, "For one person who can think there are

at least a hundred persons who can observe. An accurate observer is no doubt rare; but an accurate thinker is far rarer." With equal truth writes Liebig, "The attaching too high a value to the mere facts is often a sign of a want of ideas."

Although Duchenne has been so clearly and so variously identified with electro-therapeutics, that the very mention of electricity suggests his name, yet it has always seemed to us that his labors in neurology and allied departments were almost equal in importance. For, indeed, electrology and neurology are so closely allied that one cannot be thorough in one without also knowing something of the other. Every electrologist must be something of a neurologist; no neurologist can avoid the study of electrology. Duchenne, aside from his researches in infantile, pseudo-hypertrophic and glosso-laryngeal paralysis and in locomotor-ataxia, displayed great ability and energy in a work that is very little known, namely his treatise on Human Physiognomy.

This work is a model of accurate and detailed observation and experiment, but Duchenne seems not to have generalized from his observations to the great laws of expression. This task was taken up by the author of "Origin of Species," Mr. Darwin, a man in whose mind the observing and generalizing powers are harmoniously developed, who indeed observes so acutely and so minutely, that we wonder that he dares to generalize, and who generalizes so boldly that it seems scarcely necessary for him to observe. Mr. Darwin, in his remarkable, but not very widely-known work, on "The Expression of the Emotions, in Man and in Animals," continually refers to the labors of Duchenne, acknowledges frequently his indebtedness to him, and commends in terms the most exalted, his accuracy, his skill and his patience.

So marked is the aptness of Duchenne for detail, so beautiful is his precision, so accurate is he in description that Benedikt has styled him felicitously and justly the "Meissonier of clinicians." If this Darwinian genius for observation had been supplemented by something of Darwin's genius for reflection; if to this love of minute analysis had been added an equal love of system; if in short these superb gifts for detail had been

crowned by the rarer and greater gifts of generalization, Duchenne would probably have filled an even larger place in the history of science.

As it is, he is and has been most esteemed by those best fitted to judge of his labors. Trousseau, greater than he in many respects, though inferior in others, may be said to have introduced him to the world, and at a time when it was fashionable to despise electricity and ignore the nervous system.

Duchenne, was really stronger in neurology than in electrology; much as he used the faradic current in the diagnosis and treatment of paralysis, he never attempted to give electricity its place in the materia medica, or to in any degree systematize or generalize the indications and methods of its use in the vast variety of diseases, where it is now constantly and successfully employed.

In electro-surgery he had but slight experience, and in electro-physics the real scientific basis of electro-therapeutics, his knowledge was limited mostly to the phenomena of induction, but as far as he went in electricity, he was thorough and true. He who knows one thing well is a great man, it has been said; but he who knows two things is a greater. Duchenne knew well neuro-pathology and localized faradization. The field of psychology into which neurology opens, and which is now engaging the thoughts of some of our most eminent neurologists and medical electricians, as Benedikt and others, he never seems to have entered.

It was said of Liebig, that for some years before his death he had fallen behind the age even in the special branch to which his life was devoted; the new chemistry had gone ahead and left him. Similarly Duchenne failed to keep pace with the rapid advance of the very science and art of which he was one of the founders; and when he died there were numbers of experts, who in breadth and variety of attainment were far superior to him; but all of these were of necessity, under obligations to Duchenne. The same fact is illustrated in the career of Humboldt.

Duchenne was not exempt from what are called the sorrows of genius. To live long in patient obscurity, to have discov-

ered what one knows to be genuine, by some regarded as false, by others as borrowed; to be looked upon with suspicion and mild distrust; to be at first ignored, then envied; to be denied many of the so-called honors of the profession which he so greatly honored; to be misconceived and misinterpreted, and to be judged by one's failings more than by one's merits—all these experiences that have ever been and must ever be the price of pioneering truth in the world, Duchenne knew and in abundant measure. Every original man must educate his audience; but the process is oftentimes a painful one, both to the teacher and the taught.

The features in the social character of Duchenne that were constantly dominant were intensity of enthusiasm and a well-nigh limitless patience. In receptivity he was quite deficient, hence the severity of his contest with Remak, in which he was only partly in the right; hence also his inability to see, in the latter part of his life, that the current of electro-therapeutics was sweeping rapidly by him.

One thought suggested by the survey of the character of Duchenne is that the offspring of the brains of discoverers and inventors soon forget their parentage. In using the products of human skill and genius we lose sight of the lives and even the names of those to whom we are indebted for them. There is now scarcely a village in the land and soon it can be said, there is scarcely a civilized family in which may not be found those who have been relieved or cured of disease by electricity, and yet the names of the founders of electro-therapeutics, are only preserved in the narrow circle of experts and in the recorded history of medicine.

We are reminded here of the words of Ecclesiastes: "There was a little city * * now there was found in it a poor wise man, and he by his wisdom delivered the city, yet no man remembered that same poor man." The moral is, that the highest reward of scientific work, must be in the pleasure of work itself, without regard to any returns of fortune or fame. All these rewards, Duchenne, in a measure, enjoyed, but the first, it may be believed, mainly inspired him through his long life of toil.

Effect of Elevation on the Nervous System.

The following was designed to be published in the last number of the Archives, in connection with the paper of Dr. Denison, on the Effects of the Climate of Colorado on the Nervous System.

"I send you the major part of an interesting letter just received from "Wm. Thoedovius, Lgt. Sig. Ser., U. S. A.," stationed at Pike's Peak, 14,000 feet above sea level, in answer to my letter of inquiry in reference to the influence of the climate of Pike's Peak upon the nervous system.

"Persons not accustomed to a mountain climate, feel the immediate effects of the rarified atmosphere upon the summit of Pike's Peak very sensibly; they almost invariably complain of severe headache, complete loss of appetite, general debility and more or less mountain fever. During night, headache grows worse and exhibits very much the character of neuralgia.

"These symptoms generally disappear in four or five days after arrival, and in less time if cathartic pills and nitre are administered, and are superseded by an unusually good appetite and a speedy recovery.

"Difficulty of breathing is generally experienced from walking too fast or while working, but can, in my opinion, not be considered permanent, and depends, perhaps to some extent, upon the constitution of the individual's lungs.

"During the prevalence of thunder storms, the mind or rather imagination, is *said* to be excited, especially in persons of sanguine temperament, but otherwise I am not aware of any effects of the altitude upon the mind.

"There is an observation, however, which might deserve attention. During fair weather, the pulse of persons who have been here over two months generally beats from 82 to 90 per minute, during the first month from 90 to 100, and when the atmosphere is highly charged with electricity, as displayed in thunder storms of unusual severity, the pulse will increase to 110 and 120. How far, however, this latter statement will prove verified, I am unable to say, as my own observations, in this respect, have been too limited," [having been stationed at Pike's Peak but a few weeks.]

Rapidity of Motor and Sensory Conduction.

According to the more recent experiments in the study of the rapidity of motor and sensory conduction (we refer to those of Burckhardt) motor impressions are conducted through the brain, from the cortex to the cord, in about $\frac{3}{2\,0}$ of a second; through the spinal cord at the rate of about 36 feet a second; through the peripheral nerves at about 91 feet per second, while the sensory impressions are conducted very much more rapidly through the nerves at the rate of about 149 feet per second.

Supposing that there are no serious errors in these estimates, and it will be noticed that Burckhardt's conclusions agree in the main with those of Helmholtz, Marey, Schelske and others, we have in them a strong argument for the theory that the difference between a motor and a sensory impression, is simply a difference of molecular motion.

Diabetes relieved by Central Galvanization.

J. P. Cowles, M. D., of Camden, Maine, reports the following result of central galvanization in a case of traumatic diabetes. Similar relief we have reported, by the same method in two cases.

"I had an interesting case of diabetes-mellitus, last winter. Patient, a physician. Age, about thirty. Weight, about 225. Had lost some 30 lbs. Flow of urine excessive, highly saccharine, great thirst, progressive feebleness and emaciation, and every other symptom clearly demonstrating the presence of this disease; caused by a fall, striking upon the back and shoulders.

"I gave a few irregular treatments according to the system of central galvanization, using from 4 to 18 cells, Kidder galvanic battery. Result, cessation of immoderate thirst, and voidance of urine, return of strength and weight; but falling into the error that thousands of others do, discontinued treatment too soon, and I hear now that the disease has returned."

Reflex Irritation as a Cause of Nervous Diseases.

Recently there have been some most important and suggestive contributions to the subject of reflex irritation as a cause of nervous diseases. Dr. Sayre had called attention in 1870, to a number of cases of paralysis dependent on some disorder of the genital organs, and cured by a relief of that irritation. Recently in a paper entitled, "On Reflex Irritation throughout the genito-urinary tract, resulting from contraction of the urethra at or near the meatus-urinarius," Dr. Otis has collected some facts of the highest interest. He mentions pain and general discomfort about the perineum, gleety discharge, nocturnal emissions, frequent and painful micturition, pain accompanying seminal emission, a feeling of wetness at the glans penis, spasmodic contraction of the penis, pain in the back, testicles, groin and thighs, all may result from contraction of the urethra at or near the meatus urinarius, and that relief of this contraction brings relief of these symptoms. In a recent number of the *Detroit Journal of Medicine*, Dr. J. H. Carstens, of Detroit, relates a case where the symptoms of locomotor ataxia were clearly produced by a scar on the ball of the large toe. The cicatrix was removed by Dr. McGraw, and the ataxic symptoms disappeared so directly and rapidly as to leave no chance for doubt that they were caused by the cicatrix. Dr. Greenhow, of London, in a recent lecture suggests that the peculiar color of Addison's disease, may arise through "reflex irritation through the cerebro-spinal nervous system."

Dr. Lewis Fisher, of New York, has succeeded in curing an obstinate case of chronic discharge from the urethra, by a mechanical appliance contrived for the relief of the ligaments at the bottom of the feet. The ligaments had been strained in walking, and afterwards walking became very painful, and through reflex irritation, chronic urethral discharge appeared that resisted all treatment until the weaker sinews were properly supported. The case, if reported in full, would be very interesting.

Charcot has shown that compression of one of the ovaries may avert an attack of hysteria. This treatment is based on

the theory that in the crises of hysteria there is an aura that has its point of departure in one of the ovaries. The compression is made by the fingers, as in compressing the iliac artery, or by a tourniquet. In hysteria in men the testicles have been compressed.

Mr. Thomas Smith, of London, has reported recently to the Clinical Society, a case of nervous disease, in a baby sixteen months old. There was spinal irritation and general nervousness, and the child was very fretful and irritable. The nervous symptoms could be at once relieved by roughly scratching either of the palms of the hands, or the soles of the feet. Under this treatment she quickly became quiet, in a few minutes perspiration appeared. For hours the child would remain quiet under this treatment. Scratching the head would have the same effect. The case suggests the query whether other cases of nervousness and irritability in children might not be similarly treated.

Effects of great Elevation in the Tropics.

Mr. O. F. Nichols, civil engineer in Peru, informs us that in that country many people live at an elevation of 15,000 feet above the level of the sea. Quito is 12,000 feet above the level of the sea. The town of Cerrodepasco is situated 15,000 above the sea level, and contains a population of nearly one thousand. The residents of these regions have broad shoulders, full chests, but otherwise are small. The average height would be very low; a police officer, for example, is only required to be 5 feet 2 inches in height. These people are civilized Indians; they are very robust.

On foreigners, this climate, at first, acts badly, producing a disease called *sorroche*, or difficuty of breathing, nausea and vomiting, and pain in head, and they do not well acclimate.

In the valley of Jacja, situated 10,000 feet above the level of the sea, consumptives are greatly benefited. The living and surroundings are very bad, sometimes it is quite cold, and the houses have no stoves.

There is a limited region at an altitude of from 4,000 to 6,000 feet and between latitude 8° and 15° South, where there

prevails a disease called *verrugas* occurs. This disease consists of fever, rheumatic-like pains and smarts. This disease may be fatal. It attacks both natives and foreigners.

The climate is favorable to nervous patients. It is said there that in the moderate altitudes the strong grow weak, and the weak grow strong when they visit these regions.

The Wave Theory in Physiology, Pathology and Therapeutics.

The hypothesis that the great forces of nature, light, heat and electricity in its different forms, are but different varieties of motion is now pretty generally accepted. No man ever saw with his eyes the waves of these forces, as no one ever saw the force of gravitation; only by their phenomena can these forces be studied, and from the phenomena we evolve an hypothesis of wave motion of the ether and of all matter, by which these phenomena can be explained. This wave hypothesis which now dominates in the world of science, the future may possibly repudiate. Even gravity itself may be proved to be only a partial truth; but with our present knowledge the wave theory is the best hypothesis that has been devised, and by its aid we are studying far more satisfactorily than heretofore, the phenomena of the great forces of inanimate nature. Even if it is cast aside in time, it is nevertheless useful and indispensable as a temporary scaffolding.

The next step will be the extension of the wave theory to animate nature, to biology; physiology, pathology and therapeutics will be made clearer, and their progress will be aided by it. Only by the wave theory can we account for the manifold functions of the nerves, of motion, of sensation and of special sense. There are many varieties of sensation, some of which may be impaired, while others are normal; for example, sensibility to pain, to temperature, to pressure, to touch, and to faradization. The wonderful functions of the nerves of hearing, seeing, smelling and tasting are all in harmony with the wave theory; and they are not explained satisfactorily by any other. It has been proved very recently by Mr. Edison by experiments, some of which we have witnessed, that eight messages can be sent over one wire each way, provided dif-

ferent rates of vibration of electricity are used, as determined by tuning forks. On the same principle the nerves may transmit without interference different sensations corresponding to different rates of vibration.

In pathology the wave theory enables us to dispense with the theory of trophic nerves. Cases of muscular atrophy and of unilateral atrophy of the face may be caused by central disease affecting the transmissions of certain vibrations.

In therapeutics it is admitted already that the effects of electricity in medicine and surgery, are simply due to molecular changes; and many of our medicines probably act in a similar way. The vibrations caused by rubbing and pounding are of acknowledged benefit; and by the aid of tuning fork the application of vibrations to the treatment of disease may yet be reduced to something of a science.

GLEANINGS.

Differential Action of the Currents. Dr. Onimus, of Paris, (*The Practitioner*, September, 1875,) says that inducted currents cause nerves to lose their excitability, not by a chemical alteration, as galvanic currents do, but by the mechanical effects of a succession of shocks.

Becquerel has found electric currents in the bones, tendons and arteries, and Bernard has discovered the cutaneous and musculo-cutaneous currents, and in all organic substances there is electricity.

Hermann has shown that the surface of the muscle being exposed to the air decomposes more rapidly and even becomes negative to the transverse sections, hence all the laws of the muscle and nerve current.

Becquerel has made close experiments which show that when muscles are reduced to a paste, a current passes from the interior to the exterior surface, because the exterior being more rapidly oxidized by being exposed to the air, is negative.

Becquerel has shown that when two different solutions that are conductors of electricity are separated by an organic membrane, there is an electro-chemical circuit.

In experimenting with the galvanometer on patients in Salpetriere hospital, Onimus found that if needles are buried in the muscles both quiescent, the galvanometer needle interposed will not diverge, but if one of the muscles is in a state of contraction, the needle diverges, showing that the muscle in contraction is negative, owing to the increased chemical action, just as the outer surface of a muscle is negative to the inner surface, through greater oxidation.

So in comparing pathological muscles in contraction with healthy muscles in quiescence, the former are negative compared with the latter, when a muscle has been long contracted and becomes weakened, then it is positive instead of negative.

Whence Onimus derived this general law, "*A living tissue assumes in relation to the very same tissue the negative electric sign when the phenomena of oxidation are more pronounced in it.*"

Still further the law is illustrated by comparing muscles that are acting with those that are passively contracted on the same patients; the former will resemble natural contraction in being negative; the latter will be positive, because they are shortened and are capable of very little movement, and their nutritive charges are feeble.

Onimus finds that in long-standing paralysis of the lower limbs the natural electric current is much more feeble than in healthy limbs.

Matteucci showed, in 1868, that the electrotonic state could be produced in all bodies capable of electrolytic action, potato, stalks of cab-

bage, &c. A platinum wire covered with flax or cotton and dipped in salt water showed the phenomena of electrotonos when the electrodes were applied at a given point. Electrotonos is not thus peculiar to nerve or muscles; it may be found in the skin of any patient who will bear strong currents. The effect of the current will be felt at a long distance from the electrode, as will be shown by a delicate galvanometer.

Anelectrotonos and catelectrotonos, Onimus explains by the irritated effects of alkalies at the electrode and the calming effects of acids at the anode.

Longevity of Brain Workers The *Deutsche Versicherungs Zeitung*, (Berlin, der 21. Jan. 1875,) contains the following on the Longevity of Brainworkers. "For a number of years it has been proved by statistica evidence, that men of learning, on the whole, have less mortality, and live longer than those in other callings, particularly artisans, laborers &c. Among men of learning again there are degrees of longevity. * * * *

"Formerly and until within the past ten years, it was generally believed that mind and brain workers, as, for example, scholars, artists, literati, physicians, &c. have a much less expectation of life than the bone and muscle workers. This view has been overthrown completely by later investigation based on the facts of statistics; and to the astonishment of the adherents of older theories, the very reverse of these older suppositions has been demonstrated. The results of these new investigations are recapitulated in a work of Dr. George M. Beard, which was prepared for the American Public Health Association, and which has recently been published in the Medical Record. It is true that we miss in the above special statistical proof; however the author states that his doctrines were derived from the closest study of statistical materials in this department; and in consideration of the excellent position which medical science in North America takes, and for which even a man like Professor Vichow, recently contends in most complimentary words, we must dismiss all doubts of the genuineness and accuracy of the above thesis.

"We are the more justified in taking this position, since the results obtained by Dr. Beard, presented thus, are in full harmony with the demonstrated principles of modern science; and similar theories have frequently been brought forward from various quarters, and proved with mathematical precision. But it is the especial merit of Dr. Beard, to have systematized these results in such a clear, comprehensive form.

"It was for this author not so much to bring something novel, as to derive necessary conclusions and instruction from abundant experience already stated.

"This method of investigation, which has created for us the basis of medicine of our time, and of all modern science, has our fullest confidence, and we must accept it unhesitatingly."

Atrophy of the Brain following action of the Sympathetic. M. Dupuy presented to the Societé de Biologie, (Nov. 13th, 1875,) the brain of an animal, of which the right sympathetic had been cut. The cerebrum, the cerebellum and the spinal cord on the right side were atrophied. Brown-Sequard stated that in two cases he had obtained atrophy of the two halves of the brain after section of both sympathetics.

Electrization of the Brain. Bochefontaine (*Le Progrès Médical, Dec. 4th*, 1875,) has produced various effects from electrization of the brain, such as secretions of the glands, modification of the vascular tension, etc. He presented to the *Societé de Biologie* the brains on which were indicated the points which on being irritated produced these various phenomena.

Paraplegia caused by Cauterization of the Brain. Brown-Sequard, (*Le Progrès Médical, Nov. 20th*, 1875,) stated to the *Societé de Biologie*, that many cases of paraplegia had followed unilateral injuries of the brain. He exhibited to the society dogs whose brains had been cauterized. Besides the usual symptoms there was a notable diminution of the muscular sense in the limbs, and there was paralysis of the posterior limb particularly on the side that had been cauterized. The question arose in the society whether the phenomena were essentially propagative of inflammation to the cord or by nervous influence merely.

Unipolar Irritation of Nerves. M. A. Chaveau (*Gazette Hebdomadaire, Nov. 12th*, 1875,) speaks of experiments in the unipolar electric irritation of nerves. His studies were made especially on the motor nerves of the face, the effects being noted by the tracings caused by the muscular contraction; sensory nerves were also studied. He concludes that with a certain strength of current both poles have the same effect; that below a certain strength of current the negative pole has the greater effect; below the standard of strength, the effects are reversed, the positive being more powerful, and the difference increases up to a certain point with the increase of the strength of the current.

NOTICES OF BOOKS.

Paralysis from Brain Disease.—By H. Charlton Bastian, M. D. &c.—D. Appleton and Co., N. Y.

These lectures, as published in the *Lancet*, were read with interest, and were well appreciated by those who give attention to diseases of the nervous system. The work does not so much profess to add to our knowledge of the subject, as to arrange the results of the studies of many observers; in a word, to give in a compact form what is known on the subject, and in greater detail as well as with more precision than has been attempted hitherto.

Among the more important sections of the work are those that relate to the cerebral circulation; the temperature variations; the alterations in nutrition in the paralyzed limbs and regional diagnosis. Under this latter head he gives the differential diagnosis of diseases of the Pons Varolii in its central parts, in the lower half of its lateral region; and in the upper half of its lateral region, in the crus cerebri, its upper and outer part, its lower and inner part; in the Thalamus, in the lateral ventricle, in the cerebral hemisphere and in the cerebellum.

All these points are well discussed; and that it is now possible to discuss them, shows the progress that has been made in neuro-pathology.

In the treatment of paralysis from brain disease, Dr. Bastian is less satisfactory. The condition is not usually an inviting one therapeutically; but in some cases more can be done than Dr. Bastian would imply. His remarks on the electrical treatment are partly untrue; on this subject he seems to have copied the errors of his predecessors. There is no danger in applying electricity in the earlier stages of hemiplegia, say the second or third week, provided the application be properly made; if improperly made there is danger at every stage. For the average physician the advice to wait is necessary, for the average physician is apt to overdo electrical treatment.

The book, on the whole, is to be most highly commended.

Mysteries of the Head and the Heart.—By J. Stanley Grimes. W. B. Keen, Cooke and Co., Chicago. 1875.

The title of this book is one not very likely to arouse the confidence of men of science; and the portions that are devoted to phrenology will hardly be popular among those who wish for definite data in the physiology of the brain.

The author of this treatise is, however, without question, a man of original genius, who has given much thought to certain departments of physiology that men of science have despised and neglected. If Mr. Grimes had received a thorough medical training, according to the

modern system, and had through other works obtained recognition as an authority in physiology, and if he had acquired the art of stating new facts in such a way as to convince sceptical scientists, he might have written a book that would have made an era. Unfortunately this book is written for the people, in a popular style, and partly for that reason it will never receive the attention among physicians that, in spite of its defects, it deserves. The book is in some of the topics it discusses exceedingly suggestive, and will be best appreciated by those who have given the most thought to these subjects.

The section on phrenology is, on the whole, the best thing we have yet seen on that subject, and it shows clearly that this department of physiology ought to be re-studied, from what may be called the clinical stand-point, and by those who are authorities in this or allied departments.

The strong point of the book is the section devoted to mesmeric trance, in the study of which the author has probably had a larger experience than any other living man. His views on the subject are, in the main, just and true, and the time will come when his experiments in this department will be appreciated. Mr. Grimes sees, as every body in the next century will see, that animal magnetism is a delusion and that the mesmeric trance is simply produced by mind acting on body. Mr. Grimes claims to have been the first to have discovered this fact, and to have anticipated Braid. The first experiments of Grimes were made in Buffalo, N. Y., 1838, and his first work on the subject was published in 1845. One of the pupils of Mr. Grimes, Dr. Darling, introduced his method of inducing the mesmeric trance into Great Britain.

The method which Mr. Grimes employs for inducing the trance, is to select a number of persons, have them stand still with closed eyes and folded hands in the attitude of prayer. His theory is that through the emotions of reverence and expectancy the subject loses his will, and acts upon the expressed suggestion of the operator. His theory we believe to be the correct one, and by it all the forms of emotional trance, including Braidism, can be explained. Mr. Grimes further claims that he anticipated Darwin by the publication in 1850, of a work entitled "Phreno-Geology," a title, by the way, enough of itself to kill any scientific book. Mr. Grimes asserts that his book was stereotyped, that five hundred copies only were published; that his publisher, James Munroe, consulted with Agassiz, who denounced the idea, declaring that no respectable naturalist, in Europe or America, held to the views of Lamarck or any modification of them. In obedience to the wishes of his friends, and fearing the vengeance of the religious portion of the community, Mr. Grimes boxed up the stereotype plates and has them now.

This is surely a note-worthy fact in history, and as such we here record it. Twenty-five years have passed, and at the present time three-

fourths of living naturalists, nearly all the younger men, are advocates of natural evolution; and in Europe, as we were told while visiting there in 1869, Agassiz had lost ground among scientific men simply because he opposed evolution.

The remarks of Mr. Grimes on the relation of accent and pauses to pulsation and respiration are exceedingly interesting; and here also he anticipated by many years the essay on the "Physiology of Versification," by Dr. Oliver Wendell Holmes. Mr. Grimes first called attention to the subject in a work published in Buffalo, in 1838. Finally we commend his work to those who have sufficient liberality to overlook the worst title ever given to a book of any scientific value, and who have thought sufficiently on these themes to enable them to discriminate between the fanciful and the true.

Der Medicinische Unterricht der Zukunft. Zur Psychophysik der Moral und des Rechtes. Zur Anthropologie der Verbrechen.—By Dr. Moritz Benedikt.

The titles of these reprints from different German journals are of interest, as showing that Dr. Benedikt has given much thought to Psychology and allied sciences. In these excellent papers he appears as a philosopher and proves himself to be a man of general scholarship. These writings are suggestive, like the purely professional writings of this author, and may be studied with advantage, even by those who feel compelled to reject his conclusions.

Ueber Multiple Pulsfühlung. Zur Physiologie und Pathologie der Pyramider. By Prof. Dr. Moritz Benedikt.

The first of these papers contains some interesting observations on variations of pulse in different arteries. He gives cases where the pulse in one artery would be strong and full, in some other artery feeble. Local causes, or diseases of the arteries and spasms may account for these phenomena. In Grave's disease, for example, the pulse in both carotid arteries is strong; in both radial arteries feeble. In one of Benedikt's patients the hand was cold and pale and no pulse could be felt on the arm while the subclavian pulse was very strong. The author states that it is his custom to study the pulse in several arteries in his patients.

Notes on the Climate of the Isles of Shoals, By. D. F. Lincoln, M. D.

In this reprint from the *Boston Medical and Surgical Journal*, Dr. Lincoln makes an interesting comparison between the climatology of the Isles of Shoals and Nantucket, the former being the colder. In both places sleep is promoted and neither place is of special service in rheumatism. Fever is relieved on the Isles of Shoals, provided the wind does not come from the land. At Nantucket, the relief is less decided, probably, we may suggest, on account of the greater warmth of the climate.

Lectures on Diseases of the Nervous System. By Jerome K. Bauduy, M. D. J. B. Lippincott, & Co., 1875.

These lectures contain an amount of information in regard to some of the diseases of the nervous system far greater than is possessed by the majority even of recent medical graduates, and this information is given in a very lively, interesting style that will attract the reader, as it no doubt interested those who listened to the lectures as they were delivered.

This work has been almost savagely criticised, mainly because it is so incomplete. It seems to us that these criticisms have been over-severe. The work is not, and does not, as we understand, profess to be a systematic exhaustive treatise on diseases of the nervous system; but rather so much as the author was able and willing to give to a class of medical students. When we consider what the ordinary medical student is, how little he knows of medicine or indeed of any subject, and how poorly capable he is of appreciating first-class work of any kind, we surely cannot expect that lectures designed for them will be of a very high standard. There are thousands of practitioners, young and old, who, would find much that is new to them in these lectures; the specialist ought to know all they contain, and a great deal more, that future editions of the work should contain. There are a number of mistakes in the book, positive blunders, as well as omissions, of which we cannot here speak in detail. The statement, on page 259, that drunkenness is on the increase, corresponds with the popular impression, but is, nevertheless, quite erroneous. Chronic alcoholism is increasing, and for the same reason that nervous diseases in general are increasing; but there probably never was a time in the history of civilization when, in proportion to the population there was so little intemperance as now. The work is especially deficient in therapeutics; both in electrical and in general treatment the author's experience would appear to have been deficient. We observe that he makes the common mistake (started, we believe, by Dr. Garratt, or Jerome Kidder) of confounding the *primary* with the galvanic current. We would suggest to Dr. Bauduy that before publishing a new edition of this work, he familiarize himself with the French and German literature of nervous diseases, and then, with a larger practical experience and his clear and vivid manner of telling what he knows, he could make a first class-book.

Der Elektrische Palmospasmus.—By Dr. Vater, Ritter v. Artens. In this monograph Dr. Vater describes a spasm of the muscle of the hand that in certain pathological states follows the opening of the anode, or after the removal of the electrodes of the faradic current. This pathological state may exist a number of weeks. In some cases palmospasm follows galvano-faradization, but not the use of either current alone. Electric palmospasm is found in progressive muscular atrophy.

Ueber einen wenig bekannter spinalen Symptomen complex.—By Dr. Erb, of Heidelberg. In this paper symptoms are described that appear to indicate lateral sclerosis, more or less complicated.

Ueber spinallähmung bei Erwachsenen.—By Dr. Erb, of Heidelberg. This reprint from the *Archiv für Psychiatrie* is a valuable contribution to the subject of special paralysis in adults, now exciting considerable attention. Dr. Erb here goes over the literature of the subject and relates a number of cases.

Die Anwendung der Elektrizität bei Behandlung der Geisteskrankheiten.—By Dr. Ullersperger, München, 1875. Dr. Ullersperger here gives an imperfect resumé of what has been done for the treatment of diseases of the mind by electricity. The author's treatment of the subject is hardly philosophical, but as a collection of cases and facts and suggestions it is of value, and will, on the whole, encourage those who are studying this branch of medicine.

Electricity as used in Parturition. Post-Partum Hemorrhage and Resuscitation of new-born infants.—By A. Murray, M. D.

This reprint from the *Psychological Journal* is a contribution of great value to the subjects of which it treats. Dr. Murray has employed faradization in 104 cases of labor, five of which are here reported. He believes with Tripier (see article in present number of Archives) that faradization has advantage in some cases over ergot. Dr. Murray states that faradization has, in his hands, terminated labor in six, eight, or ten minutes in a number of cases, and usually in twenty-two minutes. The longest time occupied was fifty-six minutes. In only four cases were the results negative.

Dr. Murray has treated five cases of post-partum hemorrhage by faradization. His method is to introduce an electrode he has devised for this purpose into the cavity of the womb, connecting it with the positive pole, and apply the other over the abdomen. He begins with a moderate current, then increases and reduces the current very slowy.

Dr. Murray has used electricity in twenty-nine cases of suspended animation in new-born infants; in twenty-three of these cases he succeeded; in five of them the usual means had failed. Faradization of the phrenic nerve he avoids, as is proper to do; he lost one case by carelessness in other respects. It is difficult to faradize the phrenic nerve without also faradizing the pneumogastric, and thus stopping, perhaps, the feebly acting heart. In adults, also, there is danger in this direction, as we have elsewhere insisted. Dr. Murray makes his application over the stomach and cardiac region, and uses mild currents. This monograph should be widely read.

LIST OF AUTHORS AND SUBJECTS, IN VOLS. I. & II.

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