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ELECTRO-PHYSIOLOGY:

A

Scientific, Popular, and Practical Treatise

ON THE

PREVENTION, CAUSES, AND CURE

OF DISEASE;

OR,

ELECTRICITY AS A CURATIVE AGENT,

SUPPORTED BY THEORY AND FACT.

BY

DR. GERSHOM HUFF.

Embellished with Numerous Illustrations.

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Physiol.

Introduction.

The author has been induced to publish the following pages not only from a sense of public duty, but at the pressing solicitations of numerous friends and others, whose benevolence and philanthropy are particularly directed to the rising generation.

Many of them, having been sufferers by the painful maladies, the physiology, pathology, and cure of which it has been the object of the author of these pages to investigate and point out, have, by their advice and encouragement, urged him onward in the performance of a task from which, under less auspicious influences, he might possibly have shrunk.

Prevention is at all times better than cure ; but when a possibility no longer exists of securing the former, the best substitute is the most rational and scientific mode of obtaining the latter, which can only be founded on a thorough knowledge of anatomy, physiology, and therapeutics, so far as they are connected with the derangements of the system under treatment.

The intention of this work has failed in its fulfilment if both of the above advantages have not been secured.

The salutary lessons of history teach us, if we would profit by them, that the ratio of disease is proportioned to the increase of wealth and its concomitant, luxury; but, like Dr. Franklin's "Poor Richard," in this respect, we hear a good sermon, acknowledge its truthfulness, and act—in direct opposition to its precepts.

With the stuffs and tinsels of the Old World, we import its follies and its vices; the simplicity of republican manners is becoming daily less visible amongst us; our habits of life, our equipages, our houses, seek rather to vie with those of Europe than to look back, for an example, to the stern simplicity which distinguished the sages of the Revolution.

American in our political feelings, in the freedom of our civil and religious institutions, we are, too often, not ashamed to become the servile imitators of the Eastern hemisphere in our fashionable and domestic follies. Our children, under the influences of fashionable example and a reckless disregard of the means to insure a vigorous constitution, arrive at maturity in youth, and experience its pains and penalties in advance of its assigned arrival.

To these causes may be attributed in no trifling degree those diseases which, having their origin in a deranged state of the functions of the nervous system, are rapidly increasing amongst us; the painful heritage of many among the present generation, the sure inheritance of the future. Among these, Scrofula in its insidious approach and ever-changing forms, Madness, Hypochondriasis, Delirium Tremens and others, the offspring of vice and the foster-children of neglected moral and physical education, are not the least appalling.

In connection with the above list, which may be termed *hereditary*, with the solitary exception of Delirium Tremens, are Neuralgia, Epilepsy, Paralysis, softenings of the brain, hip-joint disease, softening of the larger bones, contracted muscles, distorted spines; a fraction of the Protean forms of nervous disease.

Whilst the author's attention for some years has been devoted to the study and cure of nervous diseases generally, during which time he has omitted no means of information, either by direct observation or otherwise, as to their origin and symptoms, it has been specially directed to the treatment of Neuralgia, Paralysis, and Distortions of the Spine.

The method of cure in these diseases pursued by the author of this work is simple, but not the less effectual. For the *means* employed, he claims no originality; but in their adaptation, in the concentration of power to a specific purpose, he claims an indisputable priority.

It is to these he attributes a success far exceeding his sanguine expectations in eradicating and alleviating the painful symptoms which are never-failing attendants on nervous disease, and the restoration of many to the enjoyment of health and happiness, whose cases, upon a primary investigation, afforded no prospect of relief. With these few remarks, he consigns his work to the public, not less anxious for the benefits it may confer on suffering humanity than for the patronage it may obtain.

New-York, December, 1852.

Contents.

CHAPTER I.

Of the Bones.

CHAPTER II.

Muscles.

CHAPTER III.

Muscles Continued.

CHAPTER IV.

Muscles continued—Their Hygiene.

CHAPTER V.

Muscles continued—Their Hygiene.

CHAPTER VI.

Of the Nervous System.

CHAPTER VII.

Nervous System Continued.

CHAPTER X.

Spinal Nerves.

CHAPTER XI.

The Nervous System—Its Hygiene.

CHAPTER XIV.

CHAPTER XV.

CHAPTER XVI.

CHAPTER XVII.

Influence of Alcohol on the Human System.

CHAPTER XVIII.

Effects of Tobacco on the Human System.

CHAPTER XIX.

Influence of Mind over Matter, in the Production and Cure of Disease.

CHAPTER XX.

Mineral and Vegetable Poisons, and their Antidotes.

CHAPTER XXI.

PRELIMINARY REMARKS.

THE prolongation of human life, the mitigation of the diseases, physical deformities, and sufferings to which man is exposed on his journey from the cradle to the grave, are subjects of the highest earthly importance. They concern not only the philanthropist, the statesman, and the philosopher, but also come directly home to every individual, whatever may be his station in life.

It is a well-known fact, that, comparatively speaking, very few persons die of old age, or from the gradual wearing out of their animal bodies. The great mass of mankind are prematurely cut off. Why is it that so large a portion of the human family descend prematurely into their graves? We answer, it is because they violate the laws which the God of nature has, in His wisdom, established for their physical well-being; because the things which are necessary for developing and maintaining the integrity of their animal bodies are left undone, and the things which are destructive to that integrity are done.

In the following pages we propose to unfold and explain some of the most important laws of our animal nature, in a manner intelligible to non-professional readers. We must however commence with an outline of our anatomical structure.

The human body consists, 1st, of a bony frame-work, the *skeleton;* 2d, of *ligaments*, or white, fibrous bands, which unite the bones together, forming articulations or joints; 3d, of *muscles*, or red fleshy bundles arranged in layers outside of the bones for the purpose of producing motion by their alternate contraction and relaxation; 4th, of *nerves*, or whitish cords extending from the brain and spinal marrow to the muscles and external skin, through which the mind derives a knowledge of substances in contact with the body, and through which also the will operates upon the muscles; 5th, of *bloodvessels*, or elastic pipes through which the blood is conveyed to and returned from the different parts of the body, for the purpose of nourishing and promoting the growth of the tissues; 6th, the organs of respiration, consisting of the lungs, the trachea or wind pipe, and the larynx; 7th, the organs of digestion, which embrace the œsophagus or gullet, the stomach, intestines, liver, spleen, pancreas, and absorbents; 8th, the genito-urinary apparatus; 9th, the nervous centres, including the brain, the spinal marrow, and the ganglia of the sympathetic nerve; 10th, cellular and fatty tissue, by which the different parts of the body are united together, so as to constitute a beautiful whole; and 11th, the skin, which envelopes the body like a garment, and is moulded, as it were, round all its parts. This general statement of the organs composing the human body is sufficiently minute for our present purpose.

CHAPTER I.

Of the Bones.

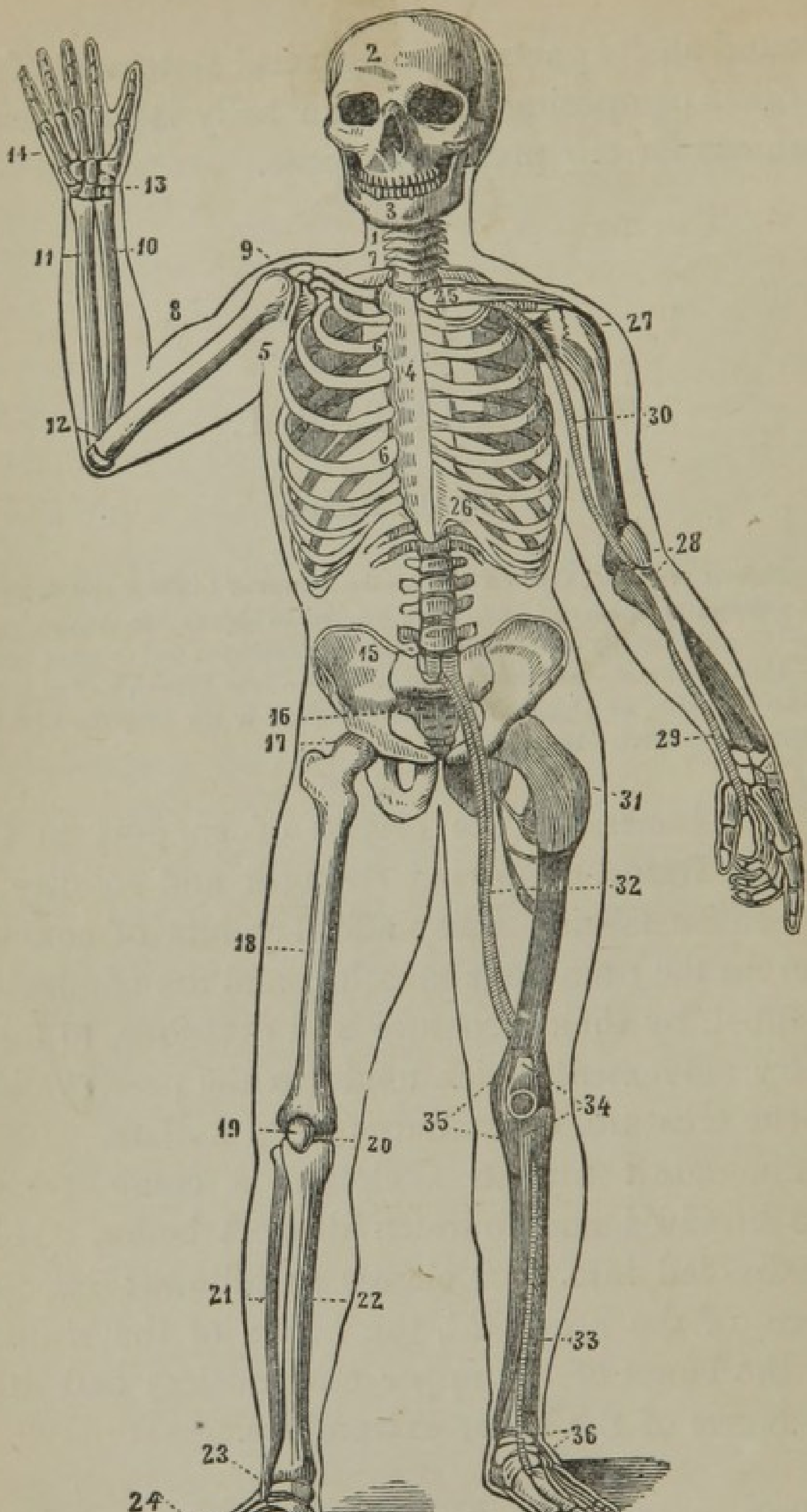
Description of Spinal Column—Unites the Nerves of Intellect and Sensation —Injuries of Spine and Brain more frequent in Mature Age than in Youth —Cause—Elasticity of the Spinal Column—Misshapen and Crooked Spines —How produced—Sternum, or Breast Bone—True Ribs—Floating Ribs— The Humerus, or Upper Arm—How attached to the Scapula, or Blade Bone—The Pelvis—Description of.

The bones are the organs of support to the animal frame, supplying strength and solidity to the entire fabric. They afford points of connection to the numerous muscles, and are admirably adapted, by their structure and divisions, to fulfil every movement which tends to the preservation of the creature, or conduces to its welfare.

The adult human skeleton is composed of two hundred and fourteen distinct bones, which are divided into four classes as follows: 1st, the bones of the head; 2d, the bones of the trunk; 3d, the bones of the upper extremities; and 4th, the bones of the lower extremities.

The following plate presents a front view of the human skeleton:

Fig. 1.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I. 1. The *spinal column*, (24 bones.)

2. The *skull.*

3. The *lower jaw.*

4. The *sternum*, or breast bone.

5. The *ribs*, (12 on each side.)

6, 6. The *cartilages*, or gristle by which the ribs are united to the sternum.

7. The *clavicle*, or collar bone.

8. The *humerus*, or upper arm.

9. The *shoulder joint.*

10. The *radius*, or outside bone of the lower arm.

11. The *ulna*, or inside bone of the lower arm.

12. The *elbow joint.*

13. The *carpus*, or wrist, (composed of eight distinct bones, arranged in two rows.)

14. The *hand.*

15. The *haunch bone.*

16. The lower part of the spine, (named the *sacrum.*)

17. The *hip joint.*

18. The *femur*, or thigh bone.

19. The *patella*, or knee pan.

20. The *knee joint.*

21. The *fibula*, or small bone of the leg.

22. The *tibia*, or large bone of the leg.

23. The *ankle joint.*

24. The *foot.*

25 and 26. The *ligaments*, or white cords connecting the ribs with the breast bone and with each other.

27, 28, 29. *Ligaments* of the shoulder, elbow, and wrist.

31. *Ligaments* of the hip joint.

34. *Ligaments* of the patella, knee and ankle.

35 and 36, as above.

The spinal column, (I. 1,) more intimately connected with the objects embraced in these pages than other portions of the skeleton, is in man a vertical, elastic pillar, descending from the outer base of the skull to the lower part of the back. It is composed of twenty-four bones, which have been termed *vertebræ,* or turning bones, (from *verto*, to turn,) having the power to move, by means of intervening cartilages between each, almost in any direction.

This movable column performs several distinct offices in the system; it forms the great bond of union between the bones of the skull and those of the upper and lower extremities, while at the same time, by means of the spinal cord or marrow, contained in its lengthened canal, it unites the nerves of the brain (of intellect and sensation) with those more particularly the agents in the production of muscular motion and sensation in the trunk and extremities, proceeding immediately from the nervous matter lodged within the spine.

The adaptation of means to the end is in no part of the human system more perfectly displayed, than in the construction of the spinal column: each bone is so formed as to be capable of an independent movement, while the whole number, locked within each other, yet each one moving as upon a pivot, are braced, held together, and supported by two strong ligaments (posterior and anterior) passing along their whole length vertically, assisted by six others in a lateral direction, giving strength and mobility to enable them to assume the various attitudes and movements of the body; and elasticity, by the cartilages interposed between each bone, to guard the tender organ contained in the canal within them, as well as the brain, against concussion. Injuries of the spine and brain, from falls or blows, are much more frequent in mature age than in youth. In early life the cartilages placed between each spinal bone easily yield to the force of a fall or blow, and in shortening the column, at the same time diffuse the effects of the concussion before they reach the brain; in more advanced life the cartilages dry and harden, the spine becomes a fixed, not a flexible, pillar, and the effect of falls proceeds along the cord directly to the brain.

The elasticity of the spinal column, and its lateral and vertical pliancy, favor the action of the various muscles with which it is protected and moved; and scarcely any thing is, unfortunately, more common than to see a misshapen and crooked spine, produced by the predominance of action given to a certain set of muscles, to the prejudice of the rest, in the assumption of those awkward attitudes which are too often neglected in early life.

Attached to the spinal column, posteriorly, are the twelve ribs, seven of which, named true ribs, have also an attachment to the sternum or breast bone; the remaining five have no anterior attachment save by cartilages to each other, and to the last of the true ribs; they are called floating ribs. (No. 5, fig. 1.) At the upper portion of the sternum or breast bone, the clavicle or collar bone is situated, which extends around the lower portion of the neck, and is inserted into the movable bone immediately behind, and forming the shoulder joint, termed the scapula or blade bone.

In a socket formed in the latter, is the ball or head of the upper arm, furnished with a double movement, the one arising from its joint, the other from the flexibility of the scapula, which moves in obedience to its muscles, at the posterior part of the chest. Whenever it is necessary to move the upper arm in a particular direction, (as rotatory,) the muscles attached to the scapula contract, and it is held as in a wedge, while the head of the upper arm bone plays in every direction in its socket.

The humerus or upper arm, attached by its ball or head into the socket of the scapula or blade bone above described, is a long bone, receiving at its lower extremity the two bones of the lower or fore arm, the radius and ulna: the former, being the larger and outer bone, articulates with the bones which form the wrist joints; the latter, the inner and smaller, forms a perfect hinge-like joint on the inner and upper part of the fore arm, by which it is enabled to rotate itself on the former.

At the lower portion of the spine is situated the pelvis or basin, composed of four bones, the innominatum or nameless bones, and the sacrum and coccyx, the lowest portions of the spinal column. The sides of the pelvis are formed of the haunch bones, (No. 15, fig. 1,) at the base of which are sockets that receive the heads or balls of the thigh bones, (No. 18, fig. 1,) to the extremities of which are attached the lower bones of the leg, tibia (No. 22, fig. 1) and fibula, (No. 21, fig. 1,) the former being the larger of the two.

With this limited anatomical description of the principal bones forming the human skeleton—the passive agents of locomotion—we shall proceed, in the following chapter, to describe the muscles by which they are set in motion and propelled in every direction.

CHAPTER II.

Muscles.

Symmetry of Form dependent on Muscular Development—Five Hundred and Twenty-seven Muscles—Various Kinds of Muscle—How shaped—Attachment between the Tendons and Bones—Muscles formed in Layers—Voluntary and Involuntary Muscles—Front View of the Muscles—Description—Rupture of the Achilles Tendon in Dancing—Difficulty of Reunion.

THE symmetry of the form, its strength and power, will be proportioned to the perfection of the muscular development; nor can the natural laws which regulate the latter be broken, except at the sacrifice of proportional beauty and the certain derangement of physical constitution.

Five hundred and twenty-seven of these motor agents, embracing all the lean, fleshy portions of the body, enter in the human formation, existing in various forms, taking directions the most opposite, yet wisely and beautifully adapted to the specific purposes for which they are destined.

They are found in one place directly longitudinal, terminating at one end in a white, fibrous cord, termed a tendon, by which they are attached to the bones upon which they exert their lever power.

In some parts of the system they radiate like a fan, their attachments to the bones being spread over a wide space; some are shaped like the half circle of a sun, with their fibres radiating to a tendon on one side; others like a quill, with a strong central tendon, to which the fibres radiate on either side.

So firm is the attachment between the tendons and the bones to which they are united, that fractures will take place in the latter while their union with the former remains undisturbed.

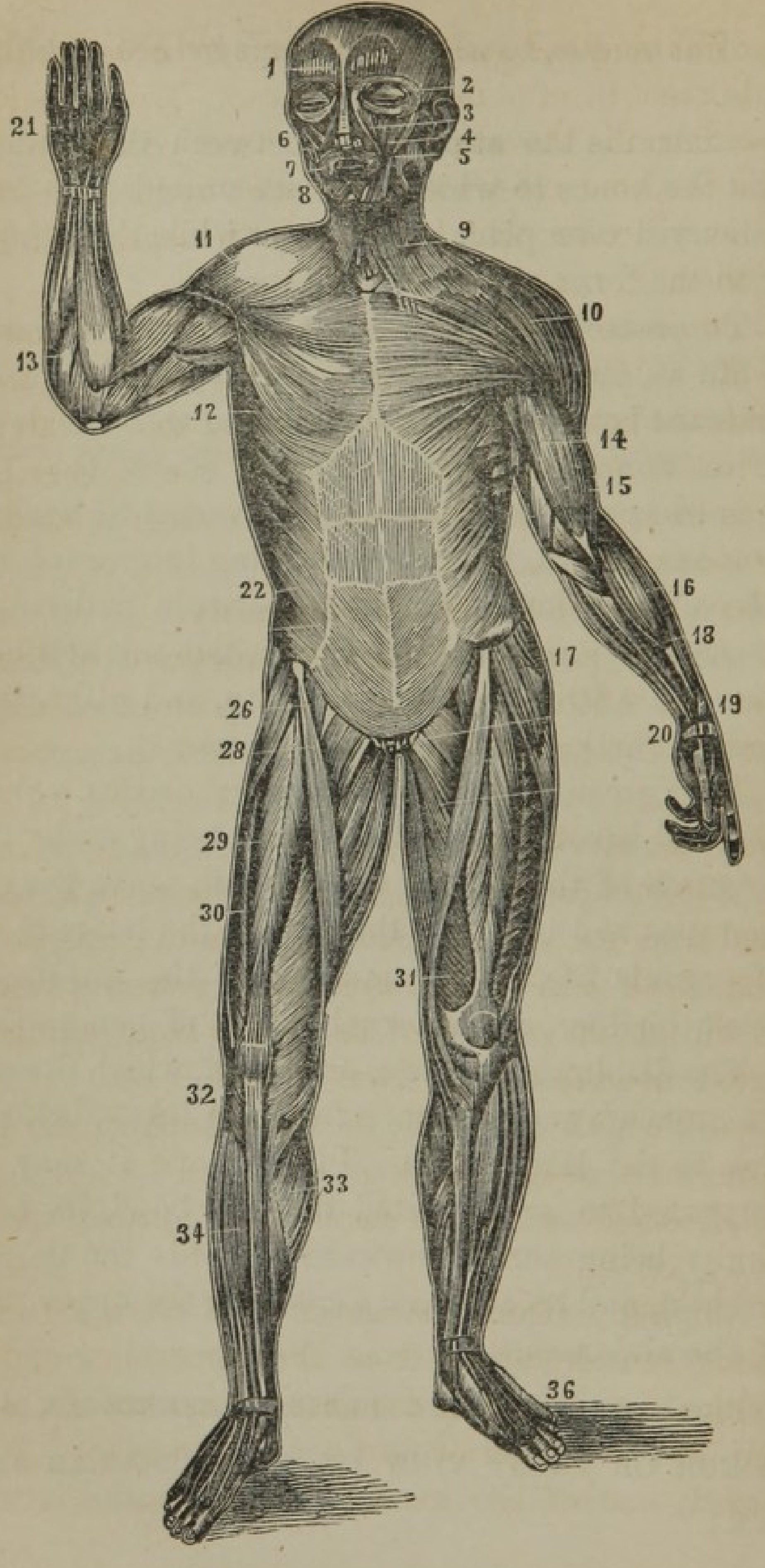
To protect the muscles in their numerous ramifications, and preserve them unimpaired by that constant action which, commencing with the dawn of existence, terminates only in death, they are formed in separate layers, and invested by a membranous sheath, fatty matter being interposed between each layer, at times between individual muscles, to prevent the friction, which might otherwise cause irritation, inflammation, and ultimately diseased action in the moving powers.

They are divided into two general classes, voluntary and involuntary; the former being under the direction of the will, as those which move the extremities and trunk of the body; the latter those of organic life, as the muscles of the intestines, heart, bladder, and internal organs of generation.

The diaphragm muscle, or midriff, which divides the stomach and abdomen from the lungs, belongs also to the latter class. In its shape it may be compared to an inverted dish or bowl, its convexity being turned upward towards the thorax or chest, and its concavity covering the upper part of the abdomen.

THE ACCOMPANYING PLATE PRESENTS AN ANTERIOR OR FRONT VIEW OF THE MUSCULAR SYSTEM:

Fig. 2.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1. *The forehead swell of the Occipito Frontinalis*, or back and front muscle of the head. This muscle arises from the lowest bone of the head, posteriorly, and is inserted by tendons into the upper edge of the bony socket which contains the eyes. (See side view, No. 1.)

2. *Orbicularis Palpebrarum*, or muscles surrounding the orbits of the eyelids. This muscle surrounds the bony socket of the eye and the eyelids: it arises from the internal angle of the forehead, and is inserted into the eyelid by a short tendon. (See side view No. 2.)

Use—To close the eye involuntarily.

3. *Levator Labii Superioris*, or elevator of the upper lip, arises from the lower portion of the socket of the eye, and is inserted into the upper lip.

Use—To elevate the upper lip.

4. *Zygomaticus Major*, or large yoke muscle, so named from its position near the yoke-like process of the cheek bone, (from *zygoma*, a yoke,) arises from the above process of the cheek bone, and is inserted into the angle of the mouth.

Use—To pull the angle of the mouth upward and outward, as in laughing.

5. *Zygomaticus Minor*, small yoke muscle, frequently wanting.

6. *Masseter*, (from *massaomai*, to chew,) the chewing muscle, arises from the upper jaw and the yoke-like process of the cheek bone, and is inserted into the posterior part of the lower jaw. It is broad, one of the most powerful among the

muscles, and is inserted by many tendons or cords at its terminations.

Use—To draw the upper and lower jaws forcibly together, bruising and grinding the food between them. (See side view No. 3.)

7. *Orbicularis Oris*, or round muscle of the mouth, completely surrounds the mouth, having neither origin nor insertion, excepting a slender fibrous attachment to the lower part of the nose.

Use—To produce a complete closure of the mouth.

8. *Depressor Labii Inferioris*, or depressor of the under lip, arises from the anterior portion of the lower jaw, and is inserted into muscle No. 7 of the lower lip.

Use—To draw the lip outward and downward.

9. *Platisma Myoides*, spreading or plate muscle, arises from the external portion of the upper arm near the shoulder joint and the collar bone near its union with that of the breast, and running up and covering the side of the neck, is inserted into the angle of the mouth and side of the chin.

Use—To draw the chin and side of the face towards the shoulder. This muscle, at times, becomes permanently contracted, the side of the head lies on the shoulder, and the face looks half upward.

10. *Deltoid*, or triangular muscle, (from *Delta*, the Greek letter,) forms the external convexity of the upper arm; it arises from the outer part of the collar bone, the whole elevation or spine of the blade bone, and is inserted by tendons into the

middle and outward portion of the upper arm. (See side view No. 6.)

Use.—It is the great elevator of the upper arm; by means of its numerous tendons, it carries the arm backward and forward so as to range within a considerable segment of a circle.

11. *Pectoralis Major*, or large breast muscle, arises from two thirds of the collar bone nearest its junction with that of the breast, one half of the latter, and from the cartilages of the first seven or true ribs, and is inserted by a broad tendon into the middle and interior part of the upper arm.

Use—To draw the arm toward the breast and aid in raising the shoulder; to assist also in expanding the chest, by drawing the breast bone and ribs upward and outward. This muscle exerts a powerful influence in the animal economy. (See side view.)

12. *Latissimus Dorsi*, or broadest back muscle, arises from nearly the whole length of the spine, and is inserted into the ridge of the upper arm bone.

Use—To bring the arm to the side.

14. *Biceps Flexor Cubiti*, or two-headed contracting muscle of the arm, arises by one head, from the superior edge of the collar bone near the shoulder joint, and by the second, from the socket of the shoulder joint; it is inserted into the radius or outward bone of the lower arm. (See side view No. 9.)

Use—To bend the lower arm at the elbow joint.

15. *Triceps*, or three-headed muscle, arises by two heads, from the upper and posterior part of the upper arm, and by a third from the inferior border of the blade bone; it is inserted into the middle of the inner bone of the fore arm, near the elbow joint.

Use—To extend the lower arm.

16. *Supinator Radii Longus*, or long muscle of the outer bone of the lower arm, arises from below the middle of the upper arm, and is inserted into the lowest part of the outward lower arm bone near the wrist.

Use—To extend the lower arm and open the hand and fingers.

18. *Flexor Carpi Radialis Longior*, or long bending muscle of the wrist and fore arm, arises from the lower and inner part of the upper arm, and is inserted into the first long bone in the palm of the hand, which joins the index or first finger.

Use—To assist with other muscles in bending the wrist and fingers.

19. *Flexor Communis Digitorum*, or common extender of the fingers, arises from the upper end of the inner fore arm bone, and is inserted into the second bones of the fingers.

Use—To bend the fingers.

20. *Annular Ligament.* A ligamentous band at the wrist joint, which surrounds all the tendons of the lower arm, and holds them in a proper position.

21. *Palmar Fascia*, or fascia of the hand. A tendinous expansion on the palm of the hand in

all directions, imparting to its numerous bones protection and flexibility.

22. *Obliquus Externus Abdominis*, or external oblique muscle of the abdomen, arises from the external surface of the eight lower ribs, and is inserted into the haunch bone and the anterior bones at the lower portion of the abdomen.

Use—To bend the body and draw the ribs outward.

26. *Psoas Magnus*, (from *psoai*, the loins,) the large muscle of the loins, arises from the last of the back and four upper loin vertebræ, or bones of the spine; uniting with the flank muscle, the tendon arising from the union is inserted into the interior and upper protuberance of the thigh bone.

Use—To bend the lower limbs of the body at the hip joints.

27. *Adductor Longus*, (from *adducere*, to draw to,) the long, drawing muscle of the thigh, arises by a round tendon from the front bone of the pelvis or bony basin at the lower end of the spine, and is inserted about the middle and inner portion of the thigh bone.

Use—To bend the thigh towards the pelvis, and to rotate the limb outwards.

28. *Sartorius*, or tailor's muscle, (from *sartus*, a tailor,) arises from the upper and outward portion of the haunch bone, crosses the upper third of the thigh obliquely, and is inserted into the large bone (tibia) of the fore leg, at its inner and upper part.

Use—To draw the leg upon the thigh and the latter on the haunch bone, at the same time carrying the leg across to the opposite side, giving rise to the cross-legged position of tailors—hence its name.

29. *Rectus Femoris*, or straight muscle of the thigh, arises from the haunch bone, and is inserted into the upper border of the knee pan.

Use—To draw one leg over the other.

30. *Vastus Externus*, or outward large muscle, arises from the outward ridge of the knee pan, and is inserted into the upper extremity of the thigh bone.

Use—To extend the leg upon the thigh.

31. *Vastus Internus*, or internal large muscle, arises from the outward edge of the knee pan, and is inserted into the thigh bone.

Use—Nearly the same as that of its fellow.

32. *Tendon* of the knee pan.

33. *Gastrocnemius*, (from two Greek words signifying belly and leg,) or muscle composing the calf of the leg, arises by tendons from the two prominences at the lower end of the thigh bone, (the inner tendon being the longest,) which, uniting together, form the calf of the leg. It is inserted by means of the Achilles tendon (sometimes torn asunder in dancing) to the hinder part of the heel.

Use—To lift the heel and raise the body. (See side view No. 14.)

34. *Tibialis Anticus*, outward muscle of the outward fore leg bone, arises from the upper two thirds of that bone, and is inserted into the instep bone attached to the bones forming the great toe.

Use—To draw the foot inwards when necessary, and to extend it when walking. (See side view No. 17.)

36. *Tendons of the long muscle* of the lower leg bones. This muscle arises from the head of the large and upper three fourths of the small bone of the fore leg. It passes through the annular ring (20), and is inserted into the second and third bone of the great toe nearest the heel.

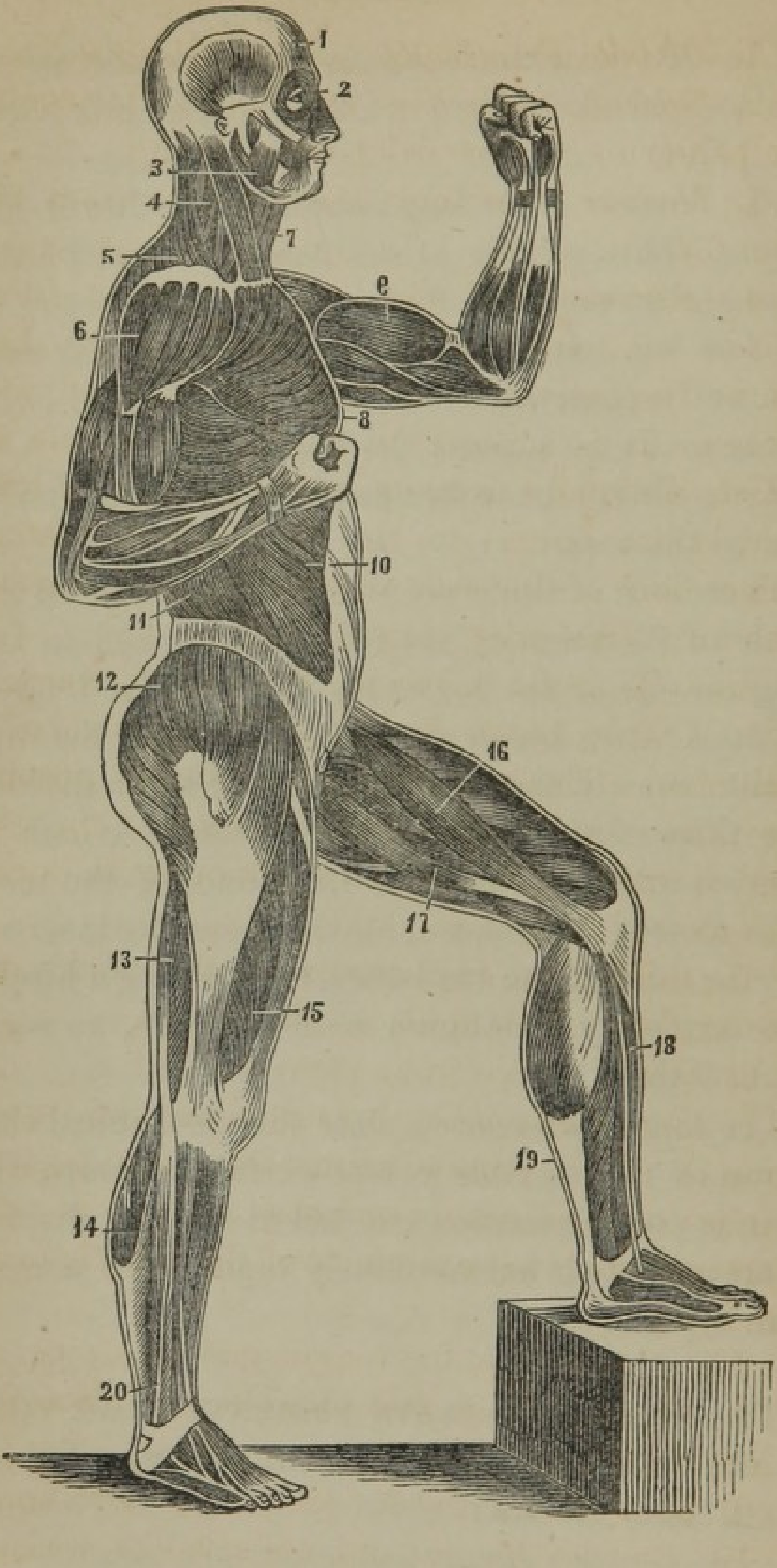
Use—To bend the foot at the ankle joint, and to extend the toes.

There is a striking peculiarity observable in the mode of insertion of the tendons attached to the long muscle of the lower leg bones. The tendon expands into a broad muscular sheet over the first of the bones of the toes. This sheet again divides into three slips, the middle division of which is inserted into the second of the bones of the toes, while the two lateral, or side divisions, are inserted into the third of the toe bones, thus giving a hinge-like flexibility, combined with strength, to each joint of the toes.

The longer we contemplate the mechanical execution of this flexible yet powerful structure, the more is our admiration excited at the vast display of means acting harmoniously together to accomplish a perfect end.

THE FOLLOWING PLATE PRESENTS A SIDE VIEW OF SOME OF THE MORE IMPORTANT MUSCLES IN THE HUMAN FRAME:

FIG. 3.



1. *Occipito Frontinalis.* (See front view No. 1.)

2. *Orbicular Muscle of the Eyelids*, (orbicularis palpebrarum.) (See front view No. 2.)

3. *Masseter* (chewing) *Muscle.* (See front view No. 6.)

4. *Sternum and Collar Bone Muscle*, (sterno cleido mastoideus.) This muscle, as its Latin name implies, arises from the breast and collar bones. It is a powerful and broad muscle, and passes obliquely from its double origin (the breast and collar bones) to the occipital or posterior lower bone of the head, where it is inserted behind the ear. (See back view No. 6.)

Use—To assist in bowing the head forward.

5. *Levator Anguli Scapulæ*, (lifting muscle of the scapulæ.) This muscle arises from the posterior portions of the four upper vertebræ of the neck, and is inserted into the scapula or blade bone at the root of its spine.

Use.—Its name explains its use, that of elevating the angle of the scapula or blade bone.

6. *Deltoid.* (See front view No. 10.)

7. *Sterno Hyoideus*, breast bone and tongue muscle. This muscle arises from the posterior surface of the sternum or breast bone at its upper part and the inner extremity of the clavicle or collar bone.

Use—To depress the tongue and windpipe.

8. *Great Pectoral, Pectoralis Major.* (See front view No. 11.)

9. *Biceps Flexor Cubiti.* (See front view No. 13.)

10. *Serratus Magnus*, or large saw-like muscle of

the trunk. This muscle arises from the last two vertebræ of the neck and the two upper dorsal or back vertebræ immediately below the former; it is inserted into the posterior surfaces of the second, third, fourth, and fifth ribs.

Use—To draw the ribs upward and expand the chest.

11. *Great Dorsal*, or back muscle. *Latissimus Dorsi.*

12. *Gluteii*, or buttock muscle. (See back view Nos. 27 and 28.)

13. *Biceps Flexor Cruris*, or double-headed muscle of the leg. This muscle arises from a tuberosity in the ischium or front bone of the basin or pelvis, at the lower end of the spine, and is inserted into the head of the tibia or large bone of the leg (shin bone). It forms the outer ham string.

Use—To evert the leg when partly bent.

14. *Gastrocnemius.* (See front view No. 33.)

15. *Rectus*, straight muscle of the thigh. This muscle arises by tendons from the anterior and lower spine of the haunch bone. It is inserted by a broad tendon into the patella or knee pan, of which it may be said to form a part.

Use.—By being attached to the haunch bone of the pelvis, and inserted into the knee pan, (the inferior ligament of which is fixed in the tibia or large bone of the leg,) the "rectus" serves to balance the trunk on the lower extremities.

16. *Triceps Extensor Cruris*, or three-headed muscle of the leg. This muscle, having three divisions, surrounds the whole posterior part of the

"femur" or thigh bone, with the exception of a rough line, termed the linea aspera. All its divisions arise from the inner and outer borders of the patella or knee pan, and are inserted into the upper end of the thigh bone on its posterior surface.

Use—To extend the leg upon the thigh, and gain great increase of power by its attachment to the knee pan, which acts as a fulcrum. It steadies the thigh bone upon the leg.

17. *Tibialis Anticus,* or muscle of the large bone of the leg, arises from the upper two thirds of the tibia, and is inserted into the "cuneiform" or wedge-like bones of the heel and one of the bones of the great toe. (See front view No. 34.)

Use—To flex the foot and preserve it flat while walking.

18. *Soleus* (sole) *Muscle.* This muscle arises from the upper portion of the fibula or small bone of the leg, and from the middle third of the tibia or large bone of the leg. Its fibres join the tendo Achillis, by which it is inserted into the heel. It forms a portion of that muscular development termed the calf of the leg.

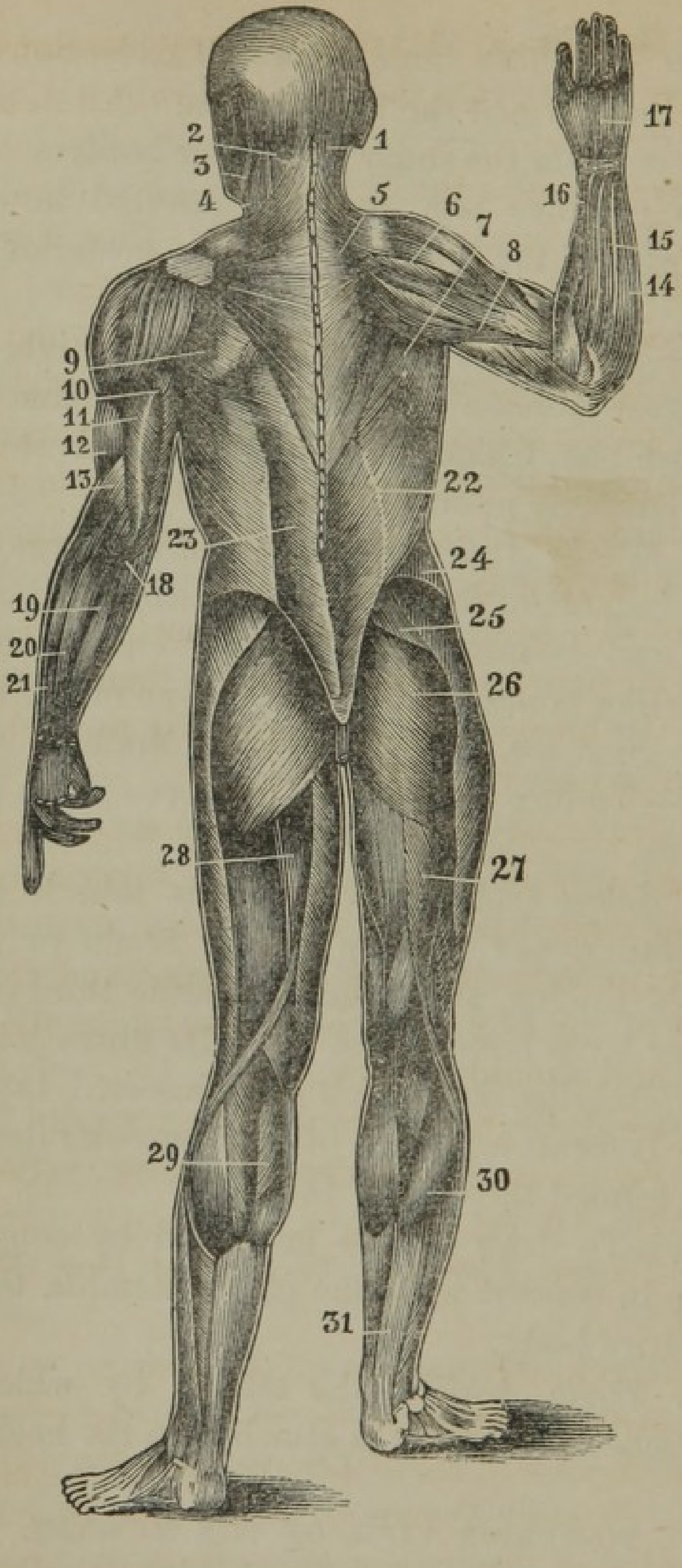
Use—To draw up the heel, and by continued action in concert with the gastrocnemius, to raise the entire body.

19. *Tendo Achillis*, the tendon by which the gastrocnemius muscle is attached to the heel.

POSTERIOR VIFW OF THE MUSCLES.

(ON THE FOLLOWING PAGE.)

FIG. 4.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1. *Complexus.* Muscle of many attachments.

Use—To elevate the head and chin.

2. *Splenius.*

Use—To raise the eyebrow.

3. *The Masseter*, see 6, fig. 2. (See side view No. 4.)

4. *Sterno Cleido Mastoideus*, or breast and collar bone muscle, arises from the breast and collar bone, passes obliquely backward and upward, and is inserted into the temporal bone behind the ear, and into the lower and back bone of the head. (See side view No. 4.)

Use—To bend the head forwards. The collar bone portion, acting more forcibly than that arising from the breast bone, gives stability to the head in carrying heavy weights.

5. *Trapezius*, (from *trapezium*, a triangle,) or triangular muscle, arises from the superior portion of the lower back bone of the head, from the last lower spinous joint of the neck, and from all those of the back, and is inserted into the collar bone and shoulder blade.

Use—To draw the shoulder backward.

6. Back view of the deltoid muscle. (See front view No. 10, fig. 2.)

7. *Triceps Extensor.* (See front view No. 15, fig. 2.)

8. Tendinous portion of the above.

9. Anterior edge of.

10. *Supinator Radii Longus.* (See No. 16, fig. 2.)

11. *Extensor Communis Digitorum*, or common extender of the fingers, arises from the lower part

of the upper arm, at its external protuberance, and divides at the wrist into four tendons, which are inserted into the four fingers.

Use—To open the fingers. It is the antagonistic muscle to the flexor communis digitorum. (No. 17, fig. 2.)

12. *Extensor Ossis Metacarpi Pollicis*, or extending muscle of the wrist and fingers, arises from the middle of the inner fore-arm bone, and is inserted into the long bone which extends from the wrist to the thumb.

Use—To extend the wrist and thumb.

13. *Tendons* of No. 17.

14. *The insertion of the Triceps*, or three-headed muscle. (See No. 15, fig. 1.)

15. *Extensor Carpi Ulnaris,* or extending muscle of the ulna and wrist, arises from the lower external protuberance of the upper arm and two thirds of the inner bone of the lower arm. It is inserted into the long bone which extends from the wrist to the little finger.

Use—To extend the wrist and little finger.

16. *Extensor Communis Digitorum.* (See No. 17.)

17. *Latissimus Dorsi.* (See No. 12, fig. 2.)

18. *Tendinous origin* of the above.

19. *Obliquus Externus.* (See No. 12, fig. 2.)

20. *Gluteus Medius*, or middle hip muscle, arises from the outer ridge of the haunch bone, four fifths of its length, and is inserted into the outer protuberance of the thigh bone near the hip joint.

Use—To rotate the thigh outward.

21. *Gluteus Maximus*, or large hip muscle, arises

from the ridge of the haunch bone and the lowest portion of the spine, and is inserted into the outward lower protuberance of the thigh bone; its broad tendons cover the outer portion of the thigh.

Use—To turn the thigh outward, and assist in carrying the leg forward. The above two muscles, with some others, form the posterior region.

22. *Biceps Flexor Cruris*, or two-headed contracting muscle of the leg, arises by two heads, one from a prominence in the ischium, (the bone on which we sit,) the other from the upper and outer portion of the thigh bone; uniting, the muscle is inserted by a tendon, at the head of the smaller bone of the leg. This muscle forms the outer ham string.

Use—To evert the leg when partially contracted.

23. *Semi Tendinosus*, or half tendinous muscle, has a similar origin to the first described head of the biceps, and is inserted into the inner and upper part of the large bone of the leg.

Use—To bend the leg at the knee joint.

24, 25. *Gastrocnemius.* (See No. 33, fig. 2.)

26. *Tendo Achillis*, or Achilles tendon, is the continuous tendon of the above large muscle, and is inserted into the hind part of the heel. It is the most powerful tendon of the leg, will lift not only the heel but the whole body. It is at times ruptured in violent athletic exercises and in dancing. Reunion is rarely if ever accomplished,

and the muscular power of that portion of the leg is destroyed.

The eighty-two muscles delineated in the above views of a portion of the muscular system, will enable us to enter more clearly on the physiology and pathology of these great moving powers; some of which, as the flexors, bend the body and extremities in every direction; others, as the extensors, stretch out to their utmost limits the bones to which they are attached; while a third set, the supinators, maintain the muscular equilibrium of the machine in its most natural and easy position.

CHAPTER III.

Muscles Continued.

Importance of the Muscular System—The Vital Stream dependent upon its Contractions—The Arts would perish if Animal Organization were deprived of Muscularity—Muscular Tissue—Muscles of Organic Life—Of Animal Life—The latter termed Striped Muscles—Difference between the Muscles of Animal and Organic Life—Shortening of Muscle when it contracts—Animal Heat generated by Muscular Contraction—Sound produced by the Contraction of a Muscle—The Power of Muscles to contract dependent upon Two Influences—Influence of the Nerves on Muscular Contractility—The Great Importance of Muscular Agency—The best Singer, or Elocutionist—Necessity of Using the Vocal Muscles—Essential Characteristic of Muscular Fibres—Voluntary Muscles dependent for their Action upon the Nerves of the Brain—Involuntary Mnscles supplied with Nerves from the Spinal Marrow—Voluntary Muscles dependent for their Contractility upon the Mind—Graceful Movement arises from a well-balanced Connection—The Ravels—Ole Bull—Jenny Lind—Madame Sontag—In the Exercise of the Voluntary Muscles the Rapidity of their Contractions has Scarcely a Maximum—The Hare—Carrier Pigeon—Race Horse—Uniformity between the Muscular and Nervous Systems essential to the Perfection and Endurance of Power—A sound and regular Muscular Contraction necessary to Digestion—Few, if any, Muscular Actions are Single—All Muscular Tissue retains its Power of Contractility for a short time after Death—Antoine Le Blanc, the Murderer of the Sayre Family, at Morristown—A Convict executed at Glasgow.

So important is the muscular system to the human frame, that no function of animal life can be performed without its aid.

The vital stream could not pursue its serpentine course to the utmost limits of the system, and again return to its source, in opposition to the acknowledged laws of gravitation, without muscular contraction. Were the muscles which draw the ribs upwards and outwards, thereby giving expansion to the chest, deprived of their power, the animal would perish from suffocation. In vain would the agriculturist essay to till his land, the sportsman attempt to pursue his game, the boatman to propel his boat, the woodman to clear the trees of the forest, if deprived of the lever power produced by muscular contractions. The arts would perish, the material world become a wilderness, and chaos again return, were it possible to deprive living, animal organization of its muscular power.

All muscular tissue consists of an assemblage of minute fibres. The muscles of organic life differ essentially from those of animal life, in respect to the appearance and arrangement of these minute fibres. Those of *organic life*, or the *unstriped muscles*, as they are also called, consist of little fibres, which, in their most perfect state, are flat, from 1-4700 to 1-3100 of an inch broad, very clear, granular, and brittle. Such fibres of organic muscle constitute the contractile coat of the lower half of the œsophagus or gullet, of the stomach and intestines, of the urinary and gall bladders, of the trachea or windpipe, and the pregnant uterus.

The *muscles* of *animal life*, or *striped muscles*, embrace all the muscles whose movements are subject to the will, together with the heart, the upper part of the gullet, and the pharynx. These muscles are composed of fleshy bundles, encased in coverings of fibro-cellular tissue, by which each is connected with, and isolated from, those adjacent to it. Each bundle is again divided into smaller ones, similarly ensheathed and similarly divisible, and so on through an uncertain gradation, till, just beyond the reach of the unaided eye, we arrive at the *primitive fasciculi*, or *ultimate muscular fibres*, as they are called. They present a striped appearance when seen through the microscope, and have a diameter of from 1-200 to 1-500 of an inch. Each ultimate fibre in turn consists of little cylindriform filaments about 1-1800 of an inch in diameter, called ultimate or primitive fibrils. It is upon these ultimate fibrils that muscular contractility depends.

The principal difference between the muscles of animal and organic life is therefore two-fold: 1st, with regard to structure, the fibres of the former are arranged in *bundles,* while those of the latter are not; and 2d, with regard to appearance, the ultimate fibres of the former are *striped*, while those of the latter present a uniform color.

When a muscle contracts, a simple, uniform, simultaneous and steady shortening of each fibre composing it takes place. What each ultimate fibre or fibril loses in length it gains in thickness: the contraction is a change of form, not of size, and is not attended with diminution of bulk from condensation of the tissue. This has been proved by causing a mass of muscles to contract in a vessel full of water, with which a fine perpendicular graduated tube communicates. Any increase or diminution of the size of the contracting muscles should affect the level of the water in the tube; but the level is found to be the same whether the muscle be contracted or not.

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Again we notice that, when muscles firmly contract, they appear to swell up and become rounder, more prominent, and harder than previously. This muscular hardness accompanying firm contractions is not produced by any condensation or increased solidity of the muscular tissue, but it is mainly due to the increased tension of each of the primitive fibres, a tension proportionate to the mechanical resistance to be overcome by the contraction.

When no resistance is offered, as when the tendon of a muscle is cut off, we do not perceive any increase of hardness during contraction; but, on the contrary, the muscular tissue seems to be even softer, more extensile, and less elastic than in its uncontracted state.

Another important property of muscular tissue is that animal heat is generated by the contraction of muscles. Becquerel and Breschet, two eminent physiologists, found that about 1° of heat was produced by each forcible contraction of the biceps muscle of a man's arm, and that the temperature of the muscle increased 2° when the actions were continued for some time.

Sound is also produced when muscles contract forcibly; and the loudness of it is directly dependent upon the force and quickness of the contraction and the number of fibres that act together or simultaneously. Any person can readily illustrate this fact by placing the tip of the little finger in the ear, and then making the muscle of the thumb contract rapidly, when a low shaking or rumbling sound will be heard. In this case the sound produced by the muscular contraction is conducted through the substance of the hand and finger to the organ of hearing.

The power of the muscles to contract is closely dependent upon two different influences: 1st, the influence of the blood; 2d, that of the nerves. Stenson first pointed out that muscles lose their power of motion if the current of arterial blood to them be cut off by the application of ligatures to the arteries, and this fact has been fully confirmed by others. It is therefore certain that the arterial blood undergoes in the muscles some change, which, while it gives the blood the venous character, renders it unfit to maintain in the muscles their contractile property; or, in other words, that the property of contractility requires for its perfect preservation the constant action of arterial blood upon the muscular fibre.

2. *Influence of the Nerves upon Muscular Contractility.*—The nerves are not only the organs through which the will operates upon the muscles to produce contractions and relaxations at the pleasure of the sentient being, but they also exert an important influence upon the *power* of the muscular contractions. Of two individuals possessing precisely similar muscular developments, the one may excel the other in feats of strength, on account of a difference in the constitution of their nervous systems.

The great importance of muscular agency is not only visible in the processes of locomotion, as in walking, running, leaping, or dancing, but in imparting force and expression to song, and power and splendor to oratory.

He will be the best singer or elocutionist, the audible perceptions of tune and time being equal, who frequently calls into action the muscular powers of the vocal muscles, those of the larynx and chest. It is not while sitting in an easy-chair that the force and expression necessary to form the master-spirits of oratory and song can ever be acquired: the vocalist, like the ploughman, must labor—he must sow the seeds if he expects to reap the harvest. Nature has supplied him with the necessary material: if, like an unskilful architect, he neglects to mould it into the proper form, the consequences are not to be charged to the account of nature, but to the wanton perversion of her gifts.

The essential characteristic of the muscular fibre is its power of contractility, that is, of shortening, so as to approximate its extremes towards each other, by a thickening or swelling in the centre. Thus the muscle which arises from the upper arm, and is inserted into the outward bone of the fore arm, (No. 14, fig. 2, the biceps,) swells in its centre in obedience to volition and nervous stimulus, and the hand is raised by the contraction, through a curved line, towards the shoulder.

A corresponding principle directs all the muscular contractile movements.

It has been stated that the muscles are divided into two classes, voluntary and involuntary, or the muscles of animal and organic life; the former being those of the trunk and limbs, dependent for their action on the nervous stimulus arising from the nerves of the brain, the latter on the influence of the nerves of the spinal marrow. Among the latter are the muscles of the heart, bladder, and intestines.

The distinction is more fanciful than real. The voluntary muscles frequently act in opposition to the will, as in excessive fits of passion, where the will has no power to restrain the violent contortions of the trunk and limbs; or, if the brain suffers material injury, the action of the involuntary muscles—those of circulation, digestion, and respiration—is suspended, if not destroyed.

Appropriate stimulus to the voluntary or involuntary muscles produces contractility; its absence, relaxation.

The voluntary muscles are doubtless dependent for most of their movements upon the mind. The more intimate and well-balanced the connection, the more beautiful and perfect will be the display of the former, as may be seen in the graceful movements of a Celeste, the astonishing gymnastic feats of the Ravels, the inimitable musical execution of Ole Bull, and the never-equalled song of Jenny Lind or Sontag.

No specific duration can be assigned for the contractility of a muscle; in some cases, it is the inverse ratio of its force. Thus in those energetic contractions where a concentration of great muscular force is required, as in raising heavy weights, pulling up the fibrous roots of trees, exerting powerful force on an extended lever to raise a ponderous body, relaxation will be more immediate than in cases in which a lesser expenditure of force is necessary.

In the exercise of the voluntary muscles, the rapidity of their contractions has scarcely a maximum. In this attribute of muscularity, man is far inferior to some of the animal creation.

What an immense number, what a countless variety, of muscular contractions are requisite to enable the timid hare to distance her pursuers, the carrier-pigeon to fly over hundreds of miles in a few hours, and the race-horse to gallop a mile per minute!

The muscular system, in reference to its strength and power, varies in individuals of a corresponding size; the nervous system, of which we shall hereafter treat, exerting considerable influence in relation to these elements.

Uniformity between the muscular and nervous systems is essential to a combination of perfection and endurance of power in the former. A muscular development inferior to the nervous distribution may, for a short period, produce great results, but the exhaustion of power will be rapid.

Where the muscular greatly exceeds the nervous development, activity will be feeble, but strength more enduring. Persons thus constituted are fitted for continuous slow labor rather than for feats of activity and strength combined.

Where strength, protection, and flexibility are most required, the muscular system is correspondingly developed, as in the spine to which we have already alluded, the first developed portion of the bony skeleton in man; the centre from which all the other parts are produced; in its earlier formation a mere cartilaginous cylinder surrounding and giving protection to the primary nervous developments, but in more advanced years a slightly curved movable pillar, protected, strengthened, and flexed by a fleshy wall composed of six muscular layers.

A portion of the muscles arising in this region, as the external oblique and some others, are common to the abdomen; their contraction assists in expelling the residuum of digestion from the bowels, bile from the gall bladder, the contents of the stomach when vomiting, mucus from the windpipe, and all irritating matter, in coughing or sneezing, from the nasal passages.

A sound and regular contraction and relaxation of the abdominal muscles, including the diaphragm or midriff, (a muscle separating the stomach from the lungs,) by promoting in a mechanical way the passage of the bile into the duodenum or lower stomach, are essentials to a healthy digestion.

Few, if any, muscular actions are single. It is by their combination that the most simple movements are performed. Thus, in lifting the hand to the head, the contracting muscles of the arm, wrist, and fingers, act in concert. And in walking, to a common observer so easy a process, nearly all the muscles of the system are called into action.

All muscular tissue retains its power of contractility for a short time after death, if stimulus be applied, provided the nervous connection has not been dissevered by a fracture of the spinal column or any other important part.

Thus, in applying the galvanic battery to executed criminals, the moment opposing points of particular nerves are touched by the galvanic fluid, the corresponding muscles are thrown into a state of the most violent contraction, and the lifeless body exhibits muscular action exceeding in its seeming power that which was one of the attributes of life. A few years since, we saw the dead form of Antoine Le Blanc, the murderer of the Sayre family at Morristown, New-Jersey, after his just execution, submitted to the action of the galvanic pile. The moment distant nerves were subjected to its influence, as those of the head, trunk, and lower extremities, the executed criminal rose from his recumbent position, and with the blood gushing from the incisions made to lay open the nerves, apparently stared wildly on the multitude who were witnessing this display of science. The arms moved violently to and fro, the eyelids opened and shut, the breast heaved convulsively, a horrid smile at times played on the grim features of death, the legs contracted and extended with great force. This artificial existence, if such it may be called, so nearly resembled the reality, that the populace, ignorantly supposing vitality might be actually renewed, and the murderer again walk forth at midnight to imbrue his hands in the blood of the aged, and send into unconscious death the sleep of youth, insisted in a voice not to be mistaken that the process should be no longer continued; and the ghastly and mutilated remains of the culprit were committed to the silent earth.

A similar result was obtained by a corresponding experiment on the dead body of a convict executed at Glasgow, in Scotland.

The neck of the criminal, just below the lower bone of the head, was opened half an hour subsequent to his execution, when one of the connecting wires from a galvanic battery was applied to the phrenic nerve (nerve of the diaphragm) near its origin in the medulla oblongata or oblong brain, at the top of the spinal column, and a second to the cartilage of the seventh rib.

Full and laborious breathing was directly produced; the chest heaved and fell; the action of the diaphragm, or midriff, forced out the abdomen, which receded as the muscle relaxed. The motion was continued uninterruptedly during the whole time the galvanic fluid was applied.

With the remarks in the preceding chapters on the structure and functions of the muscles, we proceed in the next to consider their hygiene, or the means necessary to secure and perpetuate their healthful condition.

CHAPTER IV.

Muscles continued—Their Hygiene.

Daring and Superhuman Feats of Activity--Appalling Scenes produced by the Freaks of Fashion—Belgian Giant—Chinese Porters--Turkish Carriers--The Functions of Organic Life—There is not a Solitary Function, &c.—Practice makes Perfect--Mental and Physical Powers connected—Pinel—Aristocratic Grandees of Spain in its Insane Institutions—Organic Power and Action--The Gastrocnemius Muscle—The Boatman—The Clerk—The Copper or Blacksmith—Baneful Effects of Muscular Inactivity--Sedentary, inactive Individuals become fat--Supposed to betoken Health—Supposition erroneous—How the Fat is produced—The Muscles of such Persons—A Limit in the Full Attainment of Growth and Power in a Muscle—Amount of Exercise necessary to insure vigorous Muscular Contractility varies in different Individuals—The Effects of Over-exertion on the Animal Creation--The Horse--Irish Emigrants--Alcoholic Liquors--Beautiful Uniformity between the Laws of the Animate and Inanimate Worlds--Necessity of obeying the former, Absolute—The wild Enthusiasts of Hindostan—More familiar Examples in our Seminaries of Learning--Teachers in Public and Private Schools—Ward Schools progressing in Physical Education—Yet Infants in the Elementary Knowledge--Scale graduating Seats and Desks—Mr. Paton—Fixed Position of the Muscles in Children--The System which prevails in our Schools—Physical Education—Greatest Luminaries of Intellect—Restlessness of Children—The Seats or Benches in Schools—If a stooping Attitude be Maintained--By a similar Attitude the Seamstress, &c.—The Treble Curvature.

THE daring and almost superhuman feats of activity and strength daily exhibited to public gaze teach us, in language perfectly intelligible to all classes of society, how much additional power may be imparted to the human family, individually and collectively, by a proper physical training of these powerful vital levers. Nor are we less forcibly warned by the appalling scenes produced by the wanton and heartless freaks of fashion and the perversion of natural laws, in the distorted spines, the contracted joints, and the compressed chests, how much suffering may be entailed on successive generations by a neglect of muscular physical training; a visiting of the sins of the fathers upon the children unto the third and fourth generations!

If the Belgian giant could stand under and support a weight of *two tons;* if the Chinese, proverbially a weak people, can transport on their backs for many miles the enormous weight of six or eight hundred pounds; if the Turks can carry their silks and teas, by a similar process, hundreds of miles; what strength might not the muscles attain, what infinitely higher objects might they not accomplish, under a thorough and progressive discipline!*

* In travelling through the Republic of Mexico, some years since, we were much astonished at the strength, perseverance, and elasticity of muscle exhibited by the natives.

A small race in stature, they travelled, burdened with packs of merchandise or produce, weighing two hundred pounds and upwards, from city to city, in less time than the same goods could have been transported on the backs of pack-mules. They would thus travel for hundreds of miles.

By taking *la vereda*, as they are called, (by-paths,) they were enabled to accomplish a specific distance as quickly, and with as much ease, as we could travel it on our steeds. In ascending and descending the mountains, they would gain upon us.

In the manner above stated, they convey goods from Tampico to the city of Mexico, a distance of six hundred miles. At sea-ports, every imported commodity is conveyed to a place of deposit by the natives. We were much amused at seeing, for

The functions of organic life are, in no inferior degree, dependent on muscular contractility, while the latter, strengthened by its own exertions, derives support and existence from the functional perfection of the organs to which it imparts power. The muscles of the heart and chest are increased in their contractions by exercise, and the vital stream flows through the system with increased rapidity, the chest expands to its most ample dimensions, the lungs become freely dilated, the blood is more fully oxygenized, and, circulating freely among the muscles to which it is originally indebted for this increased vitality, gives additional vigor to the moving agents in this great system of animal mechanics.

There is not a solitary function in the animal economy which muscular exercise does not promote, and inaction intercept or destroy. It was by a figure of speech which took a part for the whole, that the decree was pronounced which compelled humanity to earn its bread by the sweat of its brow; in other words, by muscular exertion. This decree, issued by the fiat of Omnipotence, is a practical blessing rather than a curse. He that

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the first time, a native trotting away from a vessel with a bale of cotton upon his shoulder.

In travelling through the Indian territory, we have also seen squaws carry packs of three hundred pounds upon their backs.

The Indian has more elasticity and is more fleet in walking or running than any other portion of the human race. This wonderful combination of strength and elasticity is acquired at an early age, by a rude but constant training of the muscles.

will not exercise shall not eat, is as emphatically inscribed on the physiological constitution of man as in the records of Holy Writ.

Practice makes perfect, is the simple but true exposition of a law which governs the physical equally with the moral world.*

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* During a residence in the Southern States, we became acquainted with the fact that negroes tote (an expression used among them, synonymous with carry) all light articles and packages of goods, to and from market or elsewhere, upon their heads, frequently for a distance of many miles. This is also the custom among the natives of Central America and the West Indies. In the latter country nearly all of the merchandise and produce is conveyed from one place to another in this manner. We have seen more than three hundred pounds conveyed upon the head of a negro, for many miles, to a place of deposit. Molyneux, the negro who some years since contended for the championship of the prize-fighting ring in Great Britain, with the celebrated Tom Cribb, had so exercised the deltoid, biceps, and other muscles of the upper arm, that the latter was as thick as the thigh of a middle-sized man. The force of his blow was such that, whenever he was able to get what the members of the ring term a "fair blow" at his antagonist, the latter fell, like a bullock beneath the stroke of a butcher's hammer, several yards from the spot where the blow was first struck. He was however beaten by the superior science of Cribb, perhaps with a little unfairness on the part of the friends of the latter, who could not bear to see a colored man beat their champion.

So hard was the muscular development of this man, that his antagonist invariably laid bare his knuckles whenever he dealt one of his heavy blows on any part save the body of Molyneux.

The muscles of the negro race, in the West India Islands more especially, are not originally larger or more firm than those of the white races; it is simply by training the organs they are able to accomplish such gigantic feats of strength.

Thus it was with the celebrated Monsieur Gregoire, now amongst us, who, while very young, commenced the system of

So strongly are the mental and physical powers connected, that the suspension of the former by some shock to the nervous system, at times, as in cases of insanity, can only be restored through the influence of muscular agency, strengthened by exercise.

It is a well-known medical fact that, since the period when the great and humane physiologist, Pinel, burst asunder the fetters of the maniac and restored him to light, liberty, and exercise, the recoveries from insanity have exceeded all former belief.

The aristocratic grandees in the insane institutions of Spain, whose hereditary pride forbids them to labor, which neither reason nor force can combat, rarely recover their intellectual powers; while the humble peasant, who daily and vigorously exerts his muscles in manual labor or feats of activity, is quickly restored to reason.

Organic power and action increase with the demands made upon them within a limited degree. This law, which governs the system generally, is

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training the muscles by exercise. We have seen this man; his muscular system is prodigiously developed. He can carry a weight of one thousand pounds, support himself under the pressure of seventeen hundred pounds, kill a bullock with his powerful arm, and shiver a boulder stone into atoms with his clenched fist. He can strike a blow with a force equal to nine hundred pounds. Such feats of strength, almost superhuman, would seem incredible had they not been displayed to hundreds in this city, (New-York,) whose veracity is unimpeached and unimpeachable. Gregoire has never been equalled in this country, probably not in any other, for muscular force.

particularly applicable to the muscular apparatus: when one of its levers is called into action it increases in thickness and power. The gastrocnemius muscle, (No. 33, fig. 2,) forming the calf of the leg, is always large in constant and accomplished dancers; compared with the same muscle in the sedentary student, who scarcely rises from his chair to consume his ill-digested meal, it is like the coil of a strong rope by the side of a slender twine.

In the boatman, whose constant occupation is rowing, the muscles of the back and arms are large, the chest is broad and open, the shoulders expanded, and the *tout-ensemble* presents a perfect union of strength and health. Compare this fine muscular development with that of the clerk, bending from morn till night over his desk in a curved position, or even standing behind a counter until the muscles are wearied under a constant sameness of position; observe the feeble contractile power of the spinal muscles, the unusually contracted condition of those which circumscribe the cavity of the chest, the feeble pulsations arising from the want of a proper contracting force in the arteries, the general absence of vital energy in all the systems of organic life, and no further evidence will be requisite to establish the physiological truth that activity, energy, and strength in the muscles are essential to the healthy performance of the functions of organized beings; that without these elements, called into action and supported by bodily exercise, premature and feeble old age, perhaps death, will be the inevitable consequence.

In bending the arm accustomed to great muscular exertion, as that of the copper or blacksmith, a hard muscular swelling will be felt above the elbow joint in the inner and upper arm. In the individual who takes but little exercise, the muscles composing this group will be found flaccid, inert, and feeble: the additional power and size in the former arise from the constant action of the biceps and triceps muscles, (Nos. 14 and 15, fig. 2,) and the feebleness of the latter from the repose and inaction of these muscles.

The baneful effects of muscular inactivity are observable not only in their influences on the organs of locomotion, but upon the brain, the lungs, and all the instruments of assimilative life; the great vital functions of nutrition, circulation, and absorption languish, and a tendency to disease in the form of congestion or inflammation is the result.

At times, sedentary, inactive individuals become fat, and this development of the adipose tissue is supposed by the inexperienced observer to betoken health and strength. No supposition can be more erroneous. This accumulation of fatty matter is produced mainly by a loss of the balance between the natural waste of the system and the supply in the shape of assimilated food, the individual consuming more food than his habits of life require, and the excess being deposited throughout the body in the form of fat. The muscles of such persons are soft and flaccid, and locomotion painful and oppressive.

In the full attainment of the growth and power of the muscles in mature life, there is doubtless a limit beyond which muscular strength cannot be carried; but by well-directed exercise and proper previous management, the maximum of muscular power may be retained until the decline of life.

The amount of exercise necessary to insure an energetic and vigorous muscular contractility will greatly vary in different individuals; the exertion which would give increased vigor to the strong muscular frame might, by exhaustion, weaken, if not destroy, the more feeble.

The deposition of fresh elements from increased muscular action, acting on the circulation in the former case, would in the latter be exceeded by the loss of muscular force, power, and material. This effect of over-exertion may be seen daily in the animal creation, more especially in the attenuated frame of the horse, compelled to drag weights beyond his muscular power, or driven beyond the limits of his strength. The loss of muscular development, and consequently of power, is perceptible among our agriculturists, who, with unceasing perseverance, toil from morning until night, regardless of that excessive muscular exhaustion which is rapidly undermining the vital energies and sapping the foundations of life.

From a similar cause nine tenths of the Irish emigrants, to whose labors we are indebted for our canals and railroads, die between the ages of twenty and thirty-five years. The excessive use of alcoholic liquors, too often doubly deleterious from the poisonous ingredients mingled together by our grogsellers and sold under the name of brandy or gin, frequently accelerates the fatal event.

There is a beautiful uniformity between the laws which govern the animate and inanimate worlds; the power which commanded order to rise from chaos, light from darkness, the planets to revolve in regular succession around a common centre, the seasons to succeed each other in never-failing regularity, has decreed that relaxation shall follow contractility, that rest shall succeed to exercise, as surely as that an effect shall follow a cause.

The necessity of obeying this law is absolute, to preserve the integrity of the muscular system. The mere extension of the arm is painful at a certain limit; beyond it the limb cannot be sustained in the extended position; it falls inert in opposition to the most powerful volition.

Muscular power is enfeebled by undue tension, and annihilated if the latter be persisted in.

The wild enthusiasts of Hindostan, in their blind idolatry and fervid spirit of self-sacrifice, furnish evidences of this physiological fact, revolting to reason, shocking to humanity.

In the spirit of penance for some real or imaginary crime, the arm of the enthusiastic bigot is kept for years in a perpendicular, extended position, until the muscular power of contractility is gone, and the permanently stiffened limb, the sacrifice of nature at the shrine of superstition, is presented to the weak disciples of a false but unwavering creed, as a pious sign of the triumph of enduring faith over the agonizing pangs of mortal suffering.

But more familiar examples of the sacrifice of muscular power in obedience to customs "more honored in the breach than the observance," remarkable for nothing save the pertinacity with which they are defended by the blind adherents of conventional *systems*, which have no foundation in the physiological necessities of the human frame, are to be found in our public and private seminaries of learning.

Humanity would indeed be benefited if our teachers, public and private, and the committees to whom are intrusted the regulations of our public schools, would deign to step aside from the beaten track of a former age, and, with the new lights of science and philosophy, enter the temple of Nature and listen to her unerring precepts. She would tell them that exhaustion will as assuredly follow long-continued muscular contractility as an effect a cause.

We are fully aware that, particularly in our ward schools, which are progressing in physical and mental improvement with the advancing spirit of the age, the physical part of education receives more attention than in former years, but much remains to be done. We are yet infants in the elementary knowledge of physical education.*

The following scale, graduating the height of seats and desks to the different ages of children, has been submitted to the inspection of Robert Paton, Esq., 24 Grove street. This gentleman has given much time and study to the manufacture of school furniture that may, at the same time, support the physical frame, add to the symmetry of the form, and impart ease and comfort to the pupil.

Mr. Paton fully concurs in our views in reference to the scale, which is adopted as a standard by many of our best teachers, and which we now pre-

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* Anxious in the prosecution of this work to do full justice to any improvements in physical education, particularly in the Public and Ward schools, we visited several of the latter, among them that of the 16th Ward, situated in 24th street. We cannot but record the pleasure we experienced in witnessing the general regulations of this recently erected institution of learning, and particularly the attention paid to the physical education of the pupils.

The attitudes of the children were frequently changed, by passing from one room to another to pursue their various studies, independently of the exercise allotted them in the commodious building and in the yard.

The rooms are admirably ventilated, the seats are furnished with backs, and with the desks of the proper height corresponding to figure 5.

Much credit is due to Mr. Thomas Folk, the gentlemanly superintendent, for the good order and excellent regulation in his school; and the ladylike Miss Sarah L. Miller, who has the supervision of the female department, deserves all praise for her own government and that of her assistants. She has our best thanks for her kind attention, while conducting us through the various female departments of the school.

sent to the public, in the hope that the trustees and teachers of our public schools, of all kinds, will bestow on it that attention which it merits as a powerful and necessary aid in developing the best system of physical education.

Age.		Inches high.		Inches high.
From 14 to 17,	Seat,	10	Desk,	28½
" 12 to 14,	"	15	"	27
" 10 to 12,	"	14	"	25½
" 8 to 10,	"	13	"	24
" 6 to 8,	"	12	"	22½
" 5 to 6,	"	11	"	21
" 4 to 5,	"	10	"	19½

The accompanying figure represents a pupil 13 years of age, on a seat 15 inches high, at a small desk 27 inches high. The position is graceful, perfectly easy to the pupil, and imparts the necessary support to the muscular system.

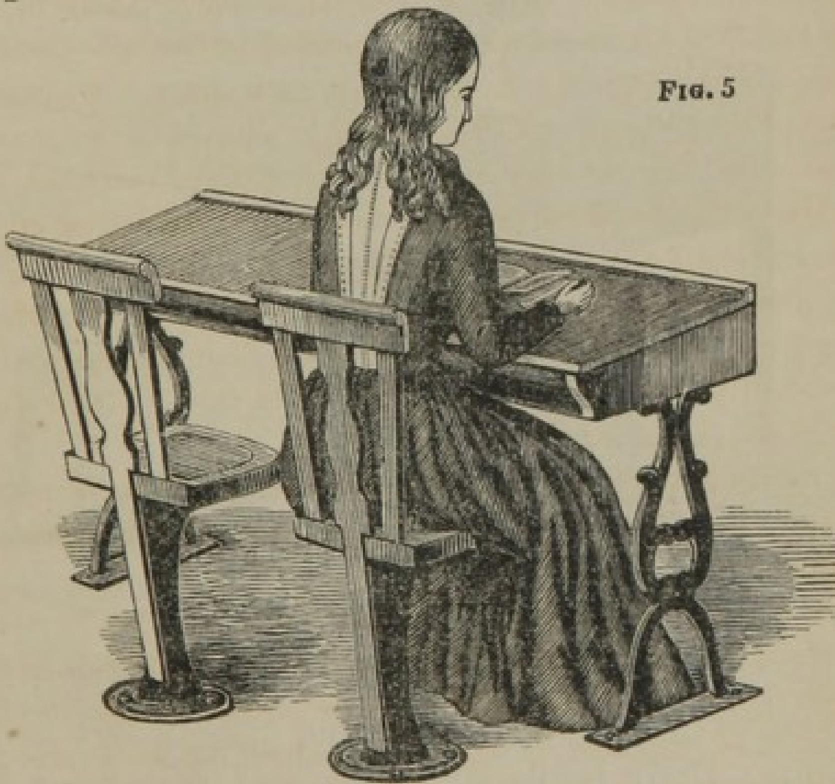
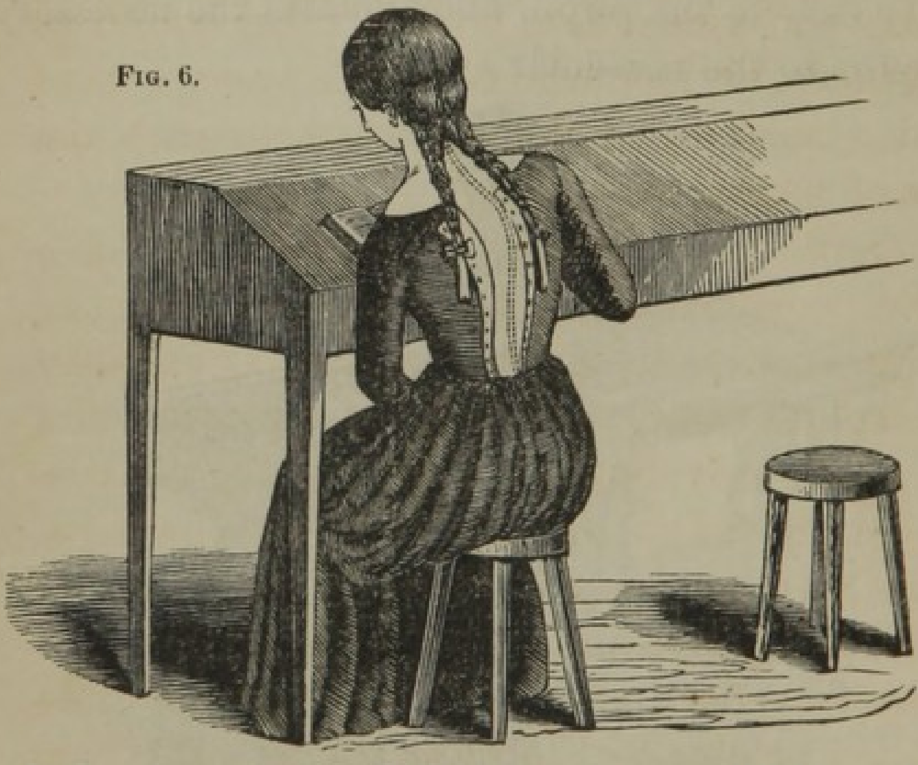


FIG. 5

As a contrast to the above combination of grace and ease, we present on the opposite page an illustration of position under the old system, which frequently has been attended with much inconvenience to the pupil, and disease combined with visible malformation to too many among the rising generation. We trust, under the influence of a well-directed physical education, based on a true philosophy and physiology, that the mechanical contrivances under the names of seats and desks, which have so long disfigured our institutions of learning, will ere long give place, under the new scientific system the elements of which we have endeavored to explain, to a more rational and healthful construction in these necessary appendages to the education of our youth.

FIG. 6.



A fixed position of the muscles in children, for any considerable length of time, cannot fail to be injurious; their bony structure and muscular developments are alike imperfect, and are readily enfeebled and injured by external causes acting upon them mechanically or by the absence of necessary external support.

The system which compels the youth, in our public or private schools, to maintain even for a solitary hour a fixed attitude, acts in direct opposition to the established laws of nature, and the advancement of physical and intellectual strength.

Physical education must form the basis upon which to erect the superstructure of intellectual power; the "*mens sana in corpore sano*" should form the solid foundation of our national system of education.

The greatest luminaries of intellectual strength, those who have shed a halo of true glory around their day and generation, both in other countries and our own, are men whose organic systems have formed a solid foundation on which to erect the temple of mental superiority.

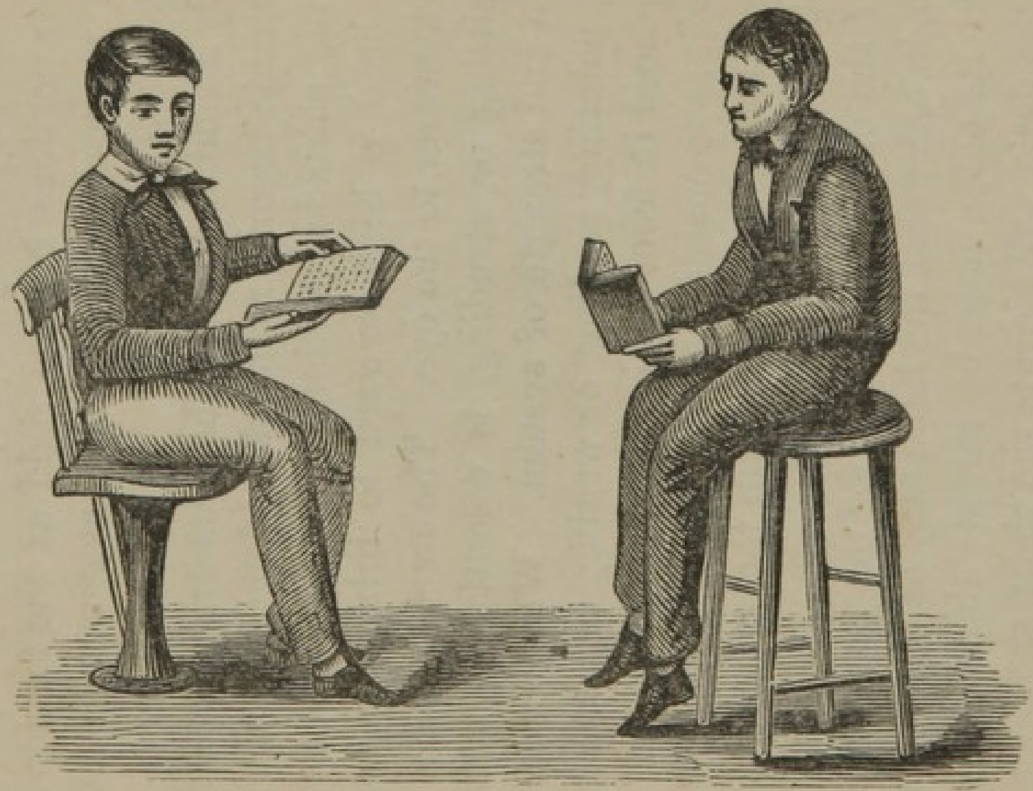
The restlessness evinced by children who have been long confined in one position, either sitting or standing, arises not only from a natural inability in the spinal muscles to support the spine and trunk of the body, but from absolute suffering arising from the effort to force muscular power beyond its limit, in obedience to the harsh dictates of established customs and a false philosophy.

A similar effect, arising from a corresponding cause, may be observed in those among our female population, who for hours unceasingly ply the needle in a sitting posture: the muscles of the back and right arm become exhausted, and rest, or change of position, which calls into action another set of muscles, can alone restore that muscular energy which has been sacrificed, too often, to the necessities of poverty and its attendants.

To the weakness of the muscles in youth, the want of frequent relaxation and more especially of proper support during the hours of juvenile scholastic study, may be ascribed distortions in the spine, hip joints and chest, which, becoming permanent, produce an incurable, lasting deformity, and an equally fatal constitutional derangement.

The seats or benches in our schools are seldom adapted to the physical requirements of the system: in seats devoid of backs, as seen in figure 7 on the following page, where the feet cannot reach the floor, the muscles of the back, too feeble to support and maintain an independent erect spinal attitude, relax; the anterior muscles of the chest contract; the neck and upper portion of the spine bend forward in a half circular direction; the proper centre of gravity is removed; the spine, posteriorly, is thrown behind it, and an injurious habit acquired which, if not corrected by the necessary mechanical relief, may ultimately produce a purmanent spinal distortion. Nor is this the only evil attending the sitting position on a seat without a back where the feet cannot reach the floor; the weight of the unsupported, dangling lower extremities, flexes the thigh bone, a curve arises in it, and we have thus a deformed spine and a bent thigh, which a little care and attention to muscular support might have prevented. Figure 7 presents a contrast to figure 8.

Fig. 8. Fig . 7.



CORRECT POSTURE. IMPERFECT POSTURE.

If a stooping attitude be maintained for any great length of time, the spine will regain with difficulty, if at all, its erect and proper position. The muscles placed immediately around each joint of this flexible bony column lose the power of contractility, especially on its posterior part; their anterior portions become rigid as the former relax, and a permanent spinal curvature is thus induced.

By a similar attitude the seamstress, student and mechanic become round-shouldered, (as the curve in the shoulder portion of the spine is termed;) the head is bent forward to bring the book or work nearer to the eye. The erect attitude, either in sitting or standing, is essential to beauty of form and strength of system. Whether in drawing, painting, reading, or writing, the desk should be placed in front of the pupil, so adapted to his height as to enable the elbow to rest easily upon it, and consequently to maintain the spine in an erect posture, as shown in fig. 5.

If the desk be too high for the pupil, the right arm, in order that the hand may be enabled to perform its office, must be raised; the elbow resting on the desk, will elevate the right shoulder above its fellow, the head and neck will be drawn on one side, and the spine will curve at the neck. It would be well if this single curvature would atone for the mechanical neglect—but the centre of spinal gravity must be maintained; an outward curve takes place in the centre of the spine, and a third in an inward direction at its lower portion, that the centre of gravity may be preserved, as represented in fig. 6.

This treble curvature, producing a lasting deformity beyond the reach of surgical art, is a minor evil compared with the consequences of which it is the sure and fatal precursor: the bony portion of the chest becomes contracted by the encroachment of its posterior column, the lungs are deprived of the necessary space for expansion, respiration is impaired; the blood is deprived of a considerable portion of its arterial vitality, (a consequence of imperfect oxygenation in the contracted lungs,) the most deplorable affections of the heart and lungs ensue, and either a miserable existence is the lot of this victim to imperfect physical education, or a premature grave.

The muscles of the chest, in every direction and on all occasions, must have free scope and play, to insure the health of the child.

CHAPTER V.

Muscles Continued—Their Hygiene.

Ribs united by Cartilages—Effects of Undue Pressure by Tight Lacing, &c. Perverted Taste—All Organic Diseases accelerated by Pressure on the Chest —A Wise Law of our Physical Condition—Muscularity essential to Animated Nature—The Colt—Severe Labor should not be imposed on Youth—The Developement of the Physical System—Skin heated by violent Muscular Exertion—Sources of Diseased Spine—Boarding Schools—Healthy Blood —Excess of Carbonic Acid Gas—Carbon the Base of Charcoal—Plants at Night—Action of Impure Air on Muscular System—Tailors, Tailoresses, Milliners, and Dress Makers—Twenty-four per cent. of Deaths caused by Impure Air—Light of the Sun—Statistics from Russia—An Impure Atmosphere when Heated—Humanity's Claims on our Public Municipal Authorities—Too much Attention cannot be paid to the Spine in Youth—Scholars, the Indolent and Weak—When the System is in a state of Exhaustion—The Muscles of the Spine under such a Condition—Strict Discipline Requisite in Physics as in Morals—Exercise properly regulated essential to Healthy Muscular Action—Laws which govern Organic Life not known in our Colleges; if known, not practised—Theological Students—Causes of Bronchitis among our Clergy—The Sculptor.

We have before stated in these pages, that the ribs are united, by means of yielding cartilages, to the sternum or breast bone. If undue pressure, either by tight lacing or in any other form, is applied to them, they readily yield; the cartilages, at times, overlap the breast bone, the cavity of the chest is contracted, the lungs become diseased from direct compression, the heart from the same cause sends forth its feeble column of venous blood to undergo a still more feeble process of aërial purification in the lungs.

How long will a perverted taste and blind adoration to a fashion founded on positive physical deformity, allure the daughters and mothers of America to follow their idol to the grave!

That tight lacing is a violation of the laws which regulate proportional beauty, needs no further proof than that produced by the contrast of fig. 9 with fig. 10, below. In the latter we have the perfect form of the chest: in the former its appearance under the compression and contraction produced by tight lacing. It is indeed true that of late years the good sense of our ladies has partially banished the fashionable hydra; but its disciples are still too numerous; youth and age yet continue to worship in the temple of their idol; health still finds her enemies, and disease and death their friends.*

FIG. 9.

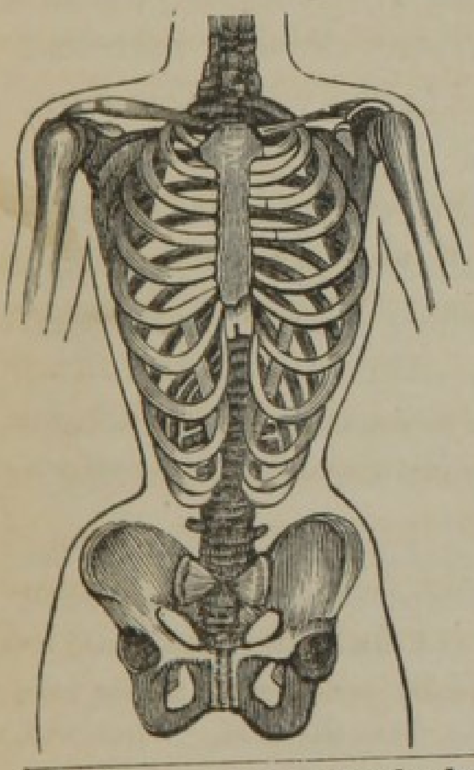
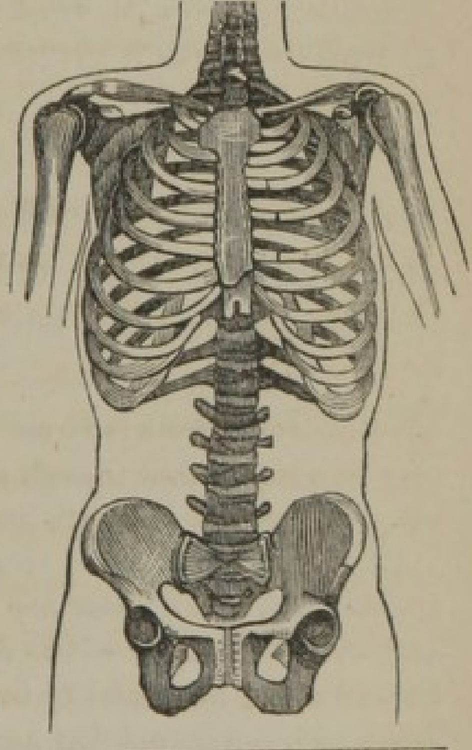


FIG. 10.



* Our pen was scarcely dry from awarding what we considered an act of justice to advancing female intelligence, when we

We know of no organic disease the progress of which may not be hastened by this unnatural compression of the chest: the liver, the lungs, the heart, are involved in its influences; digestion, secretion, and absorption are indirectly placed within its power; the nervous, the circulatory, the muscular and respiratory systems are under its immediate control. To what maladies then are they not exposed who persevere in this wanton infraction of the laws of nature?

By a wise law in our physical condition in relation to cause and effect, the means most effectual in supporting muscular and consequently constitutional energy, are those which insure the most beneficial pecuniary results. The time expended in regaining exhausted muscular force, will enable the individual, in his renovated muscularity, to accomplish a much greater amount of labor than had such repose not been granted to the wasted powers.

Throughout the whole of animated nature, maturity is essential to the full development of muscular power. The colt, taken from the pasture and compelled to labor before his muscular and

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were informed, by a lady on whose information implicit reliance may be placed, that though corsets are abandoned, their effects are still retained in youth and age.

To supply the place of these hunted-down appendages to the female form, whalebones are now introduced completely around and within the body of the dress, and the latter, when laced or hooked tight, as it usually is, is equally compressive as the corsets which public opinion has driven from the field. When will fashion succumb to the voice of reason, the dictates of nature, and the commands of God!

bony systems are strengthened by age, seldom, if ever, attains his proper degree of strength or activity. For a corresponding reason, severe labor should not be imposed on youth: the physiological principle which opposes the imposition, is the same in either case.

The development of the physical system, the growth of the bones and the muscles, the processes of digestion, circulation and respiration, rapid and constant in the young, exhaust no inconsiderable portion of vital or nervous energy.

The latter cannot, at the same time, serve two masters: if expended bountifully on the functions to which we have alluded, the necessary amount to excite vigorous or long-continued muscular activity is deficient: if the muscles be compelled to act under a feeble nervous excitement, they will become flaccid and weak, if not entirely inert.

A like effect does not follow a similar cause in maturer life; the expenditure of vital energy is not, in the latter case, required to support the growth of the system, and consequently can be applied with more impunity to the displays of muscular strength.

The muscles should not be called into sudden and violent action from a state of rest.

In complete repose, the amount of nervous fluid and arterial blood with which the muscles are supplied, is considerably diminished. As the necessary supply of each can only be increased gradually, the muscular movements to which they give rise should obey a corresponding law. The movements of the limbs after a state of rest should consequently be gradually increased.

When the skin has been heated by violent muscular exertion, and perspiration stands in drops on its surface, a current of cool air should be carefully avoided: in this case the capillaries or hair-like vessels, directly under the skin, are loaded with blood; the sudden application of cool air drives the blood away from the surface to the internal organs, producing congestion or even inflammation of important viscera. In this way pleurisy, inflammation of the lungs, rheumatism and neuralgia or tic doloreux are often produced.

An abundant supply of pure air and pure blood, the latter being chiefly dependent on the former, is essential to sustain the health and energy of the muscular system.

The sources of diseased spine may perhaps as frequently be found in a vitiated atmosphere as in the want of exercise or mechanical support.

The above remark applies especially to our boarding schools, and all places where a number of human beings, crowded together, quickly exhaust the oxygen necessary to arterialize the blood: the nutrient fluid, loaded with carbonic acid, is carried to every part of the body, in a state unfit for the nourishment and development of the tissues, and the muscles, in common with other organs, become weak and flaccid; the fleshy wall which supports the back, powerful as it is, at length succumbs; and the spine, without the means to preserve the erect posture, yields to the physical necessity, curves, and becomes a lifelong deformity.

Nature has decreed that healthy blood can alone furnish the proper stimulus to every muscle and fibre in the animal system; and as it cannot be produced except by contact with a specific quantity of oxygen in the atmosphere, through the air cells of the lungs, defect of nutrition and derangement of function must ensue where this does not exist.

We may here not inaptly allude to the deleterious consequences, the loss of muscular and vital power, produced by an excess of carbonic acid gas in inspired air. It is well known that the fumes of charcoal, if confined and breathed, will in a short time produce suffocation and death. Carbon, one of the most impure elements in the atmosphere, forms the basis of charcoal.

It is a combination of carbonic acid gas with hydrogen that forms the air-damp so fatal to those who descend wells that have been long closed up.

The gas arising from our coal fires, particularly that arising from anthracite coal, consisting principally of sulphuretted and carburetted hydrogen, is nearly as inimical to health and muscularity as that arising from charcoal; nor can those who sleep in rooms heated by this coal, more especially if it be confined within a stove, ever expect to possess that buoyant muscularity which is one of the chief elements of healthful action in the system. The same observations apply to sleeping in a room in which a number of greenhouse plants are placed. Plants at night inhale oxygen, and give out carbonic acid; no one therefore, who values health as one of the greatest earthly blessings, will sleep in a room in which plants are deposited.

The action of impure air on the muscular system and general health, may perhaps be less rapid than that of some other external agents, but it is not the less sure; insidious in its approach and progress, it passes by, too often, unheeded and unobserved, until the recuperative powers of nature are destroyed, and the pallid cheek alternated by the hectic flush, the hollow and sepulchral cough, the midnight perspiration, the rapidly attenuating frame, the fallacious but constant hope of recovery, on the verge of existence, give evidence that the constant breathing of an impure atmosphere has laid the basis of a consumption which is fast hastening its unsuspecting victim to an early grave.*

Tailors, milliners and dressmakers suffer pecu-

* During a residence of some years among the mountainous regions of the Blue Ridge, in the counties of Rappahannock, Culpepper, Madison, and Page, Virginia, we were fully impressed with the importance of pure air united to vigorous exercise on the nervous and muscular systems.

The inhabitants of those sections of our country can scarcely form an idea of nervous affections. No diseases dependent on specific affections of the nervous system are known among them. Accustomed rapidly to ascend and descend their lofty mountains, their muscular systems are well developed. Narrow, contracted chests cannot be seen among them; the shoulders are wide apart from each other, and every motion of the system indicates pure blood, strong nerves and muscles, the result of an invigorating atmosphere, and constant muscular exertion.

liarly from the effects of impure air; their work rooms frequently densely crowded in summer, and in winter kept at a high temperature by means of stoves which rapidly exhaust the oxygen of the atmosphere, leaving it highly charged with carbonic acid gas and animal effluvia, a condition totally unfit to support the function of respiration and to maintain the vital powers.

Twenty-four per cent. of all the deaths in our large cities are produced by impure air.

Among the agents for strengthening the muscular powers, the light of the sun holds a special and important station. The plant in the shade looks pale and withered and sickly, and those compelled to labor in subterranean abodes, scarcely, if ever, warmed by the rays of the sun, resemble the plant in the shade: weak and pallid, their muscular systems ill developed, have but little tenacity or power of contractility, and the whole form but too plainly evinces that nature has amply revenged herself for the neglect of her high behests.

We have alluded to the bad effects produced on individuals and society, in relation to muscular development and health, by compelling the mechanic or artisan, whether male or female, to work in subterranean abodes, where the light of the sun is scarcely ever permitted to enter, and where his beams are certainly never felt. We would add to these remarks, that the sunny side of the street is not without its influence as an antidote to, and a corrective of, disease.

In those public buildings into which the light and heat of the sun penetrate most freely, the workmen will be decidedly the most healthy.

By statistics obtained from Russia, it has been proved that in the wings of some of the barracks for the Autocrat's soldiers, into which the sun could not enter, there were three cases of sickness to one which happened on that side or wing where the rays of the sun freely entered, all other things, such as clothing, cleanliness, ventilation and diet, being equal. No other cause could in any case be found for the above disproportion, but the abstraction of the sun's rays.

This fact is well understood and appreciated in the cities of Italy. Malaria seldom attacks the houses or apartments which are freely open to the sun, while those on the opposite side during summer and autumn are not only unhealthy, but dangerous. We would again warn the employer (either manufacturer or artisan) to beware how he trifles with the health and life of those whom necessity compels to seek his employment, by compelling them to work in cellars, or indeed in any place where the beams of the sun can but partially enter to purify an atmosphere stagnant with animal effluvia; and advise the employees not to sacrifice their health and the future welfare of themselves and children, by working for employers who pay no regard, in this particular, to the physical constitutions of those whom they employ.

An impure atmosphere, particularly if heated and humid as in our inhabited cellars, the living sepulchres of poverty, frequently produces, either successively or simultaneously, not only functional but structural disease, in the liver, spleen and bowels, as well as fevers in which these organs are principally affected.

Humanity, equally with national policy and individual and collective happiness, calls aloud upon the municipal authorities of our cities to institute the most rigid scrutiny in reference to those subterranean dwellings in which poverty, in crowds, is too often compelled to seek a refuge—the forlorn hope of human suffering—disease hovering around its outposts, and death standing upon its walls. There is a physical wealth superior to that produced in the mines of California, the proper heritage of nations; pure air, industry and temperance are its handmaids, health and prosperity its offspring; it stifles the voice of avarice, stays the uplifted rod of oppression, and estimates the physical and moral strength of communities by that of their individual members.*

In closing our remarks on the hygiene of the muscles, we would again draw the attention of our readers to the advantages arising from the erect

* We are informed that a hatter in Broadway thus trifles with human life, by compelling the females employed in his department of hat trimming to work in an under cellar where they are crowded to excess, and where the atmosphere is literally charged with the elements of death.

Many of these unfortunate young females, after suffering materially in their health, are now leaving this inconsiderate, we might almost say inhuman employer; while others, it is stated, have perished from the damps and heats of his subterranean workshop.

position. In this attitude the muscles of the back are those chiefly called into action; the rest are comparatively free from contractility, consequently less power is exhausted than in any other, save a recumbent, position. Nor is this the only advantage gained by the erect attitude: the head and trunk rest upon the spinal column, and are properly balanced; the centre of gravity is neither before nor behind the bony pillar; curvature cannot take place if this position is insisted upon, as shown in figure 11.

Fig. 11.

Fig. 12.

How different would be the muscular and nervous exhaustion in the attitude described in fig. 12?

Not only are the muscles of the back and lower extremities stretched beyond their usual tone to prevent the body from falling forward, but the head, face and neck portion of the spine are thrown forward of the centre of gravity; and to form a second central point, a double curvature of the spine takes place, above and below.

Where the muscular action is limited to a single portion of the body, the expenditure of power being confined to the centre of action, much less exhaustion will ensue than when such power is distributed to many portions of the system; hence, declaiming, reading, singing or sewing may be maintained for a much longer period with the spine and head erect than in any other position.

This fact may be easily proven by attempting to hold two weights in the hands in a stooping position; the muscular exertion necessary to counterbalance the weights, and to prevent the body from falling directly forward, will quickly reduce the muscular power and cause much pain, if persevered in.

If the same weights be placed in the hands in the erect position, the muscular exertion necessary to sustain them will scarcely be realized; no exhaustion or pain will follow the muscular tension within the limits of a period far exceeding that which compelled the experimenter, in the former case, to relinquish his grasp in order to restore the exhausted muscular and nervous power.

Too much attention cannot be paid to the spine while it is flexible, in youth. If the young are permitted to sit in a bent position, either from indolence, debility, or from the badly constructed artificial supports to which we have alluded, as seats without backs, or with backs not sufficiently high, or placed too far from the floor to permit the feet to rest upon it, or any means by which the spinal column is inclined toward a bent position, round shoulders will be the certain result in after life, or some more appalling spinal deformity.

Not only does the erect posture contribute to the healthy action of the muscular and other systems of the body, but it equally conduces to the beauty and symmetry of the form. So well aware were the ancients of this physiological fact, that their Venus de Medicis, the acknowledged model of beauty in all nations, and through every successive age, is formed upon the principles we have endeavored to enforce.

Not only in hours of study but in those of relaxation, not only in the standing but in the sitting posture, should the erect attitude be enforced within certain limits.

Scholars, particularly the indolent and weak, are more or less inclined to lean forward and place the elbow or elbows on a desk or table for support. If the former require correction, the latter require kindness and attention. When sitting or standing, the erect attitude should, in them, be maintained; but the recumbent position, on a hard hair mattress and an inclined plane, should, upon the least premonition of muscular exhaustion, be immediately assumed—we say a hard hair mattress, because no facilities should be afforded by the inequalities of a softer bed, to a pressure on any particular portions of a spine too naturally inclined to curve.

Much as we have advanced as to the necessity of maintaining the erect attitude, we must repeat what has already been remarked, that change, frequent change of muscular position, is essential to the organic structure of youth. The same rule applies to mental or corporeal power. If the energies of the brain have become exhausted by intense mental application to one object, a change in the direction of such energies, that is, a diverting of the mind to some other object of a less exciting character, will gradually restore the nervous power, and destroy that feeling of complete mental prostration which is frequently the result of profound study and long-continued application.

Were it possible to maintain this fixed intellectual intensity, insanity or idiotcy would be the result. But nature has wisely fixed a limit to her physical and mental efforts, before which the puny resolves of man fall prostrate, in which human volition succumbs to a higher and better regulator of the functions over which it has but partial control.

When the system is in a state of exhaustion, either from severe muscular exertion or a continuous fixed position, the nervous power upon which the contractility of the muscles depends becomes expended, nor can the latter fulfil their functions without a fresh supply of the former.

The muscles of the spine under such a condition, numerous, diversified and powerful as they are, lose the power to maintain the head and neck in the erect attitude; nor should a child who evinces signs of fatigue arising from one of the causes to which we have above alluded, be compelled to sit or stand in the position which has produced it: a slight change in attitude will call into operation another class of muscles, and the repose which nature demands will thus be awarded to those which have been exhausted.

The relaxation of the spine produced by the elasticity of the intervening cartilages, which unite its various bones together into a pillar remarkable for its strength and flexibility, materially lessens the injurious effects arising from falls, on the spinal marrow and brain.

By means of these flexible hinges, shocks which in advanced life, when the cartilages have become rigid and the spine assumes the character of an inflexible pillar, produce death, are diffused, and produce but temporary inconvenience. The chances of escape from serious injury by falls from a high position, will be in proportion to the relaxed state of the muscles.

In falling from any considerable elevation, the knees, ankle and hips should be slightly bent, the spine slightly curved, and the toes should be the first portion of the body to touch the ground. If these rules could be observed, many of the serious injuries arising from falls, where the muscles are rigid, would be avoided.

The value of the above suggestions may be easily proved by jumping, on the ground, so as to allow the toes in the one instance first to touch the ground, and the heels in the second. In the latter case, the force of the concussion, produced by the heel forcibly striking the ground, will be felt along the spine and in the back part of the head: in the former, the force will be distributed among the various joints of the foot and instep, before it reaches the spine or brain.

Strict discipline is equally requisite in physics as in morals; nor will the muscles, without constant and proper training, fulfil their respective and important offices. The vocal organs may be adduced as affording evidence to sustain the above position.

In our seminaries and colleges we have repeatedly known students, whose sedentary habits had almost deprived them of the power of speech, the sound of whose voices would scarcely extend over the limits of a small room, so strengthen their vocal organs by a daily, well-directed exercise of the vocal muscles, as to be heard at the distance of eight hundred yards in the open air; we have known two individuals, thus vocally disciplined, to hold a conversation across the Delaware, between Bristol in Pennsylvania, and Burlington in New-Jersey, without any apparent exhaustion.

To the partial use of the vocal muscles is to be attributed much of the bronchitis and other throat affections with which our clergy, particularly those belonging to the Episcopal Church, are so frequently afflicted, and which compels them, too often ineffectually, to seek a renovation of health in the climes of Europe, or to forego their ministerial duties altogether.

Exercise, properly regulated, is essential to healthy muscular action in any portion of the system. Among the Methodist clergymen diseases of the throat are of rare occurrence. The cause of such happy physical exemption is to be found in that constant action of the vocal muscles, which imparts to them vigor and strength.

The laws which govern organic life are scarcely known in our colleges, or if partially understood, are set aside for that false notion of physical ease in the acquisition of knowledge, which may make accomplished scholars, but will inevitably make enervated men.

Totally unfitted, in their physical constitutions, for the arduous performance of those duties, for a perfect acquaintance with which they have consumed the midnight oil, our young divines leave the theological seminaries, to disseminate, through the wreck of a constitution which has been sacrificed to false notions of duty and philosophy, the precepts of that religion the injunctions of which they have, unwittingly, disobeyed, by the total neglect of those physical agencies necessary to the beginning, progress and end of their labors.

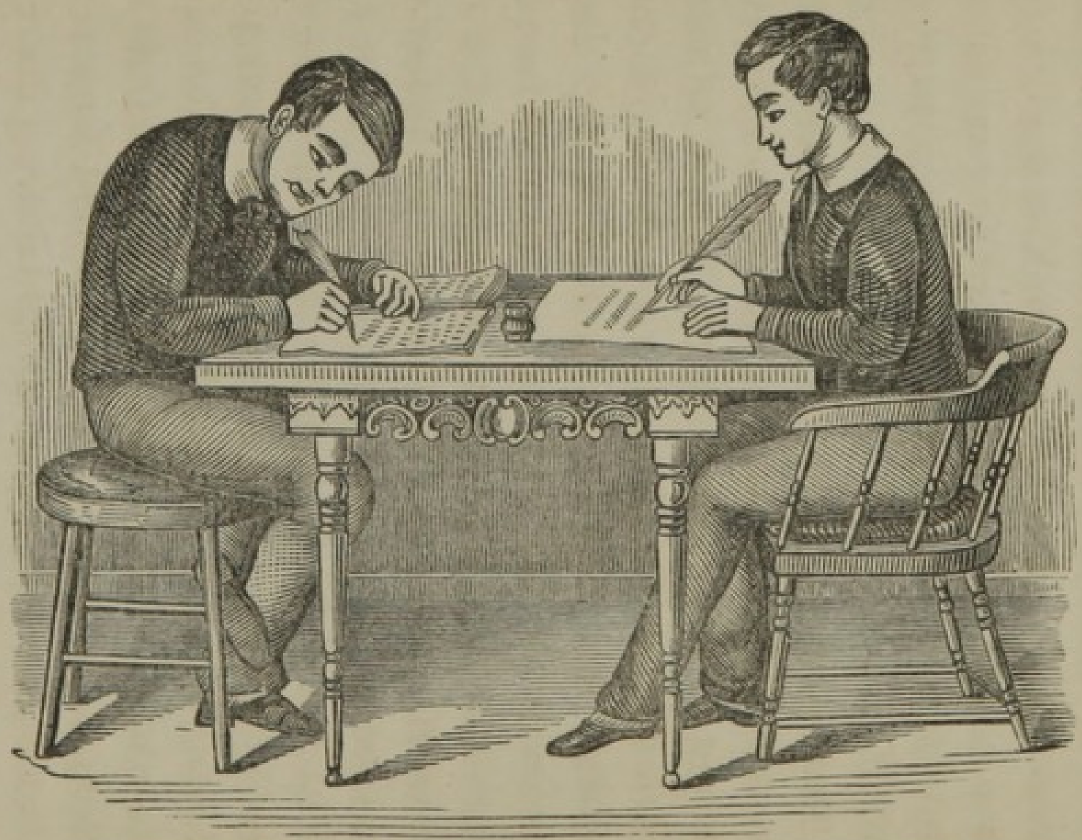
The evil of which we have above spoken, viz., the absence of proper physical exercise in our theological seminaries, and study in rooms overheated in winter by stoves filled with anthracite coal, and in summer by a burning sun, generally too small to admit the amount of air necessary to insure a vigorous and free respiration, the study of ethics in an easy chair, and the general disposition to a sitting rather than a standing posture, with the bent position of the spine, will never be thoroughly remedied until the trustees of such institutions, in their wisdom, think it necessary to enforce the laws which govern the conditions of organic life, through a regularly instituted Professor of Physiology.

Nature has taught us, in the feeble muscular efforts of the infant just attempting to walk, in its wavering step and tottering gait, that education and training are essential to the development of muscular power. The advantageous results of such education will be proportioned to its frequent repetition and its proper direction ; the latter constitute a *sine qua non* to perfection, particularly in the mechanic arts, as in penmanship and the agricultural processes of mowing and reaping.

The figures (fig. 13 and 14) on the next page, displaying an imperfect and perfect position of the spine, arms, body and fingers, will illustrate our meaning. In figure 13 the arms and fingers are contracted, the spine and knees bent. Figure 14 presents the best position : here the spine is comparatively straight, the figure free and extended, the arm in an easy and graceful position ; the whole form displays grace and ease.

There is a lateral muscular movement of the hand, indispensable to the finished penman. If the muscles of the arm are rigid and contracted,

Fig. 13. Fig. 14.



IMPERFECT POSITION. PERFECT POSITION.

the lateral movement which depends on the flexibility of the fingers cannot be made; their tendons contract, and cannot be separated until the constriction is removed by a relaxation of the lower arm muscles.

No greater muscular contraction is required in penmanship than will enable the pupil to grasp his pen and move the arm resting on the elbow joint in any lateral direction which may be required.

The intimate relationship which exists between the functions of the mind and those of the body, renders it apparent that the muscular exertion which the mind suggests and directs will be most pleasing and beneficial: the mental and physical powers should act in the relations of cause and effect. Intellect guides the skilful hand of the artisan when producing the tangible evidences of his ideal conceptions.

The sculptor, in forming the statue of which Ideality has presented the elements of symmetrical proportion and beauty, forgets his labor as the rude marble block under his chisel gradually rises into form and beauty; mental activity and muscular exertion balance each other, and the bright anticipations of the future impart nerve and vigor to the present.

CHAPTER VI.

Of the Nervous System.

A New and deeply-interesting Field of Inquiry—What the Nervous System embraces—Of what it consists—Its Constituent Portions—Composition of the Nervons Tissues—The Vesicular Nervous Substance—The Fibrous Nervous Substance—The Round White Cords—Of the Cranial Nerves—Of the Spinal Nerves—Each of these Nerves arises from the Spinal Marrow by Two Roots—The Anterior the Motor or Moving Root—The Posterior the Sensitive Root—Segments of the Brain—Three Coverings or Coats of the Brain—Two Hemispheres, Right and Left—Each Hemisphere divided into Three Lobes—The Anterior Part of the Brain—Situation of the Cerebellum and Medulla Oblongata—Anterior Part of the Brain may be sliced off with out Pain—Effects of the Removal of the Brain Proper.

A NEW and deeply interesting field of inquiry presents itself in the following pages: the anatomy, physiology, and pathology of the nervous system.

This system embraces the organs by which the sentient being directly holds communication with the external world, and by which the behests of the will are conveyed to the muscles, in order that they may perform the various voluntary movements.

It consists of the brain and spinal cord, which are called the cerebro-spinal axis, and of numerous rounded and flattened white cords, the nerves, which are connected by one extremity with the cerebro-spinal axis, from which they proceed and are distributed to all the textures of the body. It also embraces the sympathetic system, consisting of ganglia and connecting fibres or cords, which extend like chains from the cranium to the pelvis, along each side of the vertebral column, and from which nerves with ganglia proceed to the lungs, heart, liver, stomach, intestines, urinary bladder, and several other internal organs.

The nervous system therefore consists of two constituent portions: the *cerebro-spinal*, which embraces the brain and spinal cord with the nerves given off from them; and the *sympathetic* or *ganglionic*, which consists of the chain of ganglia located on each side of the spine, together with the nerves proceeding from them. The brain and spinal marrow constitute the great nervous centre, while the sympathetic system embraces a series of nervous centres, wherein each separate ganglion seems to possess the power of generating nervous influence. The former has been called the nervous system of animal life, and the latter that of organic life.

The nervous tissues are composed of essentially two kinds of structure, vesicular and fibrous, both of which appear essential to the construction of even the simplest nervous system. The *vesicular* nervous substance is composed of vesicles, or little globular cells, which vary in size from 1-1000 to 1-5000 of an inch in diameter; they are of a reddish-gray color, and are composed of a moderately thick capsule, containing a soft granular pulp. The vesicular structnre is generally collected in masses and united with the fibrous structure, as in the brain, spinal cord, and the several ganglia. These masses constitute the so-called *nervous centres*, that is, the organs in which nervous force is supposed to be generated.

The fibrous nervous system consists, as the name implies, of minute fibres, which vary in size from 1-5000 to 1-14000 of an inch in diameter. These fibres not only constitute a considerable portion of the nervous centres, but the nerves are composed of them alone. They constitute the cords of communication between the different nervous centres, and are distributed to the various parts of the body, like telegraph wires, for the purpose of conveying nervous force to them, or of transmitting to the nervous centres the impressions made by stimuli. Their office is simply the *conduction* either of impressions made by external and internal objects, or of the nervous force.

The round, white cords which we call nerves, consist exclusively of bundles of the minute fibres above described, held together by intervening fibro-cellular tissue.

Another fact worthy of mention is, that the minute filaments which compose the nerves are little tubes filled with nervous matter. They are also continuous from the nervous centres to whatever organ they may be distributed. Impressions are conveyed to the brain, strictly speaking, not by the nerves, but by these little filaments, which, when grouped together, constitute the nerves.

The nerves which are given off from the brain, and which therefore issue from the skull, through openings in the same, are termed *cranial nerves.* Those which take their origin in the spinal marrow are termed *spinal nerves.*

Of the cranial nerves there are *nine pairs.* Taken in their order from before, backwards, they are as follows, viz.:

1. The *Olfactory*, or the nerves on which the sense of smell depends.

2. The *Optic*, or the nerves of sight.

3. The *Motores Oculorum*, or the nerves which produce motion in the eyeballs, for the most part.

4. The *Pathetici*, or the nerves which cause the superior oblique muscle of the eyeball to contract.

5. The *Trifacial*, or the great sensitive nerve of the head and face, and called trifacial because it divides into three great branches.

6. The *Abducentes*, or the nerves which supply the external rectus muscle of the eyeball, and enable it to be rolled outwards.

7. This nerve consists of two parts: *a*, the *facial*, or the motor nerve of all the muscles of the face, and *b*, the *auditory*, or the nerve of hearing.

8. This nerve consists of three portions: *a*, the *glosso-pharyngeal*, which supplies the mucous membrane of the pharynx, the arches of the palate, and the back part of the tongue; *b*, the *pneumogastric*, *vagus*, or *par vagum*, which has of all the cranial nerves the most various distribution, for it supplies the muscles of the pharynx, the mucous membrane and muscular coat of the gullet, the larynx and windpipe, the lungs, the

heart, and the stomach; *c*, the *spinal accessory*, and nerve of respiration.

9. The *Hypo-glossal*, or the nerve which supplies the muscles of the tongue, and endows that organ with motion.

Again, anatomists and physiologists, in order to facilitate description, separate the cranial nerves into four groups, according to the office which they perform in the animal economy. The nerves belonging to these groups are as follows:

1. Nerves of *special sense*, which are the olfactory, optic, auditory, part of the glosso-pharyngeal, and the lingual branch of the trifacial.

2. Nerves of *common sensation*, which are the greater part of the fifth (trifacial) and part of the glosso-pharyngeal.

3. Nerves of *motion*, which are the third, (motores oculorum,) fourth, (pathetici,) lesser division of the fifth, (trifacial,) sixth, (abducentes,) facial and hypo-glossal.

4. *Mixed* nerves, which are the pneumogastric and spinal accessory.

Of the *spinal nerves* there are thirty-one pairs, which are divided into four classes, as follows:

1. The *cervical*,	consisting of	8	pairs.
2. The *dorsal*,	"	12	"
3. The *lumbar*,	"	5	"
4. The *sacral*,	"	6	"

Each of these nerves arises from the spinal marrow by *two* distinct roots, an *anterior* or *motor* root, and a *posterior* or *sensitive* root. The anterior root of each spinal nerve consists, exclusively, of motor fibres; the posterior as exclusively of sensitive fibres. For the knowledge of this important fact, and much of the consequent progress in the knowledge of the physiology of the nervous system, science is indebted to Sir Charles Bell. It is proved in various ways. Division of the anterior roots of one or more nerves is followed by complete loss of motion in the parts supplied by the fibres of such roots; but the sensation of the same parts remains perfect. Division of the posterior roots destroys the sensibility of the parts supplied by their fibres, while the power of motion continues unimpaired. Moreover, irritation of the ends of the distal portions of the divided anterior roots of a spinal nerve excites muscular movements; irritation of the ends of the proximal portions, which are still in connection with the spinal cord, are followed by no effect. Irritation of the distal portions of the divided posterior roots, on the other hand, produces no muscular movements and no manifestation of pain, for sensitive nerves convey impressions only towards the nervous centres; but irritation of the proximal portions of these roots elicits signs of intense suffering. Occasionally, also, under this last irritation, muscular movements ensue; but these are either voluntary, or the result of the irritation being reflected from the sensitive to the motor fibres.

It will thus be seen that two classes of nervous filaments are given off from the spinal cord, the one termed *sensitive*, whose office it is to convey impressions from their peripheral extremities to the nervous centres, and in that direction only, and the other termed *motor*, which convey the behests of the will, and also nervous force, to the muscles to which they are distributed, for the purpose of producing motion. While perusing the following pages, it is important for the reader to bear in mind the distinction between sensitive and motor nerves here laid down.

The brain inclosed within the skull is divided into three segments, united by means of fibres or nervous threads to each other, but performing distinct functions.

1. The brain proper, or cerebrum, situated in the upper part of the skull.

2. The cerebellum, or little brain, in the posterior and lower part of the skull.

3. The oblong marrow, or medulla oblongata, anterior to the cerebellum, but connected to it and the brain proper by numerous nervous cords or fibres.

The care evinced by nature in the outward protection of the brain evinces its importance in the animal economy. Externally, the hairy covering first meets the eye, soft and elastic, deadening the effect of blows upon the scalp, and by its non-conducting properties in relation to heat, united with its power of exhalation, contributing to maintain equality in the temperature of the brain under varying conditions of heat and cold.

Below the hair is the scalp, thick and elastic; and immediately beneath it, a broad muscle covering the superior portion of the skull from its anterior to its posterior part; and directly below this muscle, the pericranium, or membrane covering the bony-arched dome which envelopes the brain.

Upon removing the upper portion of the skull, three coverings are found between its internal surface and the brain, the dura mater, or hard mother, adhering to the skull and dividing, by extensions we shall subsequently notice, various segments or portions of the brain; the arachnoid, or spider-web membrane, so called from its resemblance to the web of that insect; the pia mater, or soft mother, directly covering the brain, and accompanying it through all its winding twists or convolutions.

Beneath the last covering, the brain presents itself divided laterally, by an extended portion of the dura mater termed the *falciform process*, (from *falx*, a scythe, in consequence of its resemblance to that implement,) into two hemispheres, right and left.

Each of these hemispheres is again divided, from the forehead backward, into three portions or lobes, called the anterior, middle, and posterior lobes. The cerebrum is separated from the cerebellum, or little brain, by another process formed by the dura mater, called the tentorium, from its fancied resemblance to the covering of a tent.

The divisions above named prevent lateral pressure between the two hemispheres of the brain proper, and horizontal pressure between the latter and the cerebellum or little brain.

The anterior part of the brain proper rests on the upper and posterior part of the sockets which contain the eyes; the middle lobe reposes in the base of the skull; and the third is placed in the back and upper part of the skull, supported by the *tentorium.*

Beneath the tentorium, or tent-like support of the brain proper, posteriorly, the *cerebellum* or little brain is situated, occupying the posterior and lower part of the skull, immediately behind and rather above the *medulla oblongata.*

The medulla oblongata, or third division of the brain, rests upon the upper part of the spine, within the skull, like the capital of a column, united to the brain proper and cerebellum by nervous fibres hereafter to be described. It is difficult, if not impossible, to define with precision the specific functions which belong to each of these divisions of the brain, or to determine with exactness the physical line which separates them from each other; but dissection furnishes negative testimony amounting nearly to demonstrative evidence.

The anterior part of the brain (brain proper) may be sliced off, yet no excitement or pain will be manifested by the animal; but the moment the knife penetrates the nervous enlargements termed tubercles, situated at the base of the cerebrum, the animal is thrown into the most terrific convulsions, accompanied with audible expressions of intense agony. Every other part of the brain, save this, may be removed without any external sign of animal suffering.

The experiment of Dr. Dowling, of New-Orleans, to which we refer in a note below, performed on a young crocodile, fully sustains the hypothesis of M. Flourin, (see page 107,) that the *cerebellum* is that portion of the brain, the office of which is to control and regulate muscular motion: the immediate paralysis following the destruction of the spinal nerves at once establishes their direct connection with muscular motion.*

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* We are informed by a friend from New-Orleans, that Dr. Dowling, a celebrated physiologist and learned physician of that city, has recently performed some experiments on a young crocodile, to elucidate the functions of the nervous system. In one case he removed the anterior part of the brain, but no sign of suffering was evinced; the cerebellum was then taken away—the animal was unable to walk, but sensation remained perfect; the *medulla oblongata* was cut into—it died instantly. In another case, with a view to ascertain the pathology of paralysis, Dr. Dowling commenced at the lower part of the spine, gradually removing the spinal cord from below upward—paralysis followed each removal in those muscles deriving nerves from the removed portion of the spinal marrow; the spine was then divided from the brain at its upper part, and universal paralysis followed, clearly showing that, while the spinal cord remains in connection with the brain, no paralysis will take place in any portion of the system *above* the injury, or which is not supplied with nerves from below the injured portion of the cord.

CHAPTER VII.

Nervous System Continued.

Experiment of M. Richerand—The Medulla Oblongata the Link which binds us to Existence—Corpora Pyramidalia—Corpora Olivaria—Restiform Bodies —Description of the Nerves issuing from the Medulla Oblongata—Their Offices—The Facial the harder portion of the Auditory Nerve—Its Extensive Ramifications—Has been called the Lesser Sympathetic—Was Supposed to be the Seat of Tic Doloreux—Supposition erroneous—It may be Paralysis from various causes—Glosso-Pharyngeal a branch of the Eighth Pair—Pneumogastric a Second Branch—Spinal Accessory a Third Branch —Case of Paralysis in "King's College," London—Lower Division of the Laryngeal Nerve—Effects of the Division of this Nerve on the Voice—Experiment on a Rabbit to prove the Pneumogastric was endued with some Motor Power—Those affected with Distorted Spines, Scrofula, Club Feet, Gout, or Epilepsy, should not Marry—To abstain from it a solemn Duty to Posterity—Children most liable to these Diseases—The well-educated Physician—Origin of the Spinal Accessory—Muscular Movements of the Passions under its Control—Front View of the Medulla Oblongata—Neck Portion of the Spinal Cord—The Medulla Oblongata the Seat where the Functions of the Mind and Body meet—Other connecting Links in the Nervous System—Connection of Hysterics with the Pneumogastric Nerve—Dance of St. Vitus—Hydrophobia—Dr. Gall's Theory of the Nervous System—Flourin's System—Cerebellum not a Central Point for Sensation—The Brain taken as a whole within the Skull.

We are not unfrequently indebted to chance for the most profound discoveries in science, and the functions and sensibilities of the brain were thus displayed by a French surgeon and physiologist, M. Richerand, while attending to a fractured parietal bone in one of the hospitals of Paris. The results clearly domonstrated that in the removal of the brain proper, the external senses cease to manifest perception; that memory, judgment, and intelligence were annihilated, while no physical sensibility was experienced. "While dressing the head of a patient affected with a considerable caries of the superior and anterior portions of the parietal (or wall) bones of the head, the pledget of lint, by accident, pressed slightly on the convolutions of the brain beneath the opening;—the patient, who had been previously talking to me, instantly ceased his conversation. Upon removing the pledget of lint, I asked him if he recollected what I had been saying to him? He replied, No. Seeing the experiment unattended with danger, I thrice repeated it, and thrice suspended sensation, volition, and perception."

In the removal of the brain proper, physical sensation remains, but judgment and intelligence are destroyed: the animal becomes a mere living machine deprived of desires and apprehensions, so far as their manifestations are visible.

If the little and lower brain, *cerebellum*, be taken from within the skull while the brain proper is undisturbed, perception is retained, but the power of voluntary motion is gone: the animal reels and staggers as if drunk. M. Flourin, a French physiologist, says: "In depriving the animal of the brain proper, it was thrown into a state resembling sleep; in taking away the cerebellum, into a condition like intoxication. Death did not in either case immediately follow; but when I removed the *medulla oblongata*, the animal directly perished."

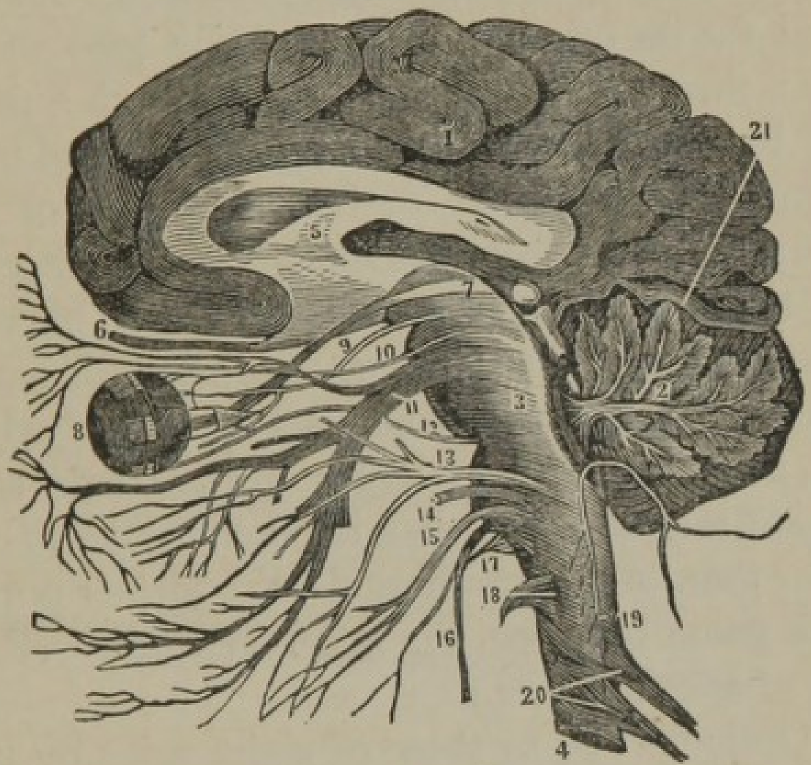
The *medulla oblongata* has been not unaptly termed the "link which binds us to existence." It is here that the nervous fibres given off from the brain proper from the cerebellum, and those sent up from the spinal cord, cross each other, and are mingled together. It is here that the nervous force is generated which presides over the important vital process of respiration.

This portion of the brain is divided into three sections, the *corpora pyramidalia* (pyramidal bodies) anteriorly; the *corpora olivaria*, or olivary bodies, (so called from their resemblance to the olive fruit,) external to the *corpora pyramidalia* and the restiform (rope-like) bodies which form the posterior segment of the medulla. Immediately behind the olivary bodies is placed a narrow white band, (which is indeed a portion of the bodies,) from which proceeds a distinct set of nerves, those of respiration or breathing nerves, both sensitive and motor filaments.

While some portion of these nerves is confined to the sensations and motor movements of the muscles employed in respiration exclusively, there is another which is the connecting link between respiration and other functions of animal existence, particularly that of digestion: the effect of this union is displayed in the symptoms of all diseases in the organs of respiration which are accompanied by derangement in the stomach, from the sympathy existing between the different portions of the pneumogastric nerve, or *vice versa*.

The accompanying figure presents a vertical section of the three divisions of the brain to which we have above referred, with the nerves issuing from the medulla oblongata.

Fig. 15.



1. Brain proper, (*cerebrum.*)

2. The inferior or little brain, (*cerebellum,*) cut down to show the beautiful nervous expansion termed *arbor vitæ*, or tree of life.

3. The oblong brain at the base of the skull, (*medulla oblongata.*)

4. Spinal cord.

5. *Corpus callosum* (hard body) lies between and at the base of the dividing line of the two lateral hemispheres; its fibres, crossing each other, are collected into bundles and penetrate each hemisphere; it connects the anterior, part of the posterior, and the middle lobes of the brain.

6. The first pair of nerves, olfactory or smelling nerves, which arise by three roots: one from the fore part of the posterior lobe of the brain; a second from a gray substance embodied in the anterior lobe; a third by a lengthened root which may be traced for its origin into the middle lobe of the brain: these roots, uniting, pass through a perforated bone at the top of the nose, and spread upon the mucous membrane or internal lining of this organ; branches from the olfactory also enter the nose through the perforated bone and nervous filaments from the anterior root of the fifth nerve. In ruminating animals which select their food by smell, this nerve is very large; in the whale tribe it is entirely wanting, and is much larger in the pointer than in the greyhound—the former pursuing his game by scent, the latter by sight. (First nerve of special sense.)

7. Optic nerves, or those of sight, arise by two roots from the upper part of the medulla oblongata, through the optic tracts, and after taking an inward curved course along the lower part of the brain, enter by a hole through the back part of the eye socket, crossing each other; they expand upon the retina or third coat of the eyes. (Second nerves of special sense.)

8. The eye.

9. Third pair of nerves, (the moving nerves of the eyelids,) arise from the upper part of the medulla oblongata, enter the orbits or sockets, and dividing into a superior and inferior branch,

the one moves the upper, the other the lower eyelid. (A nerve of motion.)

10. *Fourth pair of nerves, or pathetic*, (a nerve of respiration,) arises from below the arch of the cerebellum, (olivary columns,) passes into the orbit, and is distributed on the superior oblique muscle of the eye, of which it is the moving nerve; it joins the sympathetic.

11. Fifth pair, (*trifacial*,) a nerve of the face, arises by two roots, one from the anterior portions of two nervous columns, situated on each side of the fissure which divides the medulla oblongata, (pyramidal bodies—see Nos. 10 and 11,) the other from the posterior portion of a still more external column of the medulla oblongata, termed the restiform bodies in figure above, and hence like the spinal nerves is a *moving* nerve in its anterior and a *sensitive* nerve in its posterior root. This pair of nerves is one of the most interesting and extensively connected in the human frame. At its posterior root, near the hard part of the temporal bone, is observed an enlargement which sends off *three branches*—one to the eye, a second to the upper and a third to the lower jaw: the branch sent to the eye subdivides into three portions—one supplying the muscle which moves the canal whence issue tears, a second to the muscles of the eyelids, and a third to the muscles of the nose.

The *second division* (to the upper jaw) branches out into five subdivisions: the first, to the muscles of the temple and cheek; the second, to the muscles immediately above and anterior to the ear; the third, to the posterior teeth; the fourth, to the anterior teeth of the upper jaw; the fifth, to the eyelids, lips and nose.

The *third division* (to the under jaw) subdivides into seven branches: the first supplies the *masseter* or chewing muscle, the second the temporal muscle, the third the *buccinator* muscle (from *buccina,* a trumpet) of the upper jaw, and also the mucous membrane of the mouth; the fourth, the muscles of the palate; the fifth, the facial, or muscles of the face; the sixth, the teeth and gums of the lower jaw, and by the *mental*, or *posterior root*, the under lip; the seventh, the mucous membrane of the tongue. This branch is connected by nervous filaments with that from the lower jaw. It also joins with the ninth nerve.

The branches to the eye and upper jaw are formed of fibres arising entirely from the posterior branch of this nerve: they are consequently nerves of sensation.

The branches to the lower jaw are formed of fibres arising both from the anterior and posterior branches of the nerve, and are, necessarily, nerves of motion and sensation.

The two former general divisions of this nerve, being sentient, are spread immediately under the surface of the skin, in the forehead, the eyelids, the eyeball, the white coat of the eye, the mucous membrane of the nose, the upper lip, the integuments of the ear, the temple, the whiskers, &c.

The last general division of the fifth pair supplies the muscles of mastication with muscular power, and the lower lip, chin, beard, and mucous membrane of the mouth and tongue, with sensation.

A small branch of this nerve enters the skull, passes down the neck with the carotid artery, and joins the great sympathetic nerve. The fifth pair being extensively distributed on the integuments of the face, and thus freely exposed to vicissitudes of temperature, frequently gives rise to that painful affection of the face known by the terms *neuralgia* or *tic doloreux:* it unites in sympathy the senses of smell, sight, hearing, and, so far as the lips and tongue are concerned, touch. The mental pleasure of a kiss arises from the impression conveyed by the third branch of this nerve to the brain. The sensation termed setting the teeth on edge, produced by filing a saw, is excited by the connection established between the ear and teeth, by the branches of this important nerve.

When the curtains are suddenly drawn aside in the morning, sneezing frequently follows the effect of light upon the retina. The latter consequence, in connection with a sudden pain in the eyeball, arises from the branches of this nerve which are spread upon the eye and the nerves of respiration.

If the branch of the above nerve proceeding either to the eye or upper jaw (arising from the posterior column of the medulla oblongata) is divided, loss of sensibility immediately ensues in those regions, but the muscular power is comparatively unimpaired; but if the branch proceeding to the lower jaw (arising both from the posterior and anterior columns of the medulla oblongata) is divided, sensibility and muscular power are both destroyed. When the *original trunk* of the nerve is divided, the forehead, eyeball and nose become insensible, and the muscles of mastication paralyzed.

The fifth nerve is the motor or moving nerve in mastication, and the nerve of feeling both external and internal, which appertains to the face and fore part of the head. Its pathological conditions, as in neuralgia and tic doloreux, illustrate its physiology. In the teething of children, whether primary or secondary, this nerve is always affected in a greater or lesser degree: the irritation produced in it by the pressure of the teeth, frequently causes convulsions from the sympathy between the brain and spinal cord, and the physician, too often, in endeavoring to lessen the effect by the administration of antispasmodics, opiates, the exhibition of the warm bath, mustard cataplasms, cold douche, &c., permits the cause to ravage the sentient system until the powers of the brain are prostrated, and death terminates the painful scene; when the gum lancet, by relieving the pressure on this nerve in the division of the gum, might probably have afforded instantaneous relief.

12. *Sixth pair* (abducentes, from *abducere*, to lead away) arises from the anterior columns of the medulla oblongata, or oblong brain; runs over the sharp ridge of the temporal bone, and is distributed to the external straight muscle of the eye.

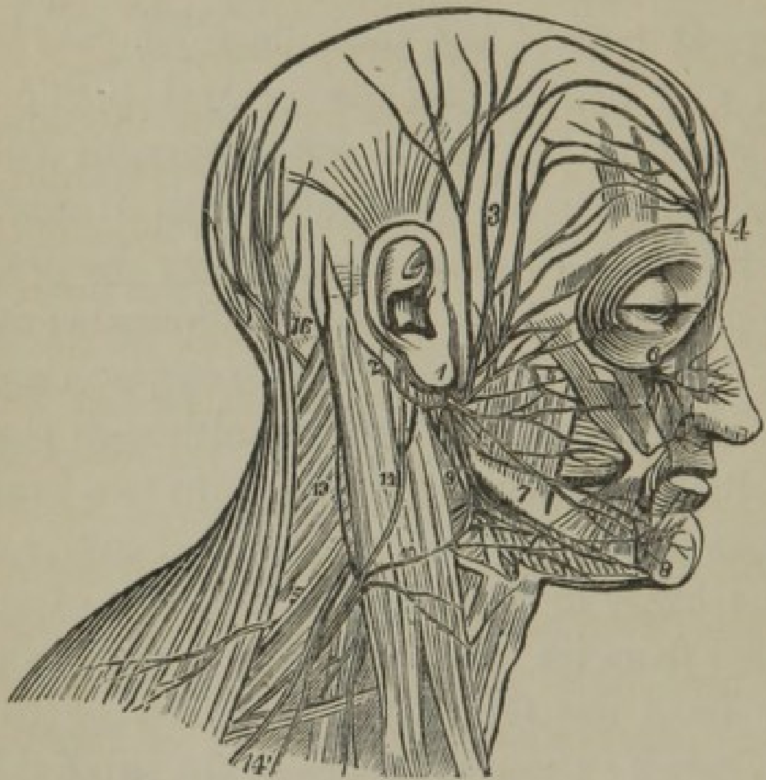
13. Auditory or hearing nerve, (seventh pair.)

This nerve forms the sensitive branch of the seventh pair, and is named the *portio mollis*, or soft portion; the *portio dura*, or hard portion, forming the facial nerve.

The *auditory nerve* arises from the posterior and upper part of the medulla oblongata by two roots: one penetrating its central portion; the other winding round the outer nervous columns of this division of the brain until it reaches a more internal column, the olivary bodies, near the upper part of the medulla oblongata; it then enters the internal channel of the ear, accompanied by the facial, (its twin brother, although performing a different office;) dividing into two branches, one goes to the vestibule or internal cavity of the ear, the other to the cochlea, a cavity of the ear so called from its resemblance to a snail's shell, or rather from the Greek words signifying to twist and to screw: these branches again subdivide and are spread over the whole internal ear. The second portion of the seventh nerve, (the facial or face nerve,) termed the *portio dura*, or hard portion, lies on the anterior part of the medulla oblongata, and, like its related branch, on the upper part immediately above the outer columns, in its middle or respiratory division. After passing through its canal or opening, it expands on the parotid gland, and is one of the principal sources which control this important gland, and consequently of the saliva. When rendered torpid from any cause, the flow of the latter is much obstructed.

The following plate represents the distribution of the two branches of the seventh pair of nerves, the *auditory* branch, or portio mollis, and the *facial*, or portio dura.

FIG. 16.



1, 2, 3, 5, 7, 9, branches of the seventh pair.

4, 6, 8, branches of the fifth pair, or *trifacial.*

10, 12, 13, 14, 15, 16, branches from nerves from the upper part of the spinal cord.

So extensive are the ramifications of this nerve, that it has been termed the lesser *sympathetic.* In its origin and functions in the respiratory column of the medulla oblongata, it is a nerve of instinctive involuntary motion, calling into action by its aid the muscles of the chest: it is connected by nervous threads to a large nerve of respiration, which arises in the upper part of the medulla oblongata, and is spread upon the muscles at the side of the chest, and to the nerve of the diaphragm or midriff, which controls the motions of that powerful internal muscle.

The facial nerve is chiefly spread upon those muscles upon which the form of the face is dependent; beauty of countenance, so far as it is connected with balance of features, depends on the proper action of this nerve on the muscles of the face: it closes the eyelid by its influence on the *orbicularis oculi*, and corrugates those of the eyebrow in frowning. It is very large in the monkey, giving great activity to the nerves of the countenance, and is the lever which raises and twists in every direction the trunk of the elephant. If this nerve is divided where it leaves the brain at a small hole behind the ear, termed the mastoid foramen, (from *mastos*, a breast, and *eidos*, form, the bone and hole resembling the breast with its nipple,) paralysis of the muscles of the face and eyelids immediately follows.

It was formerly, from its extensive ramification on the face, supposed to be the seat of neuralgia or tic doloreux; but a division of the nerve as a means of cure was followed by a paralysis of the facial muscles on that side of the face where the nerve had been divided, with total loss of voluntary power over the features; the eyelids refused to perform their office, and the corrugating muscles to contract the eyebrow into a frown.

It may be paralyzed from various causes, as from the influence of cold acting on its capillary fibres directly on the surface of the skin, from the compression of a tumor at the angle of the jaw, or from a decayed or decaying state of the temporal bone; but whatever may be the cause, the effect will be invariable—the patient will neither be able to close the eyelids, nor even to approximate them towards each other; he can neither move either lip upward or downward, nor purse them up into the form necessary for whistling; he may laugh, but only on the unaffected side.

The superficial muscles of the face may be thus paralyzed, utterly deprived of the power of voluntary motion, while those deep-seated, as the *masseter* or chewing muscles, and all those which supply the lower jaw, are unaffected, being supplied with motor nerves from the fifth pair or trifacial, already described. That it is not entirely devoid of sensibility, arises from its direct and frequent communication with the posterior branches of the trifacial and other nerves of sensation.

14. Eighth pair, comprising the glosso-pharyngeal, or tongue and gullet nerve, the pneumogastric, or lung and stomach nerve, and the spinal accessory, arises from the respiratory column of the medulla oblongata at its upper part. Its various branches, as above named, pass together through a hole at the base of the skull termed the jugular foramen, or jugular hole, being that through which the jugular vein also passes at the base of the skull, not far removed from the large opening where the spine is attached to the skull.

The glosso-pharyngeal, or first branch of the eighth nerves, after escaping through the jugular opening, passes to the gullet at its upper portion and to the tongue, on which organs its finer threads are spread. It unites with the pneumogastric, spinal accessory, and sympathetic, forms a strong plexus or web around the carotid artery in the throat, and with the facial (the harder portion of the seventh pair already described). Its principal branches are spread around the upper part of the gullet, and on the tongue, to each of which it is a nerve of sensation; it will, however, be remembered that the latter organ is furnished with another sensitive nerve from the fifth or trifacial. In a case of paralysis of the fifth nerve, which is spread on the anterior portion of the tongue, the sense of taste was destroyed, while on its posterior portion, supplied by the glosso-pharyngeal, the sense remained unimpaired. A case of paralysis which had been mistaken for hysterics, in which the glosso-pharyngeal was involved, occurred at the King's College Hospital, London: the muscles of the eyeball were paralyzed, supplied by the third nerves; those supplying the upper part of the gullet shared a similar fate, so that the power of swallowing was destroyed; the power over the *trapezius* muscle (see muscles, fig. 4, No. 7) was lost, with that over those on the back of the neck; great feebleness of voice ensued, and the patient ultimately died as if under the influence of suspended respiration. A *post mortem* examination showed a thickening of the third pair, the fourth pair on the left side, but particularly of the glosso-pharyngeal, the pneumogastric, about to be described, and the spinal accessory. The immediate cause of death doubtless was dependent on a paralysis of the branches of the pneumogastric, which supplies the muscles of the chest and the lungs.

The pneumogastric, or lung and stomach nerve, the second division of the eighth pair, called also, from its diversified ramifications, the vagus or wanderer, emerges from the medulla oblongata immediately below the glosso-pharyngeal, and slightly behind the edge of the olivary bodies, passes with it through the jugular opening in the base of the skull, descends the neck, and enters the chest, to act on its muscles immediately beneath the collar bone. After passing through the skull, it forms a plexus or web which sends off branches, one of which unites with the third branch of the eighth pair, spinal accessory, in its internal direction. It sends off two branches to the lower and upper part of the gullet, also the upper and recurrent pharyngeal to the upper part of the windpipe or larynx, (see fig. 17, 2, 3;) two to each side of the heart; inferior branches to the chest and pericardium or covering of the heart; pulmonary or lung branches, which pass in front of the lungs and penetrate their substance; to the œsophagus, or gullet, through its whole length; to the trachea or windpipe, spreading over its mucous membrane and muscular fibres, and to the posterior part of the lungs. After giving off the lung branches, the wandering nerve passes through the gullet opening of the diaphragm or midriff muscle, and distributes nervous fibres on the stomach, and inosculates freely with the great sympathetic, of which we shall hereaftear speak.

By the different branches of this nerve, a bond not only of nervous but muscular union, is established between the brain, the heart, the lungs, the gullet, the chest, the stomach, immediately; and by its connection with the great sympathetic, with every part of the system, indirectly. Can we wonder, after the establishment of this anatomical and physiological fact, that many portions of the system feel the effects of disease at the same moment? The survey of this nerve, in its physiological and pathological relations, fills the mind with deep interest. It would seem in some instances to be a motor or moving nerve, yet it is doubtful whether this be the case: the motor power which it seems to exert upon the muscles probably arises from its exciting the spinal accessory, (a nerve of motion,) the third branch of the eighth pair, which it joins. Its origin from the posterior part of the olivary bodies stamps upon it the character of a sensitive nerve.

The distribution of this nerve in the inferior animals is analogous to that of its ramifications in man. In some of them, as the dog and cat, it is more intimately connected with the sympathetic system, or the chain of ganglia, with connecting nervous cords lying on each side of the spine, and extending from the neck to the pelvis. In birds and reptiles, its course and general distribution do not differ from that in man.

The lower division of the laryngeal nerve (the subdivision of a branch of the pneumogastric, of which the upper laryngeal forms the second portion) appears to be endowed with motor or moving powers.

If the mucous membrane of the glottis (the upper and minute entrance to the windpipe) be touched, an instantaneous and violent contraction will take place, provided that the upper laryngeal nerve is uninjured; but if that nerve be divided on each side of the glottis, the latter organ may be irritated with impunity—no contraction will take place; thus furnishing proof that the upper nerve of the larynx is the nerve of sensation to the opening of the windpipe, (glottis,) while the lower branch, which it stimulates into action, is the nerve of muscular motion. It is this nerve which is more immediately involved in stammering, especially when this vocal defect is confined to the vowel sounds. The nerve highly excited produces a too frequent and rapid contraction of the glottis, in opposition to the volition of the speaker.

Destruction or impairment of voice, proportionate to the injury sustained, follows a complete or partial division of this nerve. The cure of stammering, when on the vowel elements, depends on the direction of this nerve, so as to prevent the too frequent spasmodic action of the glottis—in other words, in keeping the glottis open. Singers never stammer while in the prosecution of their art, however they may be afflicted with this obstruction in speech: the cause may be ascribed to the almost continual opening of the glottis in song.

Division of the pneumogastric nerve in the neck produces paralysis of the gullet. The pharyngeal muscles force the food into the gullet, but the latter canal, having no nervous muscular power, becomes filled with the food, and the animal perishes from suffocation, when the pneumogastric nerve is divided as above.

Dr. Reid tried this experiment on a rabbit with the above result.

It would seem from the result of this and other similar experiments, that the muscles of the larynx were involved in the paralysis to a partial extent, as the food, after overflowing the top of the gullet, found its way through the glottis into the windpipe, and even descended to the air cells of the lungs.

The experiment clearly demonstrates that the act of swallowing depends on the impression produced by the passing food first upon the nerves of sensation, and through them upon the motor or moving nerves, whereby the muscles of the throat and the muscular coat of the gullet are made to contract, and the food is pushed forward into the stomach.

On the functions of the heart, the cardiac division of this nerve produces but little effect and but slight disturbance; that organ being also supplied by the great sympathetic, which unites with the cardiac or carotid plexus or web, the latter being formed by two branches, which arise from the ascending branch of the cervical or neck ganglion, where it enters the carotid canal with the internal carotid artery.

In order to prove that the pneumogastric nerve was in some degree endued with the motor or moving power, the nerve on one side of the lung in a rabbit was dissevered, but no change of structure in the lung followed—no spasmodic or convulsive action; when the nerve was divided above the pulmonary branch, or rather both of its branches, the animal breathed like an asthmatic, the lungs became congested—the animal died.

This result explains the important influence which these branches exert in the process of respiration.

The branches of the pneumogastric nerve which supply the stomach chiefly exert their influence on its muscular coat, but the mucous coat is also in some degree controlled by them; these divisions occasion nausea and vomiting.

The origin and numerous ramifications of this nerve will explain many of those pathological conditions of the system which might otherwise seem inexplicable: how often, nay, how generally, are diseases of the stomach the hidden cause of many anomalous symptoms.

The following plate shows the origin of the fourth, (Pathetic,) second portion of the seventh, (Facial,) Glosso Pharyngeal and spinal accessory, (branches of eighth,) Phrenic, or midriff and external respiratory, nerves of the medulla oblongata:

FIG. 17.

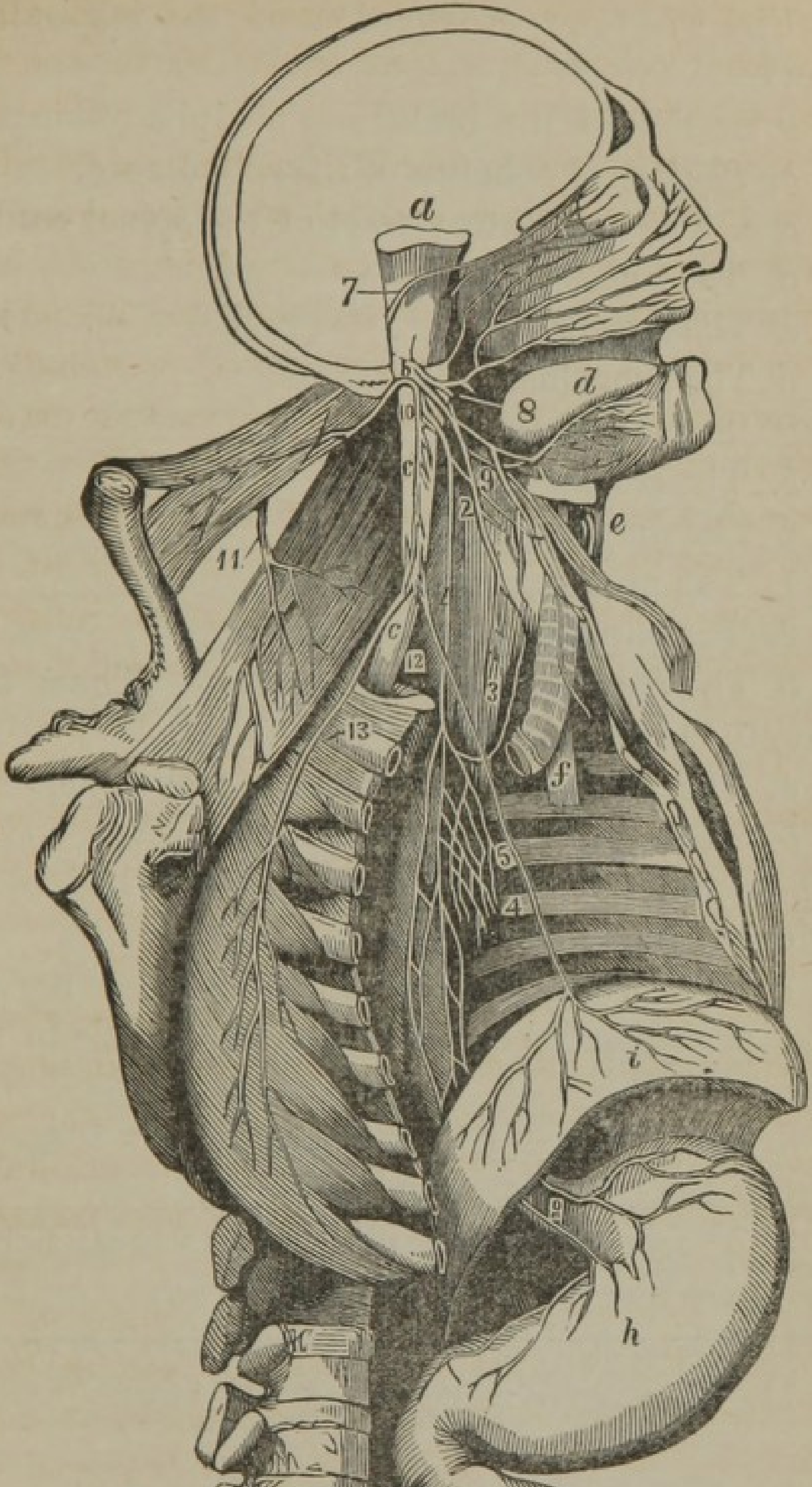


Fig. 17. The distribution of the respiratory nerves.

a. Section of the brain and medulla oblongata.

b. The lateral columns of the spinal cord.

c, c. The respiratory tract of the spinal cord.

d. The tongue.

e. The larynx.

f. The bronchia.

g. The œsophagus.

h. The stomach.

i. The diaphragm.

1. The pneumogastric nerve.

2. The superior laryngeal nerve.

3. The recurrent laryngeal nerve. (These two ramify on the larynx.)

4. The pulmonary plexus of the tenth nerve.

5. The cardiac plexus of the tenth nerve. These two plexuses supply the heart and lungs with nervous filaments.

7. The origin of the fourth pair of nerves, that passes to the superior oblique muscle of the eye.

8. The origin of the facial nerve, that is spread out on the side of the face and nose.

9. The origin of the glosso-pharyngeal nerve, that passes to the tongue and pharynx.

10. The origin of the spinal accessory nerve.

11. This nerve penetrating the sterno-mastoideus muscle.

12. The origin of the internal respiratory or phrenic nerve, that is seen to ramify on the diaphragm.

13. The origin of the external respiratory nerve, that ramifies on the pectoral and scaleni muscles.

The diseases of no other tissues of the body are so readily transmitted through successive generations as those of the nervous system. Every body knows how strong the tendency is in children to inherit both the habits and diseases of their parents.

The rickety or club-footed,* those laboring

* The club-foot sometimes produced by weakness of the muscular power which supports the ankle joint, at others by a defect in nature at birth, exists under two forms.

In the first, the child walks on the outer ankle, as represented in figure 18 below; in the second, on the inner ankle, as represented in figure 19.

FIG. 18.

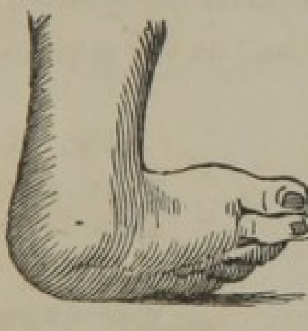


FIG. 19.

The first is most usually a natural deformity, but still within the reach of art. The second is produced by a bad habit of walking, increased by allowing the infant to walk too early; the inner ankle in the latter case frequently touches the ground.

Both forms most generally occur in children of delicate nervous susceptibility and weak muscular development, probably of scrofulous habits.

The constitutional derangement must be primarily attended to; it is an object of the first and most permanent importance, and will always arrest the immediate attention of the judicious under severe lung disease, or predisposed to insanity, scrofula, gout, or epilepsy, should conscientiously abstain from entering into any matrimonial connections: it is a solemn duty they owe to posterity. If the former three painful maladies are not hereditary, it is well known, from woful

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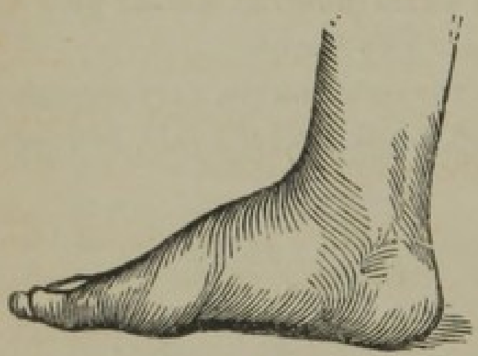
practitioner; after which we would recommend, in preference to any other, the apparatus and bandages invented and used by Benjamin C. Everett, at the Surgeons' Bandage Institute, 34 South Sixth street, Philadelphia, the effects of which are shown

FIG. 20.



in figure 20, where the deformities represented by 18 and 19 have both yielded to their application, and a perfect joint has been formed. Nor have their efforts been less successful in the cure of other distortions in the bony and muscular systems, as will be seen by the case and figure below, and on the opposite page.

FIG. 21.

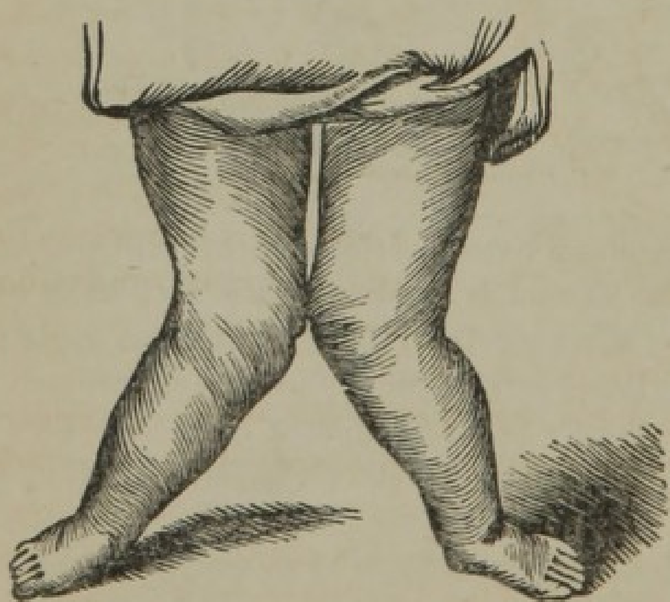


Fig. 21 represents a case of Knock-knee. The deformity is the consequence of general debility in most cases, but is produced by dancing when very young, or weak, or from jumping from a height, thus straining the ligaments and fascia which sustain the arch of the foot, the yielding of which proexperience through successive families, that the latter, more particularly connected with the nervous system, are; that hereditary insanity fills our lunatic asylums, and scrofula has deformed our ancestors through countless generations.

It is among children descended from those in whom wealth and luxury have produced habitual indolence, or from those of the opposite extreme, to whom poverty has denied the necessaries of animal existence, that we find the most feeble nervous systems; the former in consequence of continued nervous inaction; the latter, the result of a

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duces flat foot, and a tendency of the knees inward. This is a curable derangement when in the incipient state.

Fig. 22.

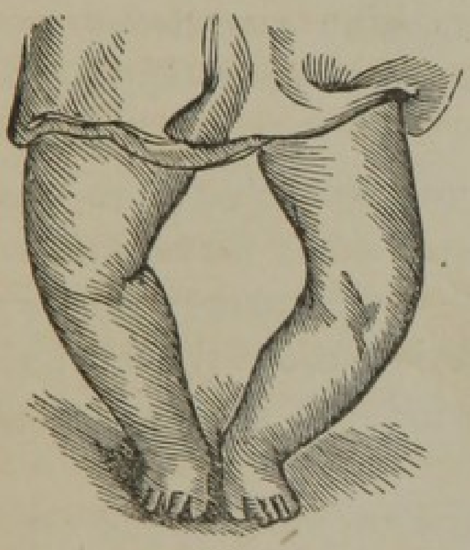


Fig. 22 represents a case of Bow-leg, the consequence of an excessive contraction of one set of muscles. Children of a good constitution are frequently found thus deformed, and it is not unfrequently found to be hereditary in families. This deformity can also be remedied by properly constructed bandages applied when the individual is in infancy and just commencing to walk. Cases have been cured at ten years of age.

It is unnecessary to add any thing to the numerous testimonials of success resulting from the application of the apparatus and bandages of Mr. Everett, in almost every case of osseous or muscular deformity, from the medical faculty and the sufferers themselves. They speak in a language more forcible than any which we can adopt.

feeble nutrition incompatible with the required expenditure of nervous power.

The well educated physician examines the condition of his patient's tongue, as an index to acquaint him with the physical condition of other organs. As an anatomist, he is perfectly conversant with the fact that the pneumogastric nerve, after leaving its origin, extends over every portion of the frame; as a physiologist, he is fully aware that every organ over which its fibres are expanded, is connected sympathetically, either in sensation or action, perhaps both. He consequently decides on the state of the stomach, perhaps other organs, by the appearance of the mucous membrane of the tongue, supplied by nervous fibres from the pneumogastric. Titillation of the throat will produce vomiting, through the sympathy established between that organ and the stomach by the influence of this nerve.

The branches of the vagus, distributed to the upper part of the glottis, are *moving* nerves; those sent to the upper part of the windpipe are *sensitive;* those distributed on the inferior part of the larynx, or upper portion of the windpipe, are nerves of motion.

The branches to the lungs are moving and sensitive; they cannot be destroyed without interfering with the process of respiration, obstructing the circulation through these organs, and, ultimately, causing congestion.

The *Spinal Accessory*, or third portion of the eighth pair, arises from the middle or respiratory column of the medulla oblongata in its anterior part, and is consequently a nerve of muscular motion; by a second root it is attached to the spinal portion of the cord about midway in the neck portion of the spinal column; hence its name of spinal accessory. Its principal fibres are distributed over two large muscles, deeply connected with the muscular movements of the head and shoulders, termed the cleido-mastoideus and trapezius, (see muscles 6 and 7, fig. 4;) these fibres arise from the external branch. The office of its *internal* branch, arising principally very near the posterior part of the spinal cord, it is not so easy to determine; some declaring it to be solely a nerve of muscular motion, dependent for its power of calling the muscles into play upon the action of the vagus, with which it is closely connected. Dr. Robert Bentley Tod, a distinguished writer on Physiology, who is also one of the most correct pathologists of the day, seems disposed to assign to the internal branch of this nerve the office of a nerve of sensation.

The spinal accessory and pneumogastric conjoined, resemble the double-rooted nerves of the spinal cord in origin and function. As a peculiar nerve of sensation, the branches arising from the posterior part of the spinal column, in its respiratory tract, transmit no sensations save those connected with respiration. As a nerve of motion, it moves the tongue and gullet when necessary; acting as a nerve of instinct. By the combined action of its three branches above described, (the three branches of the eighth pair,) the muscles used in either ordinary or laborious breathing are brought into action, combined and directed within the proper limitation of force, to perform the necessary function.

All the passions, so far as muscular action gives character to physical expression, are under the influence of these nerves of respiration. In a paroxysm of anger the eyes protrude, the facial muscles are at times contracted, at others extended, the chest heaves like a volcano seeking to lift up the covering of the smothered crater. By what power are these diversified muscular actions called into existence at the same time? By the intimate connection and consequent sympathy existing between the above-described nerves and those of the facial and trifacial, already described.

To illustrate more fully the influence of the three branches of the eighth pair in their various curious and sympathetic relations with the great facial and other nerves, over the expressions of the passions and emotions, we select the emotion of Terror.

The form under its influence is fixed and erect, inclining backward; the eye stares wildly on the object which has produced the emotion; the eyelids, by the sudden and powerful contraction of the various muscles which move them, are placed at their utmost limit of distance; if the victim has power to move, his limbs totter, almost refusing to perform their office, and his general aspect is bewildered. So far the *mind* is intensely occupied with the object of apprehension. While the nerves of *sensation*, directly or indirectly, are thus acting, the immediate nerves of muscular motion throw the muscles of the chest into convulsive action, the breathing is hurried from the forcible contraction and expansion of the muscles of the chest, the throat swells with a sense of suffocation, the heart beats violently against the breast bone and ribs, while the pallid countenance evinces that the blood has forsaken the circumference for the centre. Such are the physical organic signs of terror, produced by the immediate controlling influence of the anterior roots of the eighth pair, in their union with other organic nerves, excited by the roots of their posterior origin. They are the legitimate instruments of expression, from the smile which plays on the lips of infantile beauty, to the last throes of mortal agony.

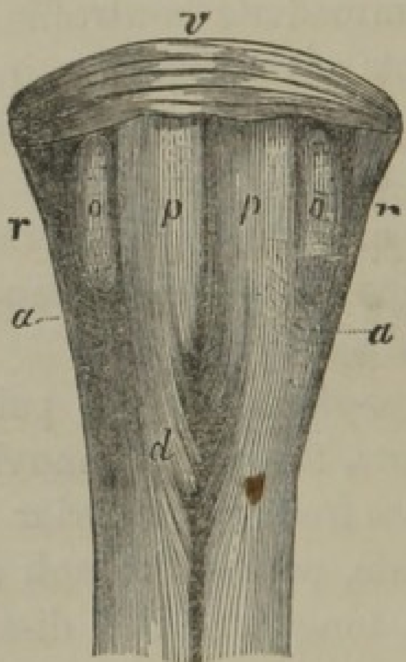
16. The *Hypo-glossal*, (ninth pair,) or muscle above the tongue, the proper moving muscle of the tongue, arises from the anterior portion of the medulla oblongata, passes through an opening at the base of the tongue, and is distributed freely to the muscles which move it.

The above cranial nerves, or nerves of the brain, send descending filaments to the upper spinal nerves, and to the great sympathetic, and by these means are connected with the whole nervons system.

Having enumerated the nerves of the cerebum or brain proper, the cerebellum or little brain, and the medulla oblongata or oblong marrow, necessary to our future inquiry into diseases of the nervous system, we shall, after presenting to the reader a front view of the medulla oblongata, notice more particularly the physiological and pathological conditions of the three divisions of the brain, within the skull, which are here described.

The following front view of the medulla oblongata is taken from "Tod's Physiological Anatomy," page 240.

Fig. 23.



p, *p*. Pyramidal bodies.

d, *o*, *o*. Olivary bodies which lie along the side of the former, and form the tract of nervous matter from which proceeds the nerve of respiration.

a, *a*. Arciform fibres.

r, *r*. Restiform bodies.

v. Lower fibres of the pons Varolii, or bridge of Varolius. The office of the nerves which arise from this section of the brain, enables us clearly to judge of its functions, and to assign to it the most important position in the nervous system.

That it is the seat of the nervous power which presides over the function of respiration, is established by the physical phenomena which follow its destruction or division: if this portion of the brain is pierced in a quadruped or a bird, it falls senseless to the ground.

Some animals, as reptiles, and also birds, have no diaphragm or midriff: if in these the spinal cord be removed to within a few lines of the medulla oblongata, loss of sensation and action takes place in the muscles beneath the divided section; but the animal can still breathe and swallow, and the higher instinctive faculties remain unimpaired.

In the paralysis which follows a fracture of the spine, below the point where the phrenic nerve passes out of the spine, respiration remains unobstructed: so long as the medulla oblongata is uninjured, the nerves of sensation and motion arising from its middle column maintain the sensation and action of the chest and lungs.

If the neck portion of the spinal cord, below the origin of the phrenic nerve, sustains a serious injury, the whole of the trunk beneath loses all muscular power, and presents the appearance of a living head resting upon a dead trunk: the muscular power of the head, however, remains the same as before; respiration is unimpaired; the medulla oblongata has escaped injury!

If the olivary bodies of this section of the brain be irritated by external agency, the muscles supplied with nerves from this portion of the brain are thrown into convulsive action; hurried breathing ensues; if continued, the spinal nerves more directly connected with those proceeding from the medulla unite with them, sympathetically, and general convulsions in the trunk and limbs come on.

If the disease affects one half of the medulla oblongata, or the nerves proceeding from the brain above the bridge of Varolius, the muscles on the opposite side will be affected from the decussation, or crossing of the nerve-fibres in the medulla; consequently, external remedies, as electricity, galvanism, &c., intended to act on the muscles of the left side of the neck, (and the remark applies to the nerves throughout the system,) will be most effectual if applied to the nerves of the opposing side.

That the medulla oblongata is the centre where the functions of the mind and body meet, cannot be doubted. The origins of the nerves of volition, so far as anatomy has been able to trace them out, appear to arise from its upper part, in two balls, termed the ophthalmic, the supposed origin of the optic or eye nerve. The removal of the brain above this section destroys the manifestations of the will, but not involuntary muscular action.

The medulla oblongata, the great forewarning agent of sensitive impressions from the head, trunk and limbs, and the olivary bodies, the great assembling station of the nerves of pure sense, furnish us with more than negative evidence that this part of the brain, the seat of the respiratory nerves, is likewise the depository of those central impressions which are the agents necessary to produce sensations.

The posterior columns of the spinal cord furnish nerves of sensation so far as external impressions are concerned, but such sensation is carried to the seat of intellect in consequence of the union which exists between them and the posterior columns of the medulla oblongata, which latter transmits to the hemispheres of the brain proper, with which it is in immediate and intimate connection, the sensations received from impressions without. That this segment sends out the nerves of respiration, anatomy has furnished the proof by tracing the origin of the fourth, seventh, eighth, midriff, external respiratory, (see fig. 17,) (all furnishing nerves to the muscles of respiration,) into the olivary bodies, the lateral division of the medulla oblongata. (See fig. 15.) Nor is the contracting influence of the medulla limited to the purposes of respiration; the function of swallowing is dependent on some of the nervous branches it sends forth, as those of the pneumogastric and glossopharyngeal. (See fig. 13.) Animals deprived of the brain proper and little brain, will continue to swallow food received within the fauces so long as the above-named nerves direct the muscles of the gullet; in other words, so long as the integrity of the medulla oblongata is preserved.

That there are other connecting links in the nervous system of respiration than those immediately proceeding from the medulla, is proved by the fact that cold water suddenly dashed on the surface will produce spasmodic action in the muscles of respiration, as from the first impression of the water in bathing; it is, however, by the connection established between the spinal nerves, the smaller branches of which on the skin are thus excited, and the nerves of respiration, that the spasmodic constriction is produced. It is not unworthy the notice of the physiologist, the pathologist, the physician, and the reader of these pages, that in maladies arising from mental emotions, as insanity, and some others, many, if not all the symptoms, point to the medulla oblongata as the seat of the disease.

In hysterics, the various branches of the pneumogastric nerve, with those of the glosso-pharyngeal, (see fig. 17,) throw the muscles of the chest, windpipe and gullet, into those violent spasmodic contractions so terrible to the beholder, while their connection with the *trifacial* (the principal nerve of the face) distorts the facial muscles to an almost inconceivable, though transient deformity.

In the disease termed the "Dance of St. Vitus," we are furnished with similar evidence of the influence of the medulla oblongata, the third, fourth and sixth nerves, and portio dura of the seventh, being those principally affected in this truly nervous disease.

In the hitherto opprobrium medicorum, Hydrophobia, the nerves of the olivary bodies, as manifested by the horrible contractions of the muscles, are primarily and chiefly affected.

There is no portion of the nervous system so intimate in its connections, so diversified in its functions, as this dome of the spinal cord: it is the centre of muscular action dependent on the emotions.

By its upward fibres it is connected with the brain proper, posteriorily with the cerebellum, downward with every spinal nerve of sensation and motion.

By its connection with the posterior bones of the former, it can excite through their gray matter the sensitive nerves of the spinal cord, forcing them, in their turn, to impart greater vigor to the moving nerves, and, consequently, to add greatly to the force of muscular movement.

We now take our leave of this great centre of union between the mental and corporeal functions, to consider those which belong to the

CEREBELLUM, OR LITTLE BRAIN.

Dr. Gall, in his theory of the nervous system, and after him Spurzheim and other phrenologists, have endeavored to prove that the cerebellum is the seat of the instinct of propagation, and that animal desire is proportioned to the development of the organ. Later anatomical research does not support this hypothesis. If it were correct, the development of this segment would of course be greatest where animal desires are most active: the reverse is the fact: in some of the mammalia, (the monkey tribe, for instance,) and among amphibious animals, (as the frog,) the instinct is much stronger than in man, yet the cerebellum is proportionally smaller; while in some animals which have been deprived of the generative organs, the cerebellum is larger, as in the gelding, compared with the entire horse.

Flourin, a French physiologist, has assigned to this division of the brain the faculty of associating and regulating voluntary movements which originate in other divisions of the brain, or in the spinal cord, and this theory is supported by anatomical proofs, of which the following may be adduced: The cerebellum may be removed or injured, especially in birds, without producing injurious effects on other parts of the brain or disturbing their functions: this, however, is only true in relation to its superficial or gray portions; if its middle and more fibrous layers be sliced off, the association of voluntary motions is destroyed, the animal reels and staggers, but can still see and hear. When the deepest layers of the cerebellum were removed by M. Flourin, the bird, the subject of the experiment, was unable, when lying on his back, or in any other position, to rise; he could see an instrument raised as if to strike him, endeavor to avoid it, but could not escape; the will but not the power remained to do so; the faculty of associating the necessary action to give force to instinctive volition, was annihilated. The situation of this organ in relation to the medulla oblongata, strengthens the above theory: its connection with the brain proper is slight, but with the medulla oblongata, extensive—being united to the latter by the fibres of the restiform bodies, as also with the spinal cord, and to the brain proper by the bridge of Varolius.

The cerebellum is evidently not a central point for sensation; it is equally certain that it is not the organ of the mental nerves and functions, but the proofs are abundant that it is in some manner connected with the lower instincts, and with the associations and regulations of actions arising from sensations in other portions of the nervous system.

We have now, so far as is necessary to the design of this work, described the anatomical structure of the brain. We have shown it to be composed of two substances, differing from each other in their structure and objects; the one the cineritious, or ash-colored portion, being the external part of the brain within the skull; the other medullary, or marrow-like, covered and seemingly protected by the first-named.

The brain, taken as a whole within the skull, has been shown to be separated into two hemispheres, and three general centres, those of intellect, sensation, and action; having their origin in the *brain proper*, the *medulla oblongata*, and the *cerebellum.* The protecting coats, or coverings, of the brain have been described, and the processes, or separating divisions which they form within the skull, to prevent undue pressure from different portions of the medullary and vesicular matter in that important organ.

In the next chapter we shall notice the progressive development of the brain in the ascending scale of animated nature, with further remarks on the pathology of disease as connected with derangements of its various coverings. Independently of the anatomical, physiological, and pathological views there laid open, the gradual development of intellectual power, as creation mounts from her most inferior animal productions to man in the plenitude of his mental powers, the master spirit of a material world, is a subject which must at all times engage the attention of the moralist, as he looks from the smallest atom scattered in his path to the boundless intelligence of a Great First Cause.

CHAPTER VIII.

Physiology and Pathology of the Brain.

Animal Existence from the Zoophyte to Man—Nerves scattered throughout the Body in the Former—The more Perfect Animals without a Spine—Animals furnished with a Spine—Spinal Marrow superadded—Reptiles, Birds, and Mammalia—Successive evolution in the Size of the Brain—Weight of the Human Brain compared with that of the Body—South American Apes same relative Proportions—Canary Bird—Goose—Weight and Size not measures of Intellectual Power—What determines the Intellectual Grade of the Animal—Reptiles and Fishes—Their Nervous System—Have no Sagacity—Their Tenacity of Life—Systems less intimately connected—Next descending Class—Divide a Zoophyte or a Worm—Ages have admitted the Cerebrum to be the Seat of Intellect—What Observation and Experiment have confirmed—Accumulations of Water in the Brain—The Outer Portions of the Convolutions—Perception, Memory, Power of Abstraction, employ the Convolutions—They stand as intervening Messengers—The Cortical Substance of the Brain—Dissection of the Brains of Lunatics—Precocity of Intellect and False Parental Pride.

As we ascend in the scale of animal existence, from the zoophyte, chained to his rocky origin, scarcely to be distinguished from a vegetable, up to man in the maturity of his intellect, we trace the progressive steps in the constitution of the nervous system. In the former, the nerves are scattered throughout the entire body without any concentration, apparently merely to serve the purposes of muscular motion. In the more perfect animals without a spine, the nervous system assumes a more distinct arrangement, forming knots, or ganglions, connected to each other by nervous threads. As we progress upward, even in the lowest class of animals furnished with a spine, as fish, we behold an addition to the knotty nervous matter in the superaddition of the *spinal marrow*, nerves of voluntary motion and sensation, of instinctive movement and of peculiar sense; but the *brain* presents scarcely any thing but its rudiments.

Proceeding through the other three classes of spinal existence, *reptiles*, *birds*, *and mammalia, or animals with breasts*, we find a successive evolution in the complexity and size of the brain and the nerves connected with it, and with each evolution, correspondingly higher grades of instinct and intelligence; until we reach Man, the most intelligent of all created beings, with a moral responsibility corresponding with the greatness of the intellectual boon with which he has been furnished. The weight of the human brain, compared with that of the body, varies from 1-22 to 1-35. In some of the South American apes it bears the same relative proportions. In the canary bird it is 1-14; in the goose, 1-300. Weight and size are not therefore measures of intellectual power. It is the size of the brain compared with that of the spinal marrow, and the texture or quality of the former, that determines the intellectual grade of the animal.

In reptiles and fishes the brain, if such it can be called, is a mere appendage to the spine, an anterior termination. Their nervous systems are confined to the mere functions of animal existence. Sagacity they have none; their instincts are limited; their tenacity of life alone is controlled by the nervous system. Their systems of organs are less intimately connected, and more independent of each other in their nervous endurance. Frogs will jump about long after their hearts are extracted, and the heart of a shark will beat for hours after the fish has been destroyed. In the next class descending, (not furnished with spines,) the independence of the nervous system is more strikingly marked. They seem to have distinct nervous bundles or ganglions in almost every part of the body, which, if not destroyed, although the animal may be cut into pieces, furnish it with a power of reproduction altogether marvellous. Divide a zoophyte or worm, and each piece will become perfect as the parent in its animal organization.

Ages have indirectly admitted the cerebrum to be the seat of intellect; a high and arched forehead has been one of the physical signs by which mankind, in the past and present, have recognized intellectual power. Observation and experiment have confirmed the belief that the brain is the appointed organ which displays the passions, the emotions, the moral affections; that it is the material temple from which the will issues its behests to the various divisions of organic life under its control, and to which the ever-changing impressions received by the five organs of sense are finally communicated.

The number of convolutions on the surface of the brain proper, which latter occupies the whole anterior, and a considerable part of the posterior chamber of the skull, is in the direct ratio of the advancement of intellectual power. In infancy the convolutions are imperfectly developed, and the intellect consequently feeble. The manifestations of intellect increase with age, as the convolutions increase in matter and size. If any accident arise by which the growth of the convolutions is destroyed, the mental powers remain stationary or degenerate into idiocy.

It is to the means which the convolutions afford of compressing the most matter into the smallest compass, that we must refer their specific uses.

In large accumulations of water in the brain, arising from the ventricles at its base, gradually distending and unfolding all the anterior and lateral convolutions, the intellect will remain comparatively unimpaired, if the skull, at the same time, proportionally enlarges. The outer portions of the convolutions consist of the cortical or gray matter of the brain covered directly by the pia mater, inclosing a more fibrous, marrow-like texture.

In examining these convolutions, in the ascending scale of intelligence from brute to man, we mark a progressive increase in their complications: while in animals of little intelligence, the convolutions scarcely rise above their base, they are deeper and more numerous in those endowed with greater intellectual power. This fact, taught by comparative anatomy, establishes another equally important—that mental power is proportioned to the size and complexity of the convolutions on the brain proper.

That perception, memory, the power of abstraction, and ideality, employ the convolutions as the instruments of corporeal action, that they are the seat of memory, the final resting-place of the sensations, where they take a specific form, and leave enduring mental marks, if we may so speak, of their impressions, is placed beyond the cavils of skepticism, by the fact before adduced, that the loss of this part of the brain is attended with an obliteration of these mental functions.

Injuries inflicted on the convolutions, even their removal, occasion not any pain.

They stand like intervening mental messengers between portions of the system not under the immediate influence of ordinary physical agency, aloof from action and sensation, yet registering the results of both, collectively and individually.

If, in cases of extreme cerebral irritation, the convolutions seem at times to be the source of pain or convulsions, the cause is rather to be ascribed to some morbid action in the white or fibrous portion of the brain, than in the gray matter which covers the surface of the convolutions.

If the membranes of the brain, from any cause, are in a state of inflammation, the mind is invariably affected in a degree proportioned to the physical derangement, more especially so if the last membrane, the pia mater, be the seat of the disease.

The cortical or gray substance of the brain, lying directly beneath this last membrane, is freely supplied with blood-vessels derived from it; the circulation of the one cannot consequently be affected without producing derangement in that of the other.

In low forms of delirium, as in that arising from the action of alcohol on the system, termed delirium tremens, the gray matter of the convolutions is found, on dissection, bloodless, no marks of inflammation exist; the same appearances are observed in the delirium of acute rheumatism and of gout.

Dissections of the brains of lunatics show disease in the gray matter of the convolutions, with thickening of the membranes of the arachnoid and pia mater.

Anatomical and physiological investigations have alike demonstrated the convolutions to be the centre of intellectual action; and that from their immediate union with the upper part of the medulla oblongata, the centre of actions dependent on the emotions, they may excite or be excited by them.

As changes in the intensity of light or sound may produce deranged sensations of sight or hearing, any change in the act of affording the necessary stimulus to the convolutions may give rise to that rapid development of ideas, which, being from under the control of the will, may assume the form of delirious raving.

If the workings of the mind are independent of the body, its manifestations are not; they are inexplicably connected with nervous force: upon no other hypothesis can we account for the bodily exhaustion which continued vigorous intellectual labor produces.

The material temple of intellect frequently falls prostrate before the workings of the immaterial presence which inhabits it, unable to bear the constant inroads made upon its walls.

How often is the lunatic asylum the last resort of those intellectual master-spirits, whose mental energies destroy the engine through which they act. The finely-wrought mechanism of the brain cannot withstand those powerful encroachments at times made upon it by high intellectual powers, united with unsated ambition: it requires and must have repose, or its functions become perverted, as in insanity, or perish, as in idiocy.

That precocity of intellect in childhood, so often cherished and indulged by false parental pride, is frequently fatal to intellectual vigor in maturer years. The too early employment of the brain impairs its organization; in some cases is productive of *hydrocephalus*, or water in the head, and other diseases dependent on the torpor arising from excessive action.

We would seriously admonish the friends and parents of youth never to sacrifice their early physical education (the proper development of the bones and muscles) to a false estimate of the value of that precocity to which the term "smartness" is in our country applied.

Excitement produced by intense emotion at the loss of a valued relative or friend, the sudden wreck of worldly fortune, exert the most injurious effects on the organic structure of the convolutions, and on the operations of mind as a necessary consequence. The lunatic asylums of our country are replete with examples of this kind.

CHAPTER IX.

Nervous Force and Electricity.

What is this Nervous Force or Power?—The Nerves are not Passive Agents—The application of a Poisonous Substance to a Nerve—Contact of a Solid Body—A Wound in the Sole of the Foot—Appalling Convulsions of Epilepsy—Strychnine: its effect on the Spinal Cord—Effects of Opium—Should be very cautiously used in Locked-Jaw—Nervous Polarity and the Cold Douche -Hydrocianic Acid--Comparison between the Nervous and Galvanic Fluid—The equalizing of the Electric Union--Absolute Contact between the Metals not essential—Nervous Action from a Centre—Matteucci, a Physiologist of Pisa—Galvani Nobile—Matteucci's Experiment on a Rabbit—The Electric Apparatus supplied by Nature.

WHAT is this nervous force or power, or whatever other name we may assign to it, which can exert the most destructive influence on the organ of its manifestations, and be itself injured by the effects which it has thus produced, which is so intimately connected with the corporeal functions and the workings of intellect? What, if any, are the points of resemblance between the electric fluid, its origin and effects, and this nervous force which holds in vassalage the mind and body? In the formation of its laws and the operation of its forces, there are many points of resemblance to the electric fluid, whatever reasons may be adduced for disputing the identity between the former and the latter.

That the nerves are not passive agents we know by the propagation of stimulus from their origin to their termination, in simply irritating either the one or the other. The application of certain poisonous substances to a nerve at any point, may destroy its inherent property, or produce a partial or total paralysis: vide the effects produced on the nervous system by opium, aconite, or belladonna.

The contact of a solid body will frequently produce great excitement. A spicula of bone from the alveolar process of the jaw, or even the stump of a molar tooth, by pressing on the maxillary nerves, (those of the jaws,) may produce the most excruciating forms of neuralgia; the disease may attack the eye and ear at the same time, indeed all the muscles of the face, owing to the means of nervous communication established between its various organs by branches of the fifth or trifacial nerve. Thus may a little point of bone, or even a small fleshy tumor, perhaps unnoticed or unheeded by the sufferer and his friends, pressing on one of the nerves of the jaws, or any other single nervous branch, throw the nerves by which it is surrounded and connected into a state of irritation, which will occasion the most acute suffering until the offending cause is removed. The most deplorable forms of paralysis may be thus occasioned. A wound in the sole of the foot or ball of the thumb, by means of nervous transmission to the spinal cord, and through it to the medulla oblongata, may involve a large number, if not all, of the motor or moving nerves, so as to induce contraction in all the muscles they supply, producing that fearful malady, lock-jaw, and universal cramp in the system.

The appalling convulsions in epilepsy arise from irritation of the brain involving the nerves of the spinal cord. Sometimes the convulsions attack only one side; in such cases the nerves of that side are affected, and the effect is produced on the opposite.

Some substances, of which strychnine is the chief, exert a peculiar influence somewhat resembling electric polarity on the spinal cord, if applied to it. If this poisonous drug be taken into the stomach in any quantity above fractions of a grain, a general state of cramp will be induced, while sensation remains unimpaired. So excited is the nervous system under its influence, that the slightest touch on the surface of the skin, or even a breath of wind blown upon it, will excite the most horrible convulsions; the whole extent of the spinal marrow is thrown into a high condition of polarity, and the medulla oblongata becomes involved in it; hence the closed or locked jaws, the dreadful spasmodic action of the muscles of the face, the almost unconquerable difficulties of swallowing. Opium will produce a similar polarity of the spinal cord; hence this narcotic and anti-spasmodic should be very cautiously used in cases of *locked-jaw*, particularly in large doses. This polarity of the spinal cord exists at times unaided by the effects of chemical stimulus; the examples do not, however, come within the limited purposes of these pages.

No application so effectually neutralizes this high state of nervous polarity in the diseases to which we have referred, as the application of *cold*, either in the form of the "cold douche," (dashing cold water over the frame,) or of ice along the spinal region and in that of the medulla oblongata. Hemlock and deadly night-shade judiciously administered, internally, will relieve it. Hydrocianic acid, though sometimes given, rarely produces any good effect: we might imagine this to be the case by observing the high polarity of the nervous system in animals or man poisoned by this subtle acid, who always die in a state of universal convulsions.

To follow our comparison between the galvanic and the nervous fluid, we state that to produce the force of voltaic electricity in the galvanic battery, it is essential that there be two distinct metals and an intervening compound liquid. When this latter interposing agent or compound brings into contact the opposing metals, a chemical action is produced which gives rise to an electric current in a direction *from* the metal most nearly allied to one or more of the elements contained in the liquid by which they have been united in action.

Thus, if sulphuric acid (oil of vitriol) be placed, in a diluted state, between two plates, one of zinc, the other of platinum, its oxygen is attracted to the zinc, which, in its turn, undergoing oxidation, unites with the sulphuric acid, and sulphate of zinc (commonly called white vitriol) is formed, which is dissolved as rapidly as formed in the liquid; its hydrogen is evolved at the plate of platinum. During the continuance of this action a singular phenomenon takes place: each molecular particle of the zinc, which is immersed in the fluid, and each particle of the fluid also, communicates specific force and quality to that which follows it, until the whole circuit from the zinc to the platinum, and from the platinum to the zinc, is, through the agency of the interposed fluid, in a state of electric equilibrium or polarity.

In the equalizing of this electric union, one metal may be supposed to be the origin or generator of the electric force; the other, its conductor or propeller. Absolute contact between the metals is not essential to the experiment; any conductor, merely touching the edges of both, will produce the desired effect. As the generating metal (zinc) sends forth the galvanic current through the medium conductor between the two plates, the platinum or propeller is raised in its temperature to an equality with that of the zinc.

That there are strong points of resemblance between the production and force of the galvanic current, and the corresponding elements of nervous force, must be admitted by all candid inquirers.

The sudden development of nervous force, when a stimulus, either mental or physical, is applied to a nerve, as in the sudden contraction of the glottis by stimulating the fibres of the glosso-pharyngeal nerves spread upon the fauces, resembles in a most remarkable degree the instantaneous evolution of the galvanic current under the chemical conditions we have explained. Both cease with equal rapidity when the states for their production no longer exist. Nor does the analogy rest here: there is an apparent if not a real similarity between them, in the conditions necessary to the development of both forces. In the production of the galvanic force we have dissimilar metals and an intermediate conductor: in the production of nervous force, as analogous, two kinds of nervous matter, the cortical or gray matter, the fibrous, and for an intervening conductor, the blood.

Nervous action from a centre never takes place independently of the united action of these separate kinds of nervous matter.

The relation existing between the metals in the battery and that in the nervous gray and white matter of the nerves or brain, somewhat detracts from the analogy, but does not destroy it. It is sufficient for the development of the galvanic force, that a wire of any dimensions connect a few points of the separated metals. In the production of nervous force, the points of contact between the white fibrous and gray cortical matter are much more numerous, the vesicles of the latter being abundantly brought in contact with the tissue containing the nervous fibre.

There is much in the connection between the gray and white matter of the convolutions to justify the supposition that every separate nervous fibre is connected with a vesicle of the convolutions, and that each of the latter, having thread-like appendages, may be regarded as a point of departure for one or more nervous fibres. If such an arrangement exists, we have still further analogy between the production of galvanic and nervous force: the nerve vesicles with the fibrous threads issuing from them, and the arterial system encircling both, form as distinct an apparatus for nervous polarity as the galvanic battery, with its zinc, platinum and sulphuric acid, for the polarity of electricity.

Matteucci, a celebrated physiologist of Pisa, in Italy, has clearly proved, by a set of minute and careful experiments, that an electric current is constantly taking place in the animal frame, more strongly marked in the muscles than in the nerves, and more powerful in the latter than in the brain; that the electric fluid passes from the interior to the surface of the muscle: but in instituting further experiments to find from what portions of the system most electric fluid might be obtained, he found that a greater *derived current* was derived from the brain than the nerves, and from the latter than the muscles, but that the *conducting power* of the latter exceeded by four times that of the former.

Galvani Nobile, another physiologist of Italy, has ascertained that in passing the galvanic current through the lumbar nerves of a frog, contractions occurred under different circumstances, according to the vitality in the nerves. He divides the vitality of the nerves into five periods: in the first, the direct current, or that directed from the *brain* to the *nerves*, causes contractions in the muscles on *closing* the electric circuit; the inverse current, or that from the nerves to the brain, produces similar effects upon *opening* it. In the second period, the *direct* current causes muscular contractions on *closing* the circuit, and slighter ones on *opening* it; the *inverse* current causes contractions only on opening it. In the third period, contractions occur only on closing the direct circuit, and on *opening* the *inverse*. In the fourth, contractions occur only on closing the direct current; and in the fifth, the nerve ceases to be influenced by the electrical stimulus.

Matteucci, in support of these observations, divided the sciatic or loin nerve of a rabbit, devoting one nerve to the direct, the other to the inverse current. On closing the direct current, contractions were produced in the limbs and back, with marked signs of animal suffering; the same phenomena resulted from closing the inverse current, and from opening both. After the nerve has been so exhausted as to produce but feeble contractions, it may be excited so as again to produce actions powerful as at the first, by an increase of the electric current.

If the phenomena above described do not prove an identity in the electric and nervous fluids, they show the nervous power as a polar force developed by molecular changes in nerves excited by various stimuli, of which, next to the mental, that of electricity is the *most powerful*.

The electric apparatus supplied by nature to some of the fish tribe, as the gymnotus electricus, torpedo, &c., furnish further evidence of the similarity between the nervous and electric fluids.

CHAPTER X.

Spinal Nerves.

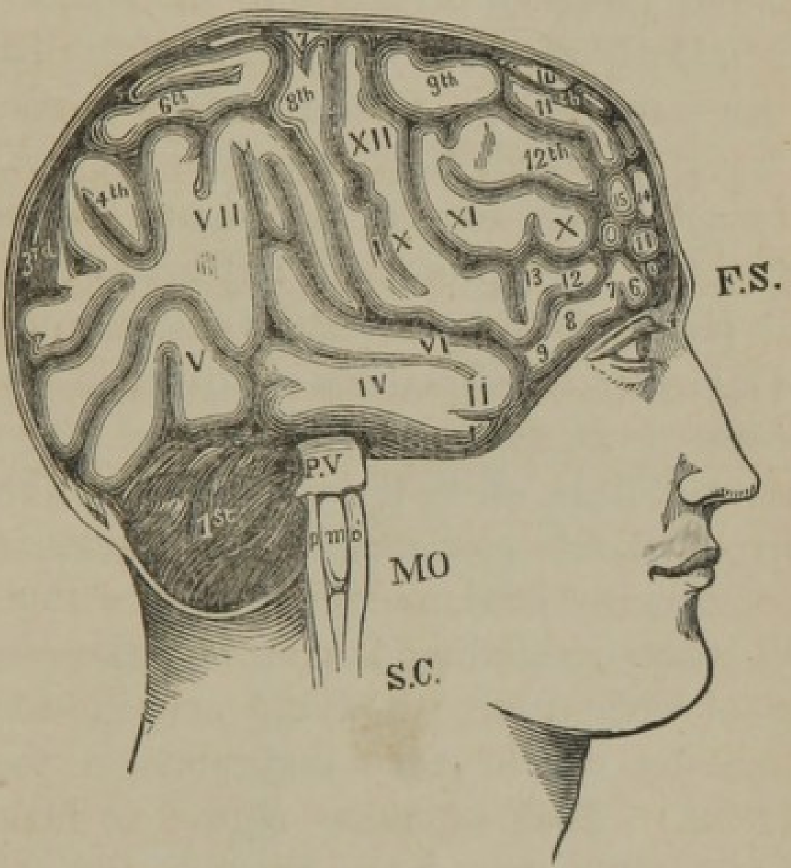
The Spinal Cord—Representation of the Medulla Oblongata—What will be seen by the Figure—Nerves at the Lower Joints of the Neck—The External Cutaneous Nerve—The Internal Cutaneous Nerve—The Median Nerve—The Ulnar Nerve—The Auricularis Magnus, or Large Ear Nerve—Formation of the descending Branches of the Cervical Plexus—The Communicans Noni—The Phrenic, or Midriff Nerve—Formation of the Posterior Cervical Plexus—The Dorsal, or Back Nerves—The Branches between the False Ribs—Branches of the Intercostal—Cutaneous Branch of the Last Dorsal—A Section of the Brain and Spinal Column—The Anterior Branches of the Lumbar Nerves—The Posterior Branches—The Muscular Cutaneous—The External Cutaneous—The Genito-Crural—The Femoral, or Thigh Nerve—Sympathetic Nerve—Representation and Description of the Sympathetic—Power of Contractility in the Coats of the Blood-vessels no longer disputed.

THE spinal cord, the centre of the spinal nerves which are especially devoted to sensation and action in the involuntary muscles, extends from the large hole at the base of the skull, nearly to the extremity of the spinal column.

Besides the strong band of muscles which surrounds, strengthens and protects it, it is still further preserved by three membranes, which, with the brain proper, the cerebellum and the medulla oblongata, are common to it, the *dura mater*, *pia mater*, and *arachnoid membrane*.

From its second membrane, the *arachnoid*, it is furnished with a serous moisture, and may thus be said to be suspended in a fluid medium, being immediately supported and maintained in its proper position by ties which stretch from the "dura" to the "pia mater," the first and last coverings. It is subdivided into three cords, corresponding with the anterior, middle or respiratory, and posterior columns of the medulla oblongata, as represented in the annexed figure.

Fig. 24.



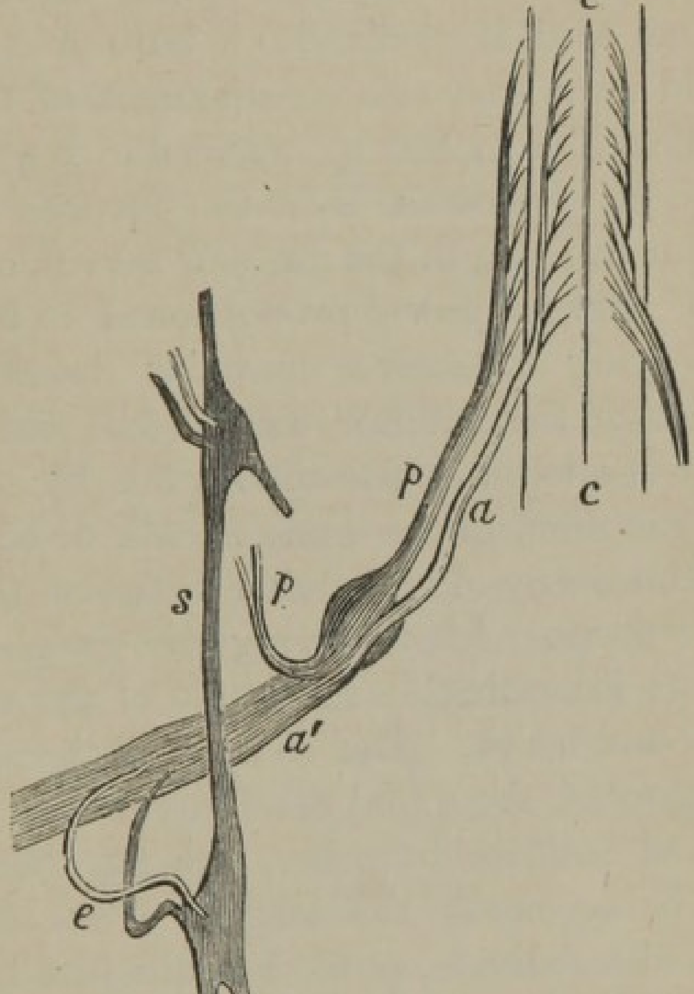
F. S. Frontal Sinus.
P. V. Pons Varolii.
M. O. Medulla Oblongata.

a. Anterior, *m.* Middle, *p.* Posterior	columns of the medulla oblongata.

S. C. Spinal Cord, on which its divisions are shaded to show the similarity of their arrangement with the columns of the medulla oblongata. The anterior column is that through which the brain acts on the nerves of muscular motion: the middle column, like that of the medulla oblongata, imparts sensation, if not motion also, to the muscles of respiration; the posterior column gives origin to those nerves which convey sensations to the brain. Thirty-one pairs of nerves proceed from the anterior and posterior divisions of the spinal cord, independently of those which arise from its central part, respiratory, to the various portions of the body to which they are destined. Among the spinal nerves the Great Ischiatic stands forward as the most prominent: it arises from the sacral plexus or web, and at its exit through the spine measures three quarters of an inch in breadth; it passes down the posterior part of the thigh about two thirds, where it divides into two branches, one of which passes under the posterior portion of the knee joint, under the name of Popliteal, which latter, descending down the leg, assumes the name of tibial, from supplying nervous force to the muscles which move that bone of the leg, (the tibia.) Each of these nerves is furnished with two roots, one in the anterior, the other in the posterior part of the spinal cord, which, uniting, proceed on their journey to fulfil the different functions with which they are charged: the former (anterior) giving effect to muscular motion; the latter (posterior) fullfilling the purposes of sensation to the various muscles, tendons and ligaments, upon which minute ramifications are spread after separating from its larger branches.

The following figure (from Tod, p. 205) will enable the reader to comprehend the construction of a spinal nerve.

FIG. 25.



c, *c*. The anterior fissure of the spinal cord.

a. The anterior root of the nerve.

p. The posterior root, with its ganglion or enlargement.

a. The anterior branch of the nerve.

p. The posterior branch.

s. Sympathetic nerve.

e. Its double junction with the anterior branch of the spinal nerve, by a white and gray filament, (a filament of action and sensation.)

By the above figure it will be seen that soon after the posterior root of a spinal nerve leaves the spinal cord, it swells into a bulb or ganglion: it would seem that this enlargement of the gray or cortical-like matter at particular portions of of the nervous system, is for the purpose of supplying or exciting in the anterior nerves, an extra share of nervous power proportioned to its waste in supplying extensive muscular development. The root of the anterior nerve (that which supplies power to muscular action) lies by the side of the ganglion, in the same sheath or covering, but without any direct union between their respective fibres. After leaving the ganglion, the two roots intermingle; the result of the union is a compound nerve. The compound thus formed passes through the spinal canal, divided in its posterior and anterior branches, (see fig. 25, *a*,) the former being much the larger. The branches divide and subdivide, until they are lost in those final ramifications which defy the powers of unaided sight, but whose existence is recognized by the aid of the microscope.

At the lower joints of the neck, four of the nerves which supply its muscles, with an equal number of those emerging from the upper part of the spine, immediately below the neck, pass into each other, separate and reunite, forming what is termed the brachial or arm plexus or web. This web, spread over the posterior part of the neck, and the upper part of the back, near the shoulder, passes to the axilla or arm-pit, and divides into six branches, which again subdivide into two groups, one supplying the internal and external muscles of the arm, the other those of the chest and shoulder-blade bone, above and below.

The *external cutaneous*. or musculo-cutaneous nerve, after passing between the biceps muscle and brachialis anticus, proceeds to the outer part of the elbow bend, and finally reaches the hand.

The *internal cutaneous*, after leaving the plexus, descends and pierces the muscles of the arm pits, runs down the inner side of the upper arm to the elbow bend, and to the inner part of the fore arm as far as the hand, where, by its branches, it communicates with the external cutaneous.

The *median nerve* of this plexus runs, as its name implies, down the middle of the arm to the palm of the hand, beneath the annular ligaments of the wrist joints.

The *humeral or arm branches*, from this plexus, supply the muscles of the chest and shoulder blade.

The *ulnar, or fourth descending nerve*, from this union, runs down the inner side of the arm, resting for some distance on the head of the triceps muscle: at the elbow joint it lies, externally, near the ulnar bone, giving rise, when that bone is struck or compressed on the external part of the elbow, to the thrilling nervous sensation known by the term "striking the funny bone."

Another plexus or web, termed the *cervical* or neck plexus, is formed of communicating loops between the four upper nerves of the neck from their anterior part, while the posterior branches form the posterior cervical plexus. This web rests principally upon the muscle which lifts the angle of the blade bone, and it is covered in by the outer layer of the muscles of the neck: its branches are three, one *ascending superficial*, one *descending superficial*, and a third passing to the deep-seated muscles of the chest and neck. The first, ascending superficial, crosses the sterno cleido mastoideus muscle, (muscle of the breast bone, collar bone, and a process of the temporal bone behind the ear,) and subdivides into two branches, one of which is distributed on the side of the neck, while the other ascends to the lower jaw, forming a web with the cervical branches of the facial or face nerve.

The second, *auricularis magnus*, or large ear nerve, communicates with the facial. It curves around the posterior border of the sterno cleido mastoideus muscle, ascends by the side of the jugular vein to the parotid gland, (a large gland in front of and rather below the ear, which secretes saliva,) where it subdivides, one branch supplying the posterior, the other the anterior muscles of the ear and side of the face. The *occipitalis minor*, or small ascending nerve, passes from the plexus to the muscle which is inserted into the lower and back part of the head. It ascends from the web along the posterior border of the sterno cleido mastoideus muscle, and is distributed on the back part of the head.

The descending branch of this plexus is formed of the *acromiales*, or nerves of the acromium, (the joint which unites the shoulder and blade bone,) and the *claviculares*, or nerves of the collar bone: its branches descend over the clavicle, and are distributed to the integuments of the chest and shoulder. The muscular branches are spread upon the muscles of the neck.

The deep-seated nerves of this plexus are formed of communicating filaments with the great sympathetic, the pneumogastric, and the nerves of the tongue.

The *communicans noni*, or ninth communicator, is a long, slender nerve, formed by filaments from the second and third nerves of the neck; it descends and forms a loop over the sheath of the carotid vessels with the *descendens noni*.

The *phrenic*, or midriff nerve, which belongs to this plexus, is formed by filaments from the third, fourth and fifth nerves of the neck; it descends to its lower part, crosses the subclavian (under-collar bone) artery, and enters the chest between it and the subclavian vein; within the chest it passes between the pleura (the covering of the lungs) and the pericardium, (the covering of the heart,) to the diaphragm or midriff muscle, which separates the chest from the abdominal region, to which its fibres are freely distributed.

The *posterior cervical plexus* is formed by branches from the first, second and third posterior nerves of the neck, forming loops of communication with each other beneath a large muscle, the *complexus* or complex, which forms no inconsiderable portion of the bulk at the back of the neck. All the nerves arising from the posterior cervical plexus, are distributed to the muscles on the back part of the neck, with the solitary exception of a large ascending branch of the second cervical, the great *occipital:* this nerve pierces the complexus, and ascends to the *occipito frontinalis* muscle, (or back and front muscle of the head,) on the posterior part of which its fibres are distributed.

In tracing the nerves arising from the *cervical plexus*, we are struck with the bond of sympathy which they establish, in health and disease, between different portions of the system. A division of the first branch, ascending, unites the neck nerves with those of the face; the second, the muscles of the neck, face, and ear, while it also controls, in some degree, the flow of saliva, by stimulating the parotid gland; the third, the muscles of the head with those of the neck, while the descending branches, with the phrenic or midriff nerve, hold an intimate relationship, for good or evil, with the chest, shoulder, neck, pleura, covering of the heart, lungs and heart.

The *dorsal*, or back nerves, are twelve in number, on either side of the spinal column: the first arises from that part of the cord which lies in the spinal canal, between the eighth and ninth vertebræ, descending from the base of the skull, and the last, between the nineteenth and twentieth, connecting in the same direction. Each of these nerves, after leaving the spinal cord, divides into two branches, one of which supplies the intercostal muscles, or those between the ribs, (from *inter*, between, and *costa*, a rib ;) the other, the muscles of the back. The intercostal branches are associated by filaments with the great sympathetic. Where the true ribs terminate, they pierce the pectoral muscle, or muscle of the chest, the intercostal muscles, and are distributed to the fascia forming the breast, and to the front of the chest.

The branches between the false ribs pass behind their cartilages, and supply the *rectus*, or short muscle of the abdomen. The first and last back nerves are exceptions to the general distributions of these nerves: the anterior branch of the first divides into two branches—a smaller, which takes the course of the intercostals, and a larger, which crosses the first rib obliquely and joins the *brachial* web, or plexus. The last dorsal nerve sends off a communicating branch to the first *lumbar* nerve, to assist in forming the *lumbar plexus.*

The branches of the intercostal are partly muscular and partly cutaneous ; the latter are nerves of sensation.

The cutaneous branch of the last dorsal nerve crosses the ridge of the haunch bone, and is distributed to the integument of the gluteal region, as far down as the trochanter major.

That portion of the spinal column included between the nineteenth and twenty-fourth vertebræ (inclusive) of the spinal column, has been termed *lumbar*, (from *lumbus*, a loin,) and the nerves issuing from the spinal cord between those vertebræ the lumbar nerves.

The following figures represent a section of the brain and spinal column, and an anterior view of the brain and spinal cord.

FIG. 26.

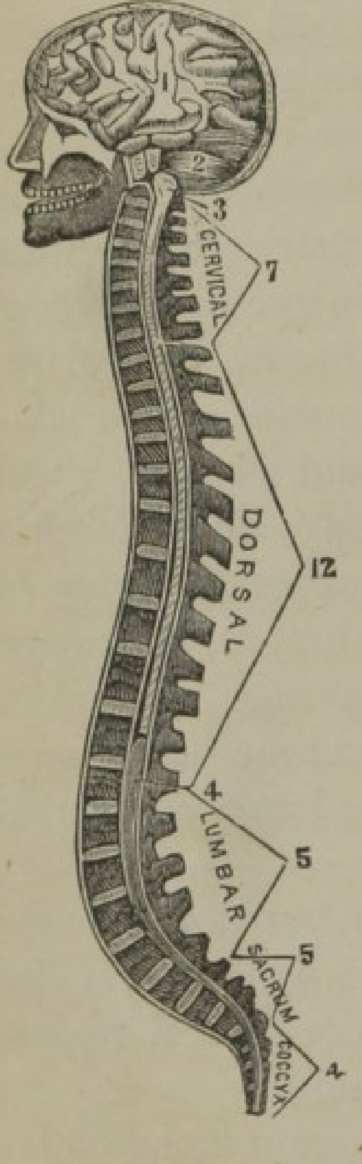
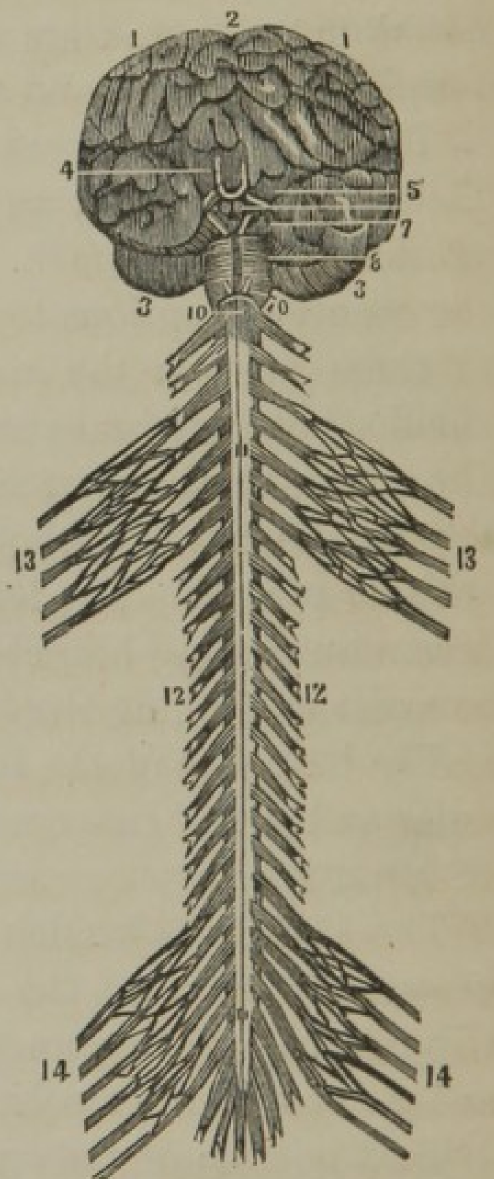


FIG. 27.



1. The cerebrum, or brain proper.
2. The cerebellum, or little brain.
3. The medulla oblongata within the *foramen magnum*, or large hole of the skull.

The cervical, or neck vertebræ, 7 in pairs.
The dorsal, or back vertebræ, 12 in pairs.
The lumbar, or loin vertebræ, 5 in pairs.
Sacral region, 5 in pairs.
Coccyx, 4 in pairs.

1--1. The two hemispheres of the brain proper.
3—3. The cerebellum, or little brain.
4. The olfactory nerve, (smelling.)
5. Optic nerve.
7. Third pair of nerves.
8. The pons Varolii.
9. Fourth pair of nerves.
10. The lower portion of the medulla oblongata.
11—11. Spinal cord.
12—12. Spinal nerves.
13—13. Brachial plexus.
14—14. Lumbar and sacral plexus.

The anterior or motor branches of the lumbar nerves increase in size from above downward, and form the lumbar plexus, or web, (fig. 27, 14,) being a union of filaments between the last anterior dorsal and four upper anterior lumbar nerves.

The posterior branches (sensitive) of the lumbar nerves pass to the muscles of the back and loins. The lumbar plexus has five branches: the *muscular cutaneous*, the *external cutaneous*, the *genito-crural*, or genital and leg, the *crural or femoral*, or leg and thigh, and the *obturator*.

The *muscular cutaneous* branch is distributed over the muscles of the hip and buttock; the muscular branch, after passing along the ridge of the haunch bone, is distributed on the abdominal muscles.

The *external cutaneous* proceeds from the second lumbar nerve, pierces the posterior fibres of the psoas muscle, (muscle of the loins,) crosses the two arteries in front of the flank, (iliac,) proceeds along the upper and outward spine of the haunch bone, and passing into the thigh among its anterior and posterior muscles, distributes its fibres to them.

The *genito-crural*, or genital and leg nerve, arises from the second nerve of the loins, traverses the psoas muscle, where it divides into two branches, one of which passes through the abdominal ring; the other crural, or leg branch, supplies nerves to the muscles on the internal part of the thigh.

The femoral (thigh) nerve, the largest division of the lumbar plexus, is formed by a union of the second, third, and fourth lumbar nerves; it passes under the psoas muscle between it and the flank muscles, supplying numerous nervous branches to both, and also fibres to the muscles of the thigh.

The *obturator* is formed by the union of two nervous branches: one from the third, the other from the fourth lumbar nerve. This nerve passes along the inner border of the line of the pelvis, or basin, at the lower end of the spine, to a hole, where it passes out, (filling the latter up; hence its name, from *obturare*, to fill up,) and joins the obturator artery. After escaping from the pelvis through the above foramen, it divides into an anterior and posterior branch; the anterior passing in front of the *adductor brevis* and *adductor longus* muscles, (see muscles,) to both of which it gives off nervous branches; the posterior (sensitive) branch passes behind the *adductor brevis*, supplying it, as also the *adductor longus*, with nervous fibres.

Sacral Nerves.—These nerves proceed from the spinal cord immediately below the last nerve of the lumbar region. Six pairs arise from this division of the spinal marrow, four of which, the upper anterior, uniting with the last nerve of the loins, form the plexus, or web, attached to this division of the spinal cord. (Fig. 27, 14—14.) From the plexus thus formed, nervous branches are sent out, which, again subdividing, impart nervous power to the muscles of the haunches, thigh, leg and foot.

Sympathetic Nerve.—The last to be mentioned, nevertheless one of the most important nerves in the whole body, is the sympathetic. The name assigned to this nerve explains its function: it sympathizes with every nerve in the system, either directly or indirectly. It extends along eaoh side of the spine from the head to the lowest division of bones in that flexible pillar.

In its downward progress, it forms between each vertebra, at the intervening cartilage, an enlargement, or ganglion, excepting in the neck; and hence it is sometimes called the ganglionic nerve.

Pervading, as it does, a large part of the human economy, forming a central bond of union between the action of muscles most distant from each other, and sensations arising from external and internal impressions on every part of the frame, its anatomy has for many years engaged the attention of the best physiologists.

The result of their labors has shown the sympathetic to be a compound nerve, formed of numerous tube-like fibres, issuing from the nerves of the spinal cord and from the vesicular matter of the ganglia.

Originating from distinct sources, like the anterior and posterior nerves of the spinal cord, these fibres, inclosed in the same sheath, travel on in company to their varied destinations.

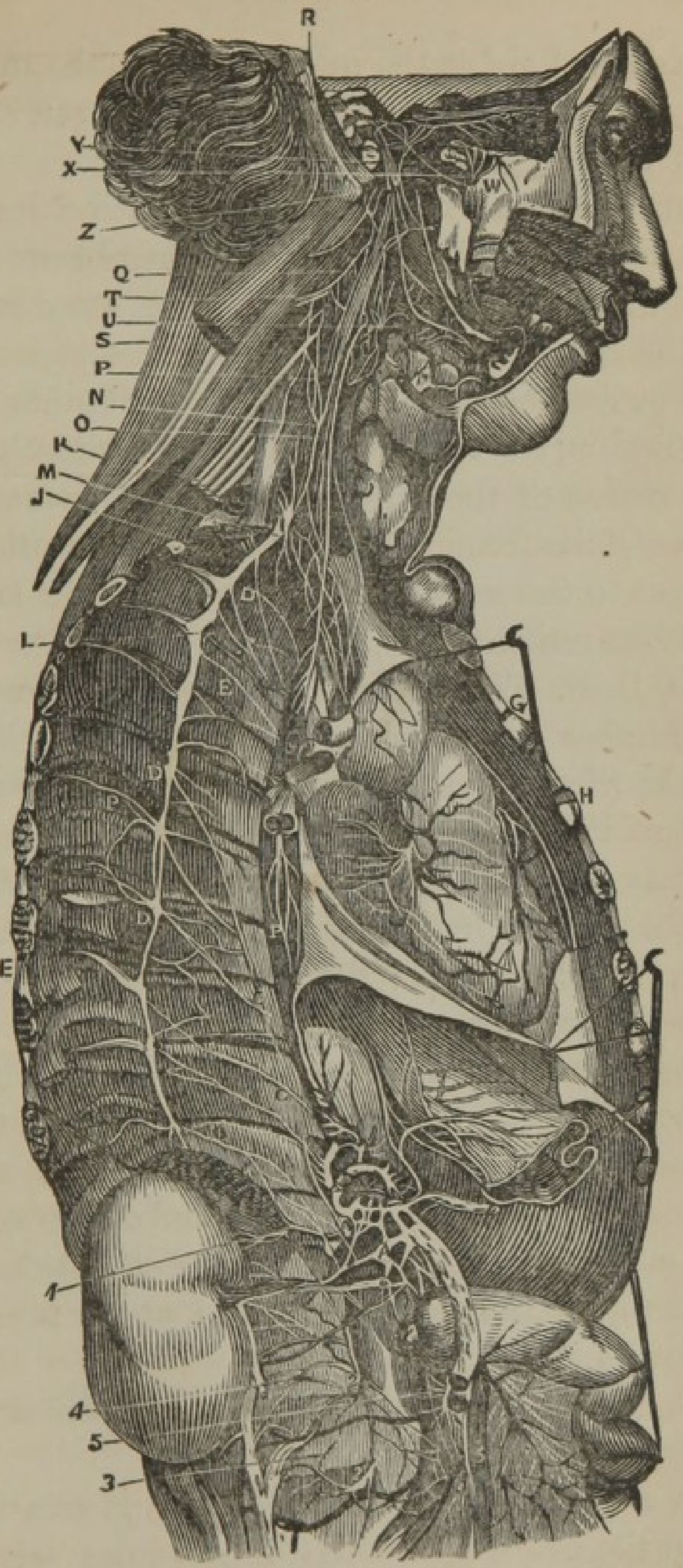
We give on the opposite page a representation of the sympathetic, its ganglia and connection with other nerves.

A, A, A. *Semilunar ganglion* and *solar plexus*, situated below the midriff and behind the stomach, in the region of what is called the pit of the stomach: the sense of severe pain, and disposition to vomit, which succeeds to a violent blow on the stomach at its lower part, are produced by the derangement of this ganglion.

The solar plexus, with most others in the abdomen, is mainly derived from two large ganglia of the sympathetic, situated in front of the aorta, or large artery of the body. The term *aorta* is derived from αηρ, air, and τηρεω, to keep—the ancients supposing, what was first disproved by the celebrated Harvey, that the arteries were air-tubes, not blood-vessels.

From the semilunar ganglion and solar plexus are formed various webs, or plexuses, which are

Fig. 28.



distributed about the midriff artery, the upper artery of the kidneys, to those of the liver, stomach and spleen, and also to the upper mesenteric, (from μεσος, the middle, and εντερον, the intestine; the mesentery being a tough membrane in the middle of the intestines by which they are held to the spine.)

The superior *mesenteric plexus*, with other nerves proceeding from the portion of the sympathetic in the region of the loins, forms the *inferior mesenteric plexus;* the former destined to give sensation and power to the muscles of the womb; the latter to the generative organs in man.

D, D, D. *The thoracic*, or *chest ganglia*, are twelve in number on each side; they rest upon the ends of the ribs, and send out four branches—the superior, inferior, external, and internal: the superior, as in all the sympathetic ganglia, are attached to the ganglia immediately above them; the inferior, to those below; the external branches, several in number, are connected with each of the spinal nerves. The internal branches of the five upper ganglia pass to the aorta; those of the lower ganglia unite in forming two large nerves, which descend in front of the spinal column, pierce the midriff, and form the semilunar ganglion and solar plexus, already referred to, at the pit of the stomach.

E, E. The *external* and *internal* branches above described.

G, H. *The right and left coronary plexus*, situate upon the heart, is derived almost exclusively from the cervical or neck plexus of the great sympathetic; situated as it is, so near the plexus of the chest, the disposition of this web is remarkable. With the exception of a few twigs from the pneumogastric, which winds around the heart, the coronary plexus is formed from nerves which have their origin in the cervical, or neck plexus.

J, N, Q. *The inferior, middle, and superior cervical ganglia.* The neck portion of the sympathetic is formed of three ganglia on each side, an inferior, middle, and superior: the middle ganglion is in many cases wanting.

The first branch, inferior, of the above ganglia, is situated on the lowest part of the neck, where it is fused with the first ganglion from the chest, and connected with the fifth, sixth, and seventh cervical nerves, and, at times, with the first nerve from the spinal cord.

The middle ganglion, when present, is opposite to the fifth vertebra of the neck: it divides into four branches, one of which joins the superior ganglion, a second, the inferior, and the third is connected with the third, fourth, and fifth spinal nerves of the neck; its fourth, or external branch, forms the middle nerve of the heart.

The superior neck ganglion descends from the upper part of the sympathetic to the third, sometimes the fourth and fifth vertebræ of the neck. Like all other ganglionic nerves, it divides into superior and inferior, external and internal branches; we may add to these branches of this ganglion, the *anterior*, *The neck ganglion* is connected by large branches with the second and third spinal nerves of the neck: its upper part sends off a branch to the carotid artery (from χαρος, lethargy; the ancients supposed this artery to be the seat of drowsiness) in the neck, and forms around this important blood-vessel a plexus, or nervous web. From this plexus, or web, it sends numerous nervous communications to the nerves of the *ear*, the *eye*, one or two to the sixth nerve, (a moving nerve of the eye,) to the third nerve, (moving nerve of the eyelids,) and to the eighth and ninth nerves at the point of their emergence from the skull.

The *renal plexus*, or that of the kidneys, is derived in part from the semilunar ganglion and solar plexus, posteriorly with which it is nearly on a level.

The *lumbar ganglia*, or those of the loins, it is unnecessary to describe minutely: they are four in number, situated on the outer bodies of the loin spinal bones, their superior and inferior branches communicating with the ganglia above and below; their external branches communicate with the lumbar spinal nerves, while the internal divide into two sets, the upper of which passes in front of the aorta, while the lower descends to give nervous power to the muscles at the lower section of the spine.

Sacral ganglia, situated at the lowest portion of the spine, send off nerves to the muscles of the posterior region.

The important organs contained in the chest, abdomen, and pelvis, are mainly supplied with nerves from the sympathetic.

This nerve seems to sustain a threefold office in the animal economy: first, that of a sensitive nerve to the parts to which it is distributed; secondly, a nerve of motion for certain muscles; and thirdly, it influences the functions of secretion and nutrition.

The power of contractility in the coats of the blood-vessels, no longer disputed by physiologists, is doubtless derived from the sympathetic, nor is it unreasonable to suppose, from its distribution over the glands in various parts of the system, that the *secretions* are materially affected by it. It does not appear, in itself, to be the seat of any peculiar nervous sympathies, but to be the great connector of those centres in which they have their origin.

CHAPTER XI.

The Nervous System—Its Hygiene.

What is a sine qua non to the Perfect Performance of the Functions of the Nervous System—What Connection exists between the Mind and Brain not the Subject of Inquiry—A Limit to Human Investigation—We know there is a Connection—The Condition on which it may be maintained—Hereditary Descent—Intermarriages between certain Degrees of Consanguinity—Entailment of Disease by Hereditary Descent—The Command given to the great Hebrew Law-giver—The Brain should not be Inactive—Pure Blood and Pure Air essential to a vigorous action of the Brain—External Agents—Consequences of their Effects being too long exerted—Continued Mental Action at any Period of Life Injurious—Particularly Injurious in Infancy—The Brain should not be Unusually Excited preceding or succeeding a Hearty Meal—The Morning of the Day the Proper Period for Mental Application—Reasons why it is so—Youth requires more Sleep than Age—Children in good Health require at least eight hours' Sleep—Feeble Children a longer Period—Mental Exertion must be controlled by Circumstances—Children whose Systems are not Developed—The Classification in Schools—At times highly Defective—Nature not to be flogged into Mental Exertion—Arrangement of Study essential—Brain should not be compelled to act in Opposition to its Physical Energies—Insanity—The Brain cannot, at one time, serve two Masters—Skull susceptible of Fracture from Slight Causes—Case of the Boy struck by a Teacher in a Western School—His subsequent Death and Post-Mortem Examination.

THE laws which are requisite in order to maintain a healthy state of the muscular powers, are equally necessary to preserve the integrity of the nervous system.

As a *sine qua non* to the perfect performance of the functions of the nervous system, whether those of the brain proper, (intellectual,) or of the medulla oblongata, (sensitive and motor,) or of the spinal cord, (sensitive and motor,) a primary healthy condition of the great cerebro-spinal centre (the brain and spinal marrow) must exist.

What connection exists between the mind and the brain, or how the sentient being perceives impressions through the nervous system, it is not our intention or our province to inquire. There is a limit to human investigation, as there is to human ambition: wherever the natural inquirer directs his eager flight, whether to the anatomy or physiology of animal or vegetable life, whether to the chemical attractions and repulsions of matter, or to those regions on which the eye of the astronomer lingers with untiring gaze and ceaseless wonder, he still meets with that line drawn, as a barrier, between the field that falls within the legitimate survey of the physical inquirer, and those unknown regions perhaps destined only to be revealed, by their Author, in the final recapitulating chapter of His mysterious operations. It is not permitted to finite intelligence to solve the great problems of Omniscience.

In reference to the mind and brain, we know there is a connection which can only be maintained in its best condition by a healthy state of the brain.

If the brain of the child be healthy, and is not forced by false notions of intellectual improvement into premature action, it is not likely, excepting from causes which have been detailed in these pages, to be deranged in after life.

Hereditary descent is one of the principal causes which give rise to nervous diseases: it may be traced in every form of insanity, from wandering intellect to the most furious maniacal paroxysms, and in those scrofulous affections which accompany families through successive generations, sometimes passing over one generation and attacking the next, but never becoming completely obliterated until the race is extinguished.

Intermarriages between certain degrees of consanguinity, particularly among the wealthy aristocracies of all countries, whose members are generally indolent epicureans, are a frequent cause of diseased nerves. Imbecility and idiocy are too frequently the heirlooms bestowed on successive generations, by these injudicious and unnatural alliances. The entailment of disease by hereditary descent is a most formidable evil; it throws obstacles in the way of recovery which can never be entirely removed; they are inseparable from the temperament in which they exist. Medical aid may indeed render them less formidable; but they are intrenched within the fortress of nature, secured and guarded by morbid associations which have existed from the foundation of the embryo, are coeval with the dawn of infantile existence, and will be totally eradicated only in the tomb.

If two individuals of weak frame and excitable nervous systems, injudiciously wedded, behold in the attenuated forms and pallid countenances of their offspring, the seeds of diseases to which death would be preferable, and will inevitably be the termination, as scrofula, madness or melancholy, let them not blame nature, but themselves, for the inauspicious consequences which have been entailed on their miserable progeny.

The command given to the great Hebrew law-giver, not to permit his people to marry within certain degrees of consanguinity, was and is in strict accordance with the laws of our being, and the wisdom of the prohibition has been confirmed by the experience of countless generations.

The brain should not be inactive. Well regulated action increases the power and the size of the brain; if constantly inactive, its size and power diminish: the great law of the muscular system, to wit, a *judicious alternation* of *activity* and repose, is equally applicable to the nervous system, and is the only true means by which the highest development of the intellectual faculties may be obtained.

To insure a healthy and vigorous action of the brain, pure blood is essential, and consequently pure air; but as we have before adverted to this physiological condition, in the remarks on the effects of carbonic acid gas, and impure air generally, on the nervous system, we must refer the reader to them. It is the absence of accustomed stimulus to the brain, which renders solitary confinement so painful to endure as to appal even the most daring profligates. The want of a proper activity in the intellect and emotions, is no uncommon cause of nervous diseases: it is the industrious mentally or physically, who are most happy; it is the industrious mentally *and* physically, who are most *healthful* and happy.

External agents acting unseasonably, or exerting their effects too long at any one period on the nervous system, are productive of serious evils. If we look at any object too long, the eye becomes bloodshot, its nerves become wearied and painful, and we are compelled to desist; perseverance in our gaze would produce greater irritation, ending perhaps in paralysis of the optic nerve and total loss of sight.

Continued mental action is at any period of life injurious, but particularly so in infancy. There is no period of life when intense mental exertion, long continued, does not produce an injurious effect on the brain; but in that of infancy, when its texture is soft, it may produce permanent mischief. The same observations we have made in reference to frequent muscular change in the young, apply with equal if not greater force to mental exertion. Yet how often is the brain of the precocious child racked to its centre, and stimulated to never-ceasing exertion, by rewards and praises for those intellectual achievements which have their origin in an excited brain supported by a weak physical fabric, daily undermined by the attempt to form *men* in intellect of *infants* in age.

The brain should not be unusually excited preceding or succeeding a hearty meal, or during the process of digestion. The mind and body are so intimately connected, that any extraordinary mental excitement, either directly before or after eating a full meal, will occasion indigestion: the stomach, through its nervous connection with the brain, will react upon that organ, and if continued, hypochondriasis will be the inevitable result.

The morning of the day, like that of life, is the proper period for mental application. There are many important indications presented to us that the early part of the day is most appropriate for great mental labor. If the arterial circulation has been disturbed during the preceding day or evening, its equilibrium has been restored during the hours of sleep; the nervous power has accumulated, and requires an object on which to expend its force; digestion does not interfere with the mental efforts of the brain; no extra amount of nervous force is demanded by the physical condition of other portions of the system; it may be concentrated on the object immediately before it.

Independently of the beneficial effects thus accruing to the subject of thought or study, by devoting the early hours of the day to its consideration, the physical necessities of the brain demand the night for repose.

If the student possess a high and excitable nervous temperament, sleepless nights will succeed great evening mental excitement; the mind cannot immediately divest itself of the image on which it has previously dwelt with intensity, the mental grasp will not relax; the circulation of the brain, a consequence of its continued nervous action, becomes quickened, its vessels overloaded; and cases are on record in which apoplexy or cerebral congestion has followed long-continued intense study at the close of the day.

Youth requires more sleep than age. The muscular and nervous systems alike substantiate the physiological truth that they require rest proportioned to the expenditure of their respective forces.

The development of the muscular system, the continued activity and general buoyancy, the mental efforts in study during childhood, independently of the processes of nutrition, digestion, circulation and respiration, are attended with immense expenditure of nervous force; the demand frequently exceeds the necessary supply, and evening finds the brain and the nervous and muscular systems of childhood in a state of great exhaustion: the rest must be proportioned to the expenditure, or the system will languish. Early hours of rest are essential to vigorous development, physically or mentally, in the young: the pallid cheek, the prematurely worn-out frame, the fretfulness of temper, and the general emaciation too often seen in children who are indulged (a term falsely applied) in sitting up late at night, too plainly and unfortunately attest this truth. Children in good health require at least eight hours' sleep—those of feeble constitutions a longer period.

Mental exertion must be controlled by circumstances. The power of the brain is modified by many circumstances—by original organization, sensual excesses, objects of study, the emotions and moral feelings. Some men may continue with impunity, a mental exertion which would destroy the feeble texture of the brain in others. Bonaparte was, and Webster and Brougham are, men of the former order:* endowed by nature with large brains and great physi-

* Since the above was written, the great statesman has departed this l fe. He died on Sunday morn:ng, between two and three A. M., October 24th, 1852.

cal development, nature seems to have selected them as among the great mental leaders of mankind. No fixed period of time can be allotted for mental labor in those whose systems have arrived at maturity.

Children whose nervous and muscular systems are not completely developed, can sustain, *with difficulty*, a much less amount than those of riper years. Nor will all children bear the same amount of mental exertion; their physical organization of the brain differ equally with those of men. Teachers and others interested in the education of youth, should have this truth deeply impressed upon their minds, and allow it to regulate their government.

The classification in schools of children of different ages, habits, physical conditions, and mental powers, is at times highly defective. The cane and the rod frequently applied to the seemingly indolent pupil, when placed in a class, the other members of which possess mental and physical powers greatly superior to his own, are instruments of *oppression* and *injustice*. Nature is not to be *flogged* into exertions beyond her power, to gratify the ambition of a teacher in obtaining the applause of a board of trustees.

Amount of mental labor is considerably influenced by general health and conditions in life: the general health must be good, the emotions and the passions be at rest, to secure the highest degree of mental exertion.

Arrangement of study is essential to the proper *direction of the moral and intellectual powers.* The repetition of an act, either physically, morally, or intellectually, greatly facilitates future progress. A gradual increase in the amount of mental labor invigorates the brain and increases the intellectual powers. Method and arrangement are essentials in the proper exercise of mental as well as physical force. He who acquires a habit of study at certain stated periods, will discharge his daily mental duties without occasioning that cerebral exhaustion which an equal amount of study will inevitably produce in those unaccustomed to regularity in their literary or scientific pursuits.

The brain should not be compelled to act in opposition to its physical energies, in obedience to the volition of the student. We imagine there are few individuals who have not, at times, experienced that want of mental concentration necessary to the solution of abstract questions in literature or science, an inaptitude over which high resolve to accomplish had no power, and which the repeated efforts of the will increased rather than diminished. Headache and vertigo or dizziness are the common results of this attempt to force beyond their power the energies of the brain.

In such cases the student should desist from his labors, and employ the mind on some less intricate subject, or cease from all mental exertion until the nervous force of the brain is properly recruited.

It is scarcely necessary to repeat what we have, in these pages, attempted to enforce with all the energy in our power, *that the mind should not be cultivated to the neglect of the physical powers.* The periods allotted to the education of youth should be equally divided in the cultivation of the mental, physical, and moral powers: such cultivation as leads to a proper development of the moral faculties is too often neglected in our institutions of learning, as if the means to obtain wealth were the only object deserving the attention of the rising generation. To the individual whose moral education has, in childhood, been properly directed, the casualties, the misfortunes of life, are disarmed of half their sting; he can look beyond the wreck of worldly fortune to that which is *within*, and be comforted in the midst of affliction. The long train of nervous diseases, hysterics, melancholy, epilepsy, apoplexy, and others, so often the effect of sudden impressions on the brain and nervous system, will pass by a mind thus matured as a transient cloud passes over the face of the sun.

Insanity will not in such cases be so often the effect of pride struggling against poverty; nor will imbecility and idiocy so frequently be the result of disorganization of the brain.

The brain cannot serve two masters at the same time. Nothing great has ever been accomplished in science or art by a brain the functions of which have been divided between two subjects: concentration of power is necessary to produce perfection. Praxiteles could never have produced the finest specimen of sculpture of which antiquity can boast, nor Rubens and Titian have breathed into the canvas the spirit and expression of life, had their mental attention been distracted at the time by other objects. When Nelson at Copenhagen, then second in command, was informed by a subordinate that the signal for recall was flying from the mast-head of the ship commanded by Admiral Parker, the first officer of the fleet, his reply was, "*Nail mine to the mast-head*:" his mental powers were concentrated on accomplishing a victory, and he succeeded. Napoleon Bonaparte may be adduced as another and more striking example of the power of mental concentration. When informed by his generals that it was impossible, at a particular season, during one of his marches into the Austrian dominions, to cross the Alps, "Let them be levelled," said the conqueror of Austerlitz. His mind was fixed on the accomplishment of a mighty purpose: he saw nothing but his army marching over the Alpine mountains.

The skull is susceptible of fracture from slight causes. Those intrusted with the care of youth should never, for any provocation, strike them on the head, particularly about the region of the temporal bone, where the skull, being thin and brittle, is most likely to fracture.

Instances of this kind, unfortunately, sometimes occur. A few years since, in one of our Western States, a boy, who either neglected his studies or disobeyed his teacher, was struck on the head by the latter with a ruler. The child at the time evinced some small degree of pain, but no danger was apprehended. On the return of the youth to his home, he was attacked with severe vomiting; a physician was sent for, who, supposing the boy was about to be attacked with fever, prescribed the usual remedies in such cases.

No improvement in the symptoms took place; the parents became alarmed; a medical consultation was required and acceded to, but the cause remained still undiscovered. The poor boy lingered for several days, and ultimately died, apparently of congestion of the brain. A post-mortem examination revealed the hidden cause—the skull had been fractured from the region of the ear to the top of the head! The bone pressing upon the brain had by sympathy deranged the action of the pneumogastric nerve, and produced the vomiting, which had been considered as the precursor of fever. So painful and yet so salutary a warning should not pass unheeded by those to whom the education and care of children are intrusted.

CHAPTER XII.

Doctrine of Life.

Seeds of Plants, Eggs of Fowls—Force in the Egg—Putrefaction—Health—First Condition essential to the Integrity of Vital Action—The Phenomena of Starvation—Effects of protracted Abstinence—Second Condition necessary for the Preservation of Organic Force—The Third Condition—Theory of Combustion—Principal Source of Animal Heat—Quantity of Carbon exhaled from the Lungs in Health per Hour—Clothing an Equivalent for a certain Amount of Food—The Kind and Quantity of Food—The Cooling of the Body—Effects of loud and continued Speaking, Crying of Infants, &c.—Connection of Vital Force and Animal Electricity—Subject of Animal Electricity New—Analysis of Electricity in Man, by Professor Müller, of Berlin—The Connection between the Human Body, in Health and Disease, and Electricity, will be shown in the next Chapter.

In the seeds of plants, the eggs of fowls, and the ova of mammalia, we recognize the presence of a remarkable force; which, under the influence of external agencies, such as impregnation, warmth, air and moisture, is roused into action, and exhibits, as the product of its activity, the development of organic forms. Thus, the grain of wheat placed in the earth by the husbandman, under the influence of the atmosphere, the moisture of the soil, and the rays of the sun, germinates, is developed into a plant, and reproduces many seeds of its own kind, through the agency of the vitality resident in it. So again, in the egg of the domestic fowl there exists a peculiar force, which is brought into action by the process of incubation, and which directs the phenomena of development and growth in such a manner that the chicken is produced with unerring certainty. There is also a similar force which presides over the development of the human embryo, and causes the elements of matter to be so combined together, that the infant, the child, and the man are successively produced. This force, found only in organized or living matter, and so different from all other forces in nature, is properly termed the *vital force*. Again, it appears in living animal tissue, not only as a cause of growth or development, but also as a power acting in opposition to those external agencies which tend to alter the form, structure, and composition of the tissue in which the vital energy resides. The amount of resistance which is offered to various external destructive agencies by the vital force, will be most readily understood by a reference to the phenomena which occur in the *dead* body. It is well known that soon after death the putrefactive process commences; that by this process, the body becomes darkened, presents a swollen appearance, exhales noisome odors, its tissues become softened, and finally so changed in character, it entirely disappears. Putrefaction consists in the operation of various chemical forces under the influence of the atmosphere, warmth, and moisture. Decomposition of the body occurs subsequent to death, because all resistance on the part of the vital force has ceased. The destructive chemical forces were just as active during life, but they produced no sensible effect in consequence of the resistance of the vital force. Death is therefore that condition in which the resistance effected by the vital force entirely ceases; and thus we see that life consists in a ceaseless antagonism between the forces of decay and the vital energy.

Health is that state of the body in which these opposing forces are properly balanced. If the sum of the vital force exceeds that of the destructive forces, the result will be an increase in the size of the tissue in which vitality resides; but if, on the other hand, the sum of the vital force is less than the sum of the destructive forces, the result will be emaciation or atrophy. This proposition is strikingly exemplified in the growth of childhood and the decay of old age.

When we consider that, at each moment of life, a change is constantly going on in the matter which composes the organism; that a portion of the structure is incessantly undergoing a transformation into unorganized matter, and therefore losing its vital condition; that every motion, every manifestation of physical force, every contraction of a muscle is accompanied by the transformation of matter just described; that every act of the mind, every conception, every mental affection is followed by changes in the chemical composition of the secretions of the body; that every thought, every sensation is accompanied by a change in the composition of the substance of the brain; we can readily understand that certain conditions must be fulfilled, in order to preserve the activity of the vital force, and to maintain the phenomena of life.

The *first* condition essential to the integrity of the vital actions in animal bodies, is an adequate supply of fresh matter, to take the place of that which is constantly passing into decomposition, and, in this shape, is excreted from the body. This supply of new matter is furnished in the form of food or nutriment, which is first taken into the stomach, and after undergoing in that organ a chemical solution, is commingled with the bile and passed downwards into the small intestines, from which it is taken up by the absorbent vessels, and poured by them into the general circulation of the blood. The fresh plastic material, mixed with the florid currents of life, is conveyed into the capillary vessels of all the tissues of the body, where, under the operation of the vital force, it speedily becomes an integral portion of the animal body, and in turn is transformed into dead matter and cast off as an effete substance. A portion of the food we daily consume is probably never organized into, or united with, the component tissues of the body, but is immediately used up in the maintenance of the vital processes. The phenomena of starvation are well known, and seem fitly to illustrate the intimate relation which exists between the supply of food and the activity of the vital force. We know that protracted abstinence from food, in whatever manner produced, causes the human body to become emaciated, the eyes and cheeks to sink, the bones to project, the face to become pale and ghastly, the eyes wild and glistening, the breath hot, the mouth dry and parched, the strength to be greatly prostrated, the body to exhale a fetid odor, and death to supervene in a fit of maniacal delirium, or in horrible convulsions. On post-mortem examination, in cases of death by starvation, we find the following appearances: The body is much emaciated, and exhales an intolerable odor, the eyes are red and open, the skin, mouth, and throat dry, the stomach and intestines empty and contracted, the heart, lungs, and large vessels collapsed and destitute of blood, and putrefaction runs a rapid course. It should also be recollected that there are certain maladies, such as closure of the gullet, organic diseases of the stomach and of the intestinal absorbent vessels, which prove fatal by starvation.

The *second* condition necessary for the preservation of the organic force in an active state, is an adequate supply of pure atmospheric air. Physiologists have demonstrated the intimate relation which exists between oxygen, one of the constituent elements of the atmosphere, and the vital processes in animated nature. During the process of respiration in animals, the venous blood gives off a portion of the carbonic acid with which it is charged, and absorbs in place thereof oxygen from the air contained in the little cells which constitute a great part of the volume of the lungs. By this interchange of carbonic acid for oxygen in the lungs, the blood loses the purple color it possessed on entering them, and acquires a bright red hue, while the pulmonic air suffers an increase in the quantity of its carbon and a diminution in the quantity of its oxygen. But the blood charged with oxygen (arterialized) passes on from the delicate membranaceous walls of the pulmonic air-cells through the pulmonary veins into the left side of the heart, and from this central organ it is distributed through the arteries to all the tissues of the body. When the scarlet streams of life reach the ultimate subdivisions of the arteries and enter the capillaries, or little hair-like tubes which connect the arteries and veins together, they bear still on their bosom the increased proportion of oxygen received in the lungs; but during their passage through the capillaries they part with this excess of oxygen, and take up in place of it carbonic acid and water. In this manner the blood loses the scarlet hue, and assumes a purple color, or in other words, is changed from arterial to venous blood. Now what other phenomena attend the giving off of oxygen from the arterial blood in the capillaries, and the absorption of carbonic acid gas and water in its stead? The oxygen passes through the thin membranous wall of the capillaries, and under the direction of the nervous and vital energies, and partly by its chemical affinity, unites with the carbon and hydrogen contained in the tissues, causing the death of the matter with which it combines, and giving carbonic acid gas as the product of its union with carbon, and water as the product of its union with hydrogen. The carbonic acid and water thus formed, are taken up by the blood, which now assumes the venous character, and is carried away in its current to be excreted or cast off from the body as effete or useless matter, through the lungs and other organs. While the blood is undergoing the process of purification, that is, is giving off the excess of carbonic acid gas and water, it again absorbs oxygen from the atmosphere, becomes arterialized afresh, and is then distributed to the capillary vessels in every part of the body, to repeat the destructive process above described.

But to supply the waste of the organic tissues occasioned by the combination of the oxygen of arterial blood with the elements (carbon and hydrogen) of these tissues, the Author of nature has wisely provided that the current of blood, which carries oxygen to the tissues, shall also carry to the same destination the nutritious principles of food, previously elaborated in the stomach and intestines. In the meshes of the net-works formed by the capillaries in every part of the body, the new plastic material, furnished from food, becomes a component part of the organism, under the direction of the vital force, and thus the waste of tissue occasioned by the action of oxygen may be fully compensated. We are now better prepared to understand the phenomena of starvation, to which allusion has already been made. We can easily see that, if the process of destruction and removal of the elements of tissue by the action of oxygen goes on for a considerable time, and the place of the organized matter, so destroyed and removed, is not supplied by fresh matter derived from the food, emaciation must ensue. We can also readily understand that, as emaciation increases, the vital energy becomes weaker and weaker, until it ceases entirely to act, and death is the result.

The *third* condition essential to the performance of the vital actions in animals, is the maintenance of a proper degree of warmth. As in chemistry, a certain temperature is required for the formation of many binary compounds, so in the human body, all the organic processes require a temperature of about 100 degrees. Every person knows that if, through the agency of atmospheric cold, the temperature of the body is depressed below a certain point, death is produced, that is, the vital force ceases to act. Now, in view of the necessity of a certain degree of warmth, for the proper performance of the vital functions, the Almighty, in His wisdom, ordained that the human body should be a self-heating machine, or in other words, that it should have the power of developing and regulating the quantity of heat required for its organic processes. A singular fact illustrative of the skilful adaptation of the various processes going on in the body to each other, and their natural dependence, under the varying external conditions in which the individual may be placed, is, that the temperature of the human body remains the same beneath the burning sun of the tropics, and amid the eternal snows which surround the poles ; for it is clear that a much larger quantity of heat generated by vital processes, is required to maintain the temperature of the body at a given point in the frigid than in the equatorial regions.

We stated in another paragraph, that, by the action of the oxygen conveyed to the tissues of the organism by arterialized blood, the substance of those tissues is decomposed, and converted into carbonic acid gas and water, because the oxygen unites with the carbon and hydrogen of the tissues. Now when charcoal (carbon) is placed in a grate or furnace with some lighted shavings, the oxygen of the atmosphere unites with the charcoal, and such chemical union is termed combustion, the well-known phenomena of which are the production of heat, light, and carbonic acid gas. Again, in whatever way carbon may combine with oxygen, the act of combination cannot take place without the disengagement of heat. It is a matter of indifference whether the combination take place rapidly or slowly, at a high or a low temperature; the amount of heat liberated is a constant quantity. The carbon of the food, which is converted into carbonic acid within the body, must give out exactly as much heat as if it had been directly burnt in the open air or in oxygen gas: the only difference is that the amount of heat produced is diffused over unequal times. In oxygen the combustion is more rapid, and the heat more intense; in air it is slower, the temperature is not raised so high, but it continues longer. (Liebig.)

The *principal source of animal heat* is, therefore, the mutual action between the elements of the tissues, food, and oxygen, conveyed by the circulation of the blood to every part of the body; or in other words, animal heat is generated mainly by the combustion of the food and tissues of the body through the agency of the oxygen of arterial blood.

The quantity of oxygen withdrawn from the atmosphere each day and introduced within the system of an adult, is very considerable. Baron Liebig estimates it at about thirty-two and a half ounces. It is also clear that the quantity of oxygen consumed by the vital processes of the animal body is not constant, but varies according to the temperature of the atmosphere in which the animal is placed. The author just cited, says: "The animal body is a heated mass, which bears the same relation to surrounding objects as that of any other heated mass. It receives heat when the surrounding objects are hotter, and loses heat when they are colder. We know that the rapidity of cooling increases with the difference between the temperature of the heated body and that of the surrounding medium; that is, the colder the surrounding medium the shorter the time required for the cooling of the former. How unequal then must be the loss of heat in a man at Palermo, where the external temperature is nearly equal to that of the body, and in the polar regions, where the external temperature is from seventy to ninety degrees lower."

The quantity of carbonic acid gas exhaled from the lungs of a healthy adult, under ordinary circumstances, amounts to 1345.3 cubic inches, or about 636 grains per hour, according to the experiments of Valentin and Brunner. This estimate corresponds pretty closely with the one furnished by Sir H. Davy, and does not widely differ from the results of experiments made by Allen and Pepys, and by Lavoisier. If this estimate be correct, the weight of pure carbon given off from the lungs is about 173 grains per hour, or 8 ounces per day. Andral and Gavarret have calculated the average quantity of carbon excreted from the lungs of a healthy adult, at 9 ounces in 24 hours.

Carbon is expelled from the organism as effete matter by the skin as well as the lungs. Though the quantity which escapes by the latter outlet is much greater than that passing out by the former, still the amount which is exhaled from the skin, commingled with the perspiration, should not be overlooked. Liebig estimates the total quantity excreted from the lungs and skin together, at 13.9 ounces per day.

Again, as the quantity of oxygen, taken into the system by the respiratory process, varies with the external conditions which surround the individual, so the quantity of carbon, exhaled from the system, varies with the same circumstances. In the polar regions a larger quantity of heat is necessary, in order to maintain the temperature of the body at a given point, than in temperate and equatorial regions, and we accordingly find a corresponding increase in the quantity of oxygen consumed and of carbon excreted. Observations made at various temperatures, ranging between 38 deg. and 75 deg. Fahr., show that every increase of temperature equal to 10 deg. Fahr. causes a diminution of about two cubic inches in the quantity of carbonic acid gas exhaled per minute. Experiments made on animals at much higher and lower temperatures than the above, also show that the higher the temperature of the respired air, the less is the amount of carbonic acid gas exhaled into it, while the nearer it approaches zero the more does the carbonic acid increase.

"It is evident that the supply of animal heat, lost from the body by radiation and conduction, is kept up by the chemical action of the oxygen of arterial blood upon the elements of food and tissue. If we may be permitted to use a familiar illustration, the animal body acts, in this respect, as a furnace, which we supply with fuel. It signifies nothing what intermediate forms food may assume, for the last change is uniformly the conversion of its carbon into carbonic acid, and of its hydrogen into water; the unassimilated nitrogen of the food, along with the unburned or unoxidized carbon, is expelled in the urine or in the solid fæces. In order to maintain a constant or uniform temperature in the furnace, we must vary the supply of fuel according to the external temperature, that is, according to the supply of oxygen.

"In the animal body the food is the fuel; and with a proper supply of oxygen, a just degree of heat is produced by its oxidation or combustion. In winter, when we take exercise in a cold atmosphere, and when consequently the amount of inspired oxygen increases, the necessity for food containing carbon and hydrogen increases in the same ratio; and by gratifying the appetite thus excited, we obtain the most efficient protection against the most piercing cold. A starving man is soon frozen to death; and animals of prey in the arctic regions, far exceed in voracity those of the torrid zone.

"In cold and temperate climates, the air, which incessantly strives to consume the body, urges man to laborious efforts in order to furnish the means of resistance to its action, while in hot climates the necessity of labor to provide food is far less urgent.

"Our clothing is merely an equivalent for a certain amount of food. The more warmly we are clothed the less urgent becomes the appetite, because the loss of heat by cooling, and consequently the amount of heat to be supplied by the food, is diminished. If we were naked, like certain savage tribes, or if in hunting or fishing we were exposed to the same degree of cold as the Samoiedes, we should be able with ease to consume ten pounds of flesh and perhaps a dozen tallow candles daily, as warmly-clad travellers have related of these people with astonishment. We should then, also, be able to take the same quantity of train oil without bad effects, because the carbon and hydrogen of this substance would only suffice to keep up the equilibrium between the external temperature and that of our bodies.

"The kind and quantity of food should therefore be regulated by the temperature of the atmosphere, by the quantity of heat given off to the surrounding medium, and by the amount of physical labor which the individual undergoes.

"The cooling of the body, generally, increases the amount of food necessary to supply the vital processes. The mere exposure to the open air, in a carriage or on the deck of a ship, by increasing radiation and evaporation from the surface, increases the loss of heat, and compels us to eat more than usual. The same is true of those who drink large quantities of cold water, which is mostly given off in the form of vapor at the temperature of the body, (98.5 deg.) It increases the appetite, and persons of weak constitutions find it necessary, by continued exercise, to supply the system with the oxygen required to restore the heat abstracted by the cold water. Loud and continued speaking, the crying of infants, moist air, all exert a decided and appreciable influence on the appetite for food and the amount of it which is taken." (Liebig.)

In the preceding paragraphs we have dwelt at some length upon the evolution of animal heat by the chemical combination between the oxygen of the blood in the capillary vessels and the carbon of the tissues, giving carbonic acid gas as the product of such combination. However, the combustion of another element of food and tissue, hydrogen, plays a no less important part in the heating process of the animal than carbon. The constant product of the union of oxygen and hydrogen is water. This fluid is excreted from the body by the kidneys, and is also exhaled from the organism in the form of vapor, through the skin and lungs. The whole quantity of water lost by exhalation from the cutaneous and respiratory surfaces of a healthy man, according to the experiments of Valentin, averages about three and a half pounds per day, of which two and a half pounds represent the amount of cutaneous exhalation, both sensible and insensible, and the remaining pound represents the amount of watery vapor expired from the lungs. But it should be borne in mind that the quantity of aqueous vapor lost by expiration and transpiration is not constantly the same, and that it is powerfully influenced by the temperature, the hygrometric state, and the stillness of the atmosphere, and the amount of exercise or physical labor performed by the individual.

Intimately connected with the manifestations of the vital force, of which we have been speaking in the preceding pages, is another subject which demands a brief notice at our hands; and that subject is *animal electricity.* Throughout the domain of inanimate nature various changes in the form and relation of matter are accompanied by a disturbance of the equilibrium of the electric fluid, in consequence of which currents of that fluid are produced, which continue till the equilibrium is completely restored. If we bear in mind the changes in the form of matter, which are incessantly occurring in every part of the organism, through the combustion of the food and the tissues by means of oxygen, we shall not be surprised to find that the human body is pervaded with electrical currents, generated, so far as we know, by the changes in the form of matter to which we have alluded. That animal electricity, or electrical currents excited by the organic processes in animal bodies, performs a very important part in the phenomena of life, we cannot doubt, although in the present state of science we are not prepared to make an exact and complete statement of what that part is.

The subject of animal electricity is comparatively new. It is also one to which the minds of many acute observers are now turned, and rapid advancement in the knowledge of it is almost daily made. We now propose to make a brief exposition of what is at present known concerning animal electricity, and for this purpose shall quote the statements of Professor Müller, of Berlin, and the later views of Dr. Emil du Bois-Reymond.

With regard to free electricity in man, the results obtained from experiments performed with the aid of delicate electrometers, according to Müller, are the following:

1. As a general rule, the kind of electricity evidenced by man in the healthy state is the positive.

2. It seldom exceeds in intensity the electricity excited when copper, which communicates by a conducting substance with the earth, comes in contact with zinc.

3. Excitable persons of a sanguine temperament have more free electricity than indolent persons of a phlegmatic temperament.

4. The quantity of electricity is greater in the evening than at other periods of the day.

5. Women are more frequently negatively electric than men, although there is no determinate rule for the greater prevalence of this kind of electricity in them.

6. In winter, the bodies of persons who are very cold, at first give evidence of no electricity; but it gradually becomes manifest as warmth is restored.

7. The body, when perfectly naked, manifests the same phenomena, which are also common to all parts of it.

8. During the continuance of rheumatic affections, the electricity of the body seems to be reduced to zero, and to become manifest again as the disease subsides. It appeared to Humboldt also that rheumatic patients had an insulating action on the feeble current produced by a simple galvanic circle.

The following have been published as the conclusions drawn from Du Bois-Reymond's researches:

1. The muscles and nerves, including the brain and spinal cord, are endowed during life with an electro-motive power, (*i. e.*, the power to produce currents of electricity.)

2. This electro-motive power acts according to a definite law, which is the same in the nerves and muscles, and may be briefly stated as the law of the antagonism of the longitudinal surface, (*i. e.*, the

surface of the sides,) and of the surface of the transverse section, (*i. e.*, the surface of the ends.) The electrical current on the *longitudinal* surface is *positive*, and that on the *transverse* section, *negative*.

3. As the nerves have no natural transverse section, their electro-motive power, in a state of rest, is not appreciable by the electrometer, unless they have previously been divided.

4. The muscles have two natural transverse sections, (one at each extremity,) and may show their electro-motive power without being divided. However, the electro-motive power of the undissected muscle is often more or less concealed by the contrary action of a muscular layer situated on the natural transverse section, called the *parelectronomic* (equal electric) layer. The contrary electro-motive power of the parelectronomic layer may be increased by cooling the animal.

5. Every minute particle of the nerves and muscles acts according to the same law as the whole nerve or muscle.

6. The electrical currents which the nerves and muscles produce in circuits, of which they form part, must be considered only as derived portions of much more intense currents, circulating in the interior of the nerves and muscles around their ultimate particles.

7. The electro-motive power lasts after death, or in dissected nerves and muscles after separation from the body of the animal, as long as the excitability of the nervous and muscular fibre continues; and this obtains whether these fibres are

allowed to die gradually from the cessation of the conditions necessary to the support of life, or whether they are suddenly deprived of their vital properties by heat, the action of chemical agents, &c.

8. In different contractile tissues of the body the electro-motive power is always proportioned to the mechanical power of the tissue.

9. Other animal tissues may, indeed, produce electro-motive action; but it is neither so strong as the same action of the nerves and muscles, nor so regular; nor does it vanish when vitality ceases to exist in the tissues; nor does it, lastly, undergo those sudden variations of intensity and direction, which may be thus briefly stated:

10. The electrical current in muscles when in the act of contraction, and in nerves when conveying motion or sensation, undergoes a sudden and great negative variation of its intensity.

11. Muscles inactive from the contrary action of the parelectronomic layer, when contracting, become active in the opposite direction to that which muscles in a state of rest exhibit. Hence it must be concluded that the electro-motive force of the parelectronomic layer remains constant in the act of contraction.

12. The negative variation of the musculo-electrical current is not a permanent one during permanent contractions. It consists rather of a series of single and sudden variations of the intensity, following each other in rapid succession.

13. It has not yet been ascertained whether, in

the act of contraction, the muscular current is only diminished or wholly vanishes, or whether itchanges its direction.

14. After the contraction has ceased, the current does not suddenly recover its original intensity; but the protracted contraction of the muscle has a slight subsequent influence on the intensity of the current.

15. The negative variation of the muscular current in the act of contraction fully explains Matteucci's so-called induced contractions.

16. If any part of a nerve is submitted to the action of a permanent current of electricity, the nerve in its whole extent suddenly undergoes a material change in its internal constitution, which disappears on breaking the circuit, as suddenly as it came on. This change, which is called the *electrotonic* state, is evidenced by a new electro-motive power, which every point of the whole length of the nerve acquires during the passage of the current, so as to produce, in addition to the usual current, a current in the direction of the extrinsic current. As regards this new mode of action, the nerve may be compared to a voltaic pile, and the transverse section loses its essential import. Hence the electric effects of the nerve, when in the electrotonic state, may also be observed in nerves without previously dividing them.

17. In the muscles the electrotonic state does not manifest itself as it does in the nerves.

18.. Approaching death, and severe injuries of the muscular and nervous systems, cause other modifications of the electro-motive power of the nerves and muscles, of which some are permanent, and connected with the total extinction of that power; others are only transitory.

19. The electric phenomena of motor and sensitive nerves are identical. Both classes of nerves transmit electric irritation in both directions. (Vide Du Bois-Reymond on Animal Electricity, p. 208 et seq.)

We have thus briefly sketched the outline of what is now positively known concerning the laws which regulate the action of the vital force. We have also mentioned the close relation, which experiments have shown to exist, between animal electricity and the vital actions. We will next proceed to state our own views on this subject more at length, particularly with regard to the relation which exists between electricity and the human body in health and disease.

CHAPTER XIII.

Philosophy of Life.

Philosophy of Life—Differs from the Doctrine of Life—Importance of Health—A peculiar Element in Nature—Life not a Simple—It is this Principle which pervades all Nature—It is not in itself Vitality—Earth, Air, and Water—Atmospheric Elements next in the Scale—Stomach—The Natural Historian—Electricity—Its attractive Force—Mingles with Human Mechanism—Influences of Electricity—Mind—The Brain of Lunatics—The Muscular Power of the Chest—The Functions of the Heart—Allopathy—Hydropathy—Simplicity in the Healing Art—Too much Art and too little Science—Disease must have a Cause—Illustrative Cases, by Dr. Parmly; by the Author.

THE *philosophy of life*, as applied to the preservation of health, differs widely from the scholastic *doctrine* of life which we endeavored to set forth in the preceding chapter.

The importance of health, the means which may be used for the prevention of disease, the various ways in which health may be impaired by derangements of the solids and fluids in particular systems, as those of the muscular, nervous, absorbent, secretive, circulating, respiratory, &c., must necessarily enter largely into the consideration of the true philosophy of life.

There is, in nature, a peculiar element to each of the above, which, uniting together, form one great and indivisible whole, consisting in its subdivisions, of earth, air, water, electricity, mind.

Life is not then a simple but a compound, composed of various elements, the highest and most active among which in the material world, is electricity.

It is this principle, or fluid, or ether, or whatever name we may choose to assign to it, which pervades universal nature; which can, as shown in these pages in the cases of Antoine Le Blanc and the Scottish murderer, call into life-like action the ghastly and mutilated forms of *death*, impart to them muscular movement, and surround them with all those seeming attributes of existence undistinguishable from its realities, save in the spirit imparted by its Author; which upheaves the ocean and levels the mountain; which buries the living and the dead, the beauty of youth and the decrepitude of age, the depositories of science and the workshops of art, in the darkness and desolation of ages.

It is not in itself vitality, but a controlling force which imparts vigor to vitality when the latter is called into action on organic matter; hence its direct and all-pervading influence on the functions of life.

This may be illustrated by viewing it in connection with the more ponderable and grosser elements in the world without.

Earth and water were doubtless the first elements in the formation of our globe. The existence of the latter, so beautifully and figuratively expressed by the Hebrew writer, "The Spirit of God moved upon the face of the waters," furnishes conclusive evidence that the liquid element was either coeval with, or immediately succeeded, the formation of the earth, of which, by its admixture, it forms the principal part of the gravity.

Here we find two important links in the chain of nature; the more gross elements, but not the most unimportant. It is a singular fact, well worthy the attention of the inquirer into natural history, that these elements bear the same relation to each other in the human system, that they do in the inorganic material world, *one* fifth being solid and *four* fifths fluid.

As we ascend in the scale of organic existence, the atmospheric elements next present themselves to our attention; they bear the same relative proportions to the more ponderous fluids that the latter do to the solids.

Of a higher grade of rarity and expansiveness, and seemingly more closely allied to a self-constituted principle, they are intimately connected with both the aqueous and solid elements.

This fact is illustrated in the convulsions occasioned by the storm and the tempest, when the mountains echo the voice of the thunder, and the lightning rends asunder the proud oak of the forest; when the ocean, lashed into fury by the winds of the tempest, dashes wildly on the crested shore, and humanity, in silent ruins, fills the hecatombs of its wrath; when the hills are uprooted and the forests desolated.

As the stomach is the receptacle for the solids and fluids in their just proportions, the lungs are the recipients of the atmospheric elements in corresponding relations. When the adaptation of these organs and elements to each other is complete, so far health is the result.

The natural historian might here end his research and the physiologist his labors, but a higher and more important principle of life commands the attention of the latter—that of electricity, the fourth link in the chain of nature.

We have heretofore in these pages drawn a comparison amounting almost to an *identity* between the electric and the nervous fluid. We shall now pursue the investigation, fully convinced that electricity opens an inexhaustible store for physiological research, and involves and develops principles most intimately connected with the best relations of organic life.

Electricity is as much more powerful and subtle than the atmosphere, as the latter is than water; it approaches much nearer an innate power and voluntary action: but still its alliance with the grosser elements cannot be dissevered; its grasp fixes alike on the loftiest summits of the Alpine mountain, as in the minutest atom which the microscope can place within the field of vision.

By its attractive force it retains the planets in their orbits, and controls them in their revolutions; the pulsations of the heart are obedient to its stimulus, and the general functions of organic life sustained.

It mingles with human mechanism equally with the other elements to which we have alluded. The experiments of Matteucci (page 156) clearly demonstrated the power of electricity over the nervous system, of which the brain is the centre: it is as much the natural element of the cerebro-spinal system, as air is that of the lungs, or fluid and solid food that of the stomach.

We have heretofore shown that every muscle, gland or tissue in the system, from the finest muscular fibre to those powerful levers which move the larger bones, is stimulated into action by the nerves of the brain or spinal cord; that the latter are the connecting links of animal and mental being, through every grade of ascending intellect and superior animal organization.

If, as we have seen, electricity can stimulate the nerves into action, when vitality, so far as we can judge from its manifestations, has fled; if the state of the system be changed *electrically*, there must be a corresponding change in the functions of life; if the relations are truly stated, the argument in favor of electrical influence is irrefragable.

The influences of electricity over the nervous system, bodily and mentally, may be *felt* in that peculiar condition or feeling of both, when the earth for a long season has not been watered by the refreshing shower, and when a sun, almost tropical in its influences, has nearly deprived our planet of its electric principle. Who has not felt the languor, the weariness, the sense of half suffocation, the nervous headache, thus occasioned; and more especially the indescribable sensation produced in the nervous system, when the gathering cloud in the west, charged with "heaven's artillery," sent forth its thunders and lightnings to relieve the physical oppressions to which we have adverted?

We have yet to advert to another element of vitality, superior in its origin, its functions and its end to all others—MIND. An emanation from the Deity, it goes forth in its spiritual dignity, connected with, yet distinct from, the grosser elements of life. In the contemplation of this great attribute, we stand on the farthest bank of reason's Rubicon. We are aware of its existence by its manifestations, but its origin rests in the revelations of the future, among the arcana of the works and wonders of God.

It is however, in some way, connected with matter, and the medium of that connection is electricity. Through this conductor it reaches the grosser elements of our being, stamping its impress on our organization, and forming an index to the workings of disease when such organization is deranged.

It is thus, physiologically considered, the connector between mind and matter; the power but not the essence of vitality.

When this element is deranged or disturbed, as in the instances we have adduced above, in relation to a long drought and the returning thunder gust, the vital functions feel the shock, the link gives way, the relative associations of mind and matter suffer a transient change; hence the brain of lunatics is always affected in those electrical conditions of the atmosphere produced by what are termed changes of the moon.

The most direct medium through which the vital force can be increased is that of electricity.

Science has placed within our reach this element, and provided us with ample means by which we may regulate the functions, through its influences, at our pleasure.

Its physiological condition, and peculiar adaptation to the brain and spinal cord, have already been stated. Nature, uniform in all her operations, has decreed that electricity shall be the natural element of the nervous centre, as that the atmosphere shall be that of the lungs, and food and drink the elements of the stomach. As all the organic functions are performed through the influence of this subtle and powerful agent exciting the nerves, and through them the muscular system, we are thus enabled to regulate those functions at our pleasure.

Is the muscular power of the chest diminished, its contractility deranged, and the necessary expansion of the lungs thereby prevented? By electricity we can restore the powers of the former, and thus facilitate the progress of the latter to a healthy expansion.

Are the functions of the *heart* deranged, the circulation impeded, and the sufferer exposed thereby to sudden death? The electric force will restore its muscular action, the current of blood will again freely flow in its wonted channel, the electrical relations of the system are changed, until strength is obtained and the disease cured.

The functions of the stomach, the liver, the kidneys, the bladder, may be restored to their normal condition in the same way.

Electropathy, in the midst of that numerous family which of late years has sprung into existence, each member of which has doubtless some good attributes, is based upon the principle of electricity, the animating and sustaining power of human organization. There is no other agent in the universe save electricity, by which energy can be imparted to the vital principle: it pervades all matter, and seems to be a universally controlling law.

The various forms of attraction are necessarily exercised for the preservation of all organized bodies, and every variation in the force affects their organization. If it be admitted that attraction and electricity are identical, it follows necessarily, that the latter is the great organizing power.

These physiological conclusions are intimately connected with the foundations of a system having for its object the regulation and control of the vital functions.

Though mysteriously connected with mind, and complicated in its structure and combinations, human mechanism is still matter, and subject to the laws which govern matter.

In medical practice matter must be regulated by matter, vitality by the vitalizing principle. Allopathy, Hydropathy, and the large family of which they form a portion, have in each some inherent good or bad elements: good if properly applied; the reverse if improperly.

Simplicity in the healing art has ever been rejected by mankind: the leper, when directed by the prophet simply to bathe in the waters of Jordan that he might be cleansed, exclaimed angrily and derisively, "Are not Abana and Pharpar, rivers of Damascus, better than all the rivers in Israel? May I not wash in these and be cleansed?" From the days of the Messiah to the present period, the art of curing disease has been practised, yet what is it at the present moment? What scientific system has been devised to heal diseases by any fixed laws? Five drops of laudanum would produce similar effects on one individual to those which twenty drops would produce on another; corresponding effects would be produced by opium, cathartic, or other pills.

How necessary then to apply an antidote to disease which all have within their power, a *watchful regard and attention to habits!* Should this have been neglected, the next important step is to trace out the cause and remove it.

We have too much art, too little science in the treatment of disease. We are too apt to generalize in our systems of therapeutics; too ready to prescribe a panacea, without investigating those shades and symptoms in a disease, which may almost have entirely altered its specific character. We administer a remedy for the *effect*, and neglect the *cause.*

As an illustration of this fact we present the two following cases. The subject of the former was an eminent physician in this city ; that of the latter, a young lady, also of New-York. We are indebted for an account of these cases to Dr. Eleazer Parmly, whose skill as an operating dentist, and integrity as a man, do not admit of a doubt.

"Some time since," said Dr. Parmly, "I was consulted by a physician in this city, suffering, as he supposed, from a disease of the jaw termed *osteo sarcoma.* A surgeon had been previously consulted, who advised the removal of a portion of the upper jaw-bone; the time for the operation had been appointed, when I was requested to make an examination of the affected part by the physician, who applied to me for that purpose.

"I immediately discovered that a portion of the root of a tooth, which had been broken, was the cause of the diseased condition of his mouth, and advised its immediate removal, which, although with much doubt as to the beneficial effect on the physician's mind, yet he submitted to the operation.

"The event, however, proved the true cause of disease; for before the time appointed for the operation of removing a part of the jaw the disease was removed, and the doctor restored to his usual good health.

"The second case, that of Miss J., similar to the above in its appearance and symptoms, had been decided, by a consultation of physicians, to be curable only by extirpating the diseased portion of the jaw. Before the period fixed upon for the operation, she was induced, by her friends, to have her teeth examined, and, as in the former case, a portion of a diseased tooth had produced all the painful symptoms of the case, which, when removed, a perfect cure was effected, and the necessity for a surgical operation was declared by her medical advisers no longer to exist."

Disease never has existed, never can exist, without a cause. Among the many causes of derangement in the physical system, decayed and decaying teeth frequently induce disease, from the absorption of a specific virus which is exuded from them, or from a pressure of their spiculæ on some branch of the nerves which supply the upper and under jaw. In the former case the fluid secreted by the salivary glands, as the *parotid,* of which we have before spoken, becomes impregnated by the virus from the diseased teeth; hence one of the causes of indigestion and torpidity of the stomach.

To the above cases of Dr. Parmly we add the following which passed under our own observation:

We were called on by a physician to visit a lady, Mrs. P., whom our medical friend had been attending, for the purpose of a consultation as to the best mode of treating her case. The lady had been supposed to be, and actually was, laboring under severe dyspepsia, accompanied by great nervous debility. She had been under medical treatment for some months, without experiencing any relief.

Supposing the *cause* might possibly exist in the teeth, we examined them: they were, generally, in a decaying or decayed condition; in some, the nerve had been completely destroyed by stimulant application or atmospheric action: these were extremely offensive, and we recommended their immediate removal, which was effected. The residue susceptible of the process were in a few days filled with gold. From the latter period, indeed we may say from the time the teeth were extracted, the symptoms of dyspepsia disappeared, the nervous system resumed its wonted energy, and a few weeks beheld her the active superintendent of those domestic affairs from which a painful disease thus induced had so long separated her.

A second case was that of a lady, Mrs. N., who had been under the medical treatment of her family physician for *seven months*, for that truly painful disease, *neuralgia.*

The whole list of narcotics, nervines, and tonics, as morphine, valerian, quinine, and others, had, in vain, been resorted to. No permanent relief was obtained; her nervous system had become shattered and feeble, yet peculiarly excitable.

As a last resort, her physician placed her under our care, at the same time giving her a certificate to that effect.

On examining the lady's mouth, we found the tooth known as the *dens sapientiæ*, or wisdom tooth, in a highly decayed condition: it had produced great inflammation in the fascia surrounding it, and had excited and contracted, through the facial nerves, the muscles of the face.

So great was the excitability of the nervous system, that it required nine hours' constant persuasion to induce her to submit to the removal of the diseased tooth. Having obtained her consent, we removed it very readily with an instrument invented by the late Dr. Physic of Philadelphia. The result of the operation was the complete restoration of the health of Mrs. N.

We will present one more case, in order to impress upon our readers the necessity of tracing disease to its cause, if a radical cure is expected.

Miss C., an interesting young lady, had a disease of the antrum of the upper jaw, (the *antrum* is the interior hollow cavity of the upper jaw.) She had consulted numerous medical gentlemen, some of whom prescribed for her, while others conscientiously declined, considering it as hopeless, beyond the reach of medical art.

The physician who watched her case most carefully called on us, and requested that we would go with him and examine the painful case. We consented to do so.

Upon repairing to her dwelling, a painful spectacle presented itself, in her situation. Her jaws were locked, her teeth clenched; no solids could be passed into the stomach. The right side of the head beggared description; its appearance was scarcely human: *seven* large tumors, commencing at the angle of the eye, extended below the posterior part of the jaw to the centre of the neck.

Her physician stated that he had no hope of her recovery: her appearance indeed fully justified the hopelessness of her case, even in the mind of a medical gentleman deservedly high in his profession, and fertile in professional resources.

Having taken the young lady under our professional care, the first object to be gained was that which might enable her to open the contracted jaws: we accomplished this desirable end in twenty-four hours.

The extension of the jaws permitted us to introduce nourishment into the stomach, which for some time had in vain been attempted.

Upon inspecting the mouth, we found several defective teeth, which were immediately removed; a hole was perforated through the floor of the antrum, and in *six weeks* this interesting young lady, whose case was considered beyond medical or surgical aid, who had not tasted solid food for *seventeen* days previously to our seeing her, was restored to perfect health.

CHAPTER XIV.

Electricity: its Connections with, and Influences and Action on, Living Bodies.

A Portion of the Functions of Organic Life--Study, Grief, Care--The Mourner at the Grave of his Friend—Dr. Marshall Hall--Experiment with the Leyden Jar--A Dry Atmosphere--A Current of Damp Air--Neuralgia, Tic Doloreux, Rheumatism--Dr. Milne Edwards—Dr. Willson Philip—Brydone —The Atmospheric Influences of an Equilibrium in Electricity--Sirocco of the South of Europe--Kamsin of Asia--Brydone's Remarks on Electricity on a Visit to Mount Etna—A Lady in Switzerland--Two Gentlemen of Geneva--The Influences of Electricity upon Respiration--Sir Humphrey Davy—Dr. Philip's Experiment—Mr. Atkinson's Cases of Cholera.

A PORTION of the functions of organic life are voluntary, but those upon which its existence chiefly depends, involuntary.

Hence the greater portion of electric force is expended on those portions of the system that are not immediately influenced by the will; that is, on those of the brain and nervous system which excite involuntary muscular action.

It may suffer exhaustion from an excess either of voluntary or involuntary action in the nervo-muscular systems.

If the stomach be deranged, as in dyspepsia, or called on to perform too much labor, the brain by its nervous connection with the former is deprived of its nervous force. If the brain labor too intently, the stomach becomes disordered from a corresponding nervous connection.

Study, grief, care, anxiety, the more violent mental emotions generally, by exhausting the nervous force which should be employed in giving energy to the direct functions of life, induce derangements in those functions.

The nervous system, thus deprived of its energies, becomes enfeebled, and the individual possessing this depressed condition of feeling is said to be *nervous*.

The mourner at the grave of his friend, the lover who in the loss of his idol sees no prospect of happiness through the distant vista of life, by brooding over their distinct objects, suffer alike from loss of appetite, indigestion and its relatives.

These facts are easily explained upon the principle of electrical action.

The system receives a specific amount of electric force, in accordance with the condition of the avenues described. Every physical action and mental emotion is aided by the action of this force: an excess not only exhausts its supply in the part exercised, but to a limited degree, in the whole system. Individual organs are subject to the operation of a corresponding law.

Dr. Marshall Hall says: "Disease of the latent lobe of the cerebellum produces paralysis of the opposite side; disease of the medulla oblongata indicates paralysis of the respiratory muscles, and consequently, when complete, instant death."

This disturbance of the varied functions of life, produced by attacks having their origin in the brain, is equally true in other respects as in those suggested by Dr. Hall.

These facts may be accounted for philosophically and conclusively, upon the principle of electrical action in the human economy.

In explaining the anatomy of the *nerves*, we have shown them connecting the *brain* with the *eye;* the function of the latter derives its vital energy from the former.

If the brain be affected by injury at the points where this connection takes place, the *electrical* action of the nerves and the functions of vision are alike disturbed: when this action ceases entirely, *amaurosis* is the result, (a disease of the optic nerve which produces partial blindness.)

The same remarks apply to the functions of hearing and smelling: if the nerves of these functions are injured between, or at their points of contact, the *electric* action is rendered feeble; if the injury be permanent and of any serious extent, deafness will be the result of the former; the loss of the sense of smell, the latter.

Upon the principle of an electrical excess or deficiency in the brain and nervous system, it is easy to account for those local and organic affections to which the human machine is subject.

When we reflect that the brain is the organ through which the mind manifests itself, that electricity is one, if not the principal bond of union between the intellect which produces and the brain which manifests, it requires no stretch of imagination to conceive the manner in which mental labor *excessively performed* exhausts the system, and deranges its organic action and equilibrium.

The perplexities of commercial life, the anxieties of relatives in sickness, excitements consequent on all great occasions, the emotions of fear, anger, love, or grief, are the mental avenues to those diseases which have their seat in an exhausted state of the *electrical* forces.

The feeble bodily condition arising from the excessive gratification of animal propensities, may likewise be ascribed to the exhaustion of electric power.

There are other causes, independent of those to which we have referred, by which the force of electricity in the system may be diminished, dependent on peculiar states of the grosser elements, as those of earth, air and water.

We have before observed that long-continued drought and heat deprive the atmosphere of its electrical properties.

If a Leyden jar, charged, be placed in a dry atmosphere, it may retain its electricity for some hours, perhaps a day.; but if removed to a damp atmosphere, or even by placing it within the reach of a current of damp air, the electric fluid immediately passes off, the latter being a conductor, the former a non-conductor of electricity.

The above are among the sources from which our systems are perpetually experiencing a renovation of electric power.

When the atmosphere is dry, (if the drought has not too long continued,) and the sun careers through a cloudless sky, the electric fluid strengthens and invigorates us; we feel an exhilaration, an unusual flow of animal spirits; the invalid almost forgets his malady in this extra renovation of the powers of life. But let a wind approach from the east, charged with its watery particles, a natural conductor of the electric fluid from the earth's surface, how rapid is the change in his feelings! The old standing chronic pains supervene; the circulation becomes enfeebled; the pulmonary organs, particularly if previously diseased, suffer a loss of vital energy, that scarcely permits them to perform their part in the process of respiration.

Such are some of the physical conditions frequently witnessed and painfully experienced, mysteriously hidden in the arcana of nature, until explained on the principle of electric admixture with the functions of organic life.

The rigors in the cold stages of intermittent and other fevers, have their origin in the diminution of electric force.

A current of damp air, passing over the individual when sitting at an open window, has, in some cases, so deprived the system of the electric fluid as to occasion *paralysis.*

Damp feet, on the same principle, are at periods productive of nearly all diseases to which humanity is subject, commencing in the nerves and terminating in inflammation of the voluntary or involuntary muscles, perhaps both, or in giving rise to what are termed *nervous diseases.*

Neuralgia, tic doloreux, and rheumatism, are dependent on diminished electric force, for their origin.

Th arguments which have been frequently adduced, and as frequently ridiculed by the ignorant and inattentive observer, to prove that there is much in nervous power of an electric nature, have received no inconsiderable support from the advancement of chemical science.

Electricity has been proved not only an essential in the contraction of a muscle, but an indispensable element in the production of heat. Heat cannot be produced without it, and the powers of life are dependent for their preservation on the maintenance of some portion of this latter vital element in the system: its production is the last function that ceases. When totally extinct, no means can restore animation; the electric and the nervous powers have departed for ever, and the body, deprived of these powerful agents, quickly mingles with and is lost in its original source.

Mr. Milne Edwards, in his work on Physiology, says: "In addition to the surmises that the nutritive equally with the muscular movements are carried on by the electric force, I can now add the fact that the hand of a remarkable personage, (of the name of Mottero,) now operating in Paris, pours forth *electricity*, which being, as it appears, modified in the human frame, cures by friction all diseases caused by a deficient or irregular action of the nerves. The remarkable power of imparting electricity, thus adapted to the human constitution, enables him to restore the equilibrium of disordered nervcus action; to renovate the capability of moving to limbs *completely paralyzed;*

to relax contracted muscles; to impel the blood in its proper direction, and to impart the strength that results from a sufficient supply of nervous energy, I should say of nervous fluid."

The French people, fully aware that the *influence* of electricity might be extended far beyond animal organization, have, throughout whole vineyards, attached numerous conductors to the plants, for the purpose of increasing the process of vegetation and invigorating the grape-vines.

Dr. Willson Philip has recently proved that the circulation in the smaller capillary tubes may continue some hours after apparent death, and that their current in life is not in exact unison with the pulsations of the heart; so that the ordinary theory of the circulation of the blood is inadequate to its complete explanation.

Brydone says: "If you cause water to trickle through a small capillary tube, the moment you *electrify* the tube the water runs in a full stream." Electricity, he adds, "must be considered the great vivifying principle of nature by which she carries on most of her operations. It is the most subtle and active of all fluids. *It is a kind of soul which pervades and quickens every part of nature.*"

When electricity finds its equilibrium on the face of nature, when it pervades equally the air and the earth, all is calm and quiet; but if that equilibrium is destroyed, consequences the most dreadful ensue until it is restored: hence the natural elemental convulsions previously alluded to in this work.

But it is not in the elements alone that the derangement takes place by these electrical changes: the animal and vegetable worlds experience their effects.

In the former, persons with a weak nervous system are exalted or depressed, according to the direction of the winds.

The sirocco in the south of Europe, the kamsin of Asia, the southeast wind of Great Britain, are attended in the human frame by a sense of lassitude, of indescribable oppression, for which no mere change of temperature will account. It is to the electrical changes superinduced that we must look for the origin of these feelings.

During the continuance of these winds, the atmosphere is nearly deprived of its electricity, and the nervous system, at the same time, of its energy.

In damp weather, when every rain-drop, in descending, and every plant or other object on the earth, quickly absorbs the electric fluid, every person in ill health must be aware of the altered state of his feelings: his spirits are dejected, the various functions of life, among them particularly that of digestion, are feebly performed; a state of complete morbid irritability ensues, which nothing but a *clear north wind*, which awakes the slumbers and torpor of electrcity, calls it into vivid action, restores functional energy, and enlivens the whole of animated nature, will subdue.

Who has not felt an excess of languor and lassitude during the atmospheric combination of a moist easterly wind and a warm sun in our own city, (New-York,) when compared with the same temperature in portions of our country more elevated or farther removed from the returning evaporations of the ocean?

In clear, frosty weather, on the contrary, the spirits are greatly elevated: there is a buoyancy in the system for which we can scarcely account; an excess of electricity which forces us to seek new objects on which to expend our nervous and muscular powers; an excess of vitality almost burdensome to its possessor.

"It is well known," says Brydone, in his remarks on electricity during a visit to Mount Etna, "that there have been instances of the human body becoming electric without the mediation of any electric substance, and even emitting sparks of fire with a disagreeable sensation, and even an extreme degree of nervous sensibility.

"About seven or eight years since, a lady in Switzerland was effected in this manner, but I was unable to learn all the particulars of her case; however, several Swiss gentlemen have confirmed to me the truth of the story.

"She was uncommonly susceptible of every atmospherical change; had her electrical feelings strongest in a clear day, or during the passage of the thunder clouds, when the air is known to be replete with electric fluid.

"Two gentlemen of Geneva had a shorter experience of the same sort of complaint, though still in a much superior degree. Professor Saussure and young Mr. Jalabert, when travelling over one of the high Alps, found their bodies so full of electrical fire, that spontaneous flashes darted from their fingers with a crackling noise, and the same kind of sensation as when electrified by art.

"It seems pretty evident, I think, that these feelings were owing to the bodies being possessed of too great a share of electric fire.

"This is a very uncommon case, but I do not think it at all improbable that many of our invalids, particularly the hypochondriac people, and those we call *malades imaginaires*, owe their disagreeable feelings to the opposite cause, or the bodies being possessed of too small a quantity of this fire; for we find that a diminution of it in the air seldom fails to increase these feelings, and *vice versa*."

The influences of electricity upon the function of respiration have but recently been imperfectly acknowledged. That the blood is vitalized by the reception of oxygen through the air-cells of the lungs by some peculiar process, experiment will not permit us to doubt; but we much question the principle upon which it has been stated to act.

That great chemist, Sir Humphrey Davy, says, from actual experiment, he is convinced that the oxygen obtained from the atmosphere which we inspire, owes its elasticity to *electricity*; that it is always, in a normal state, combined with the latter; that air which has lost its elasticity is unfit either to support animal life or produce combustion, and, conseqently, animal heat.

If the chemical philosopher is correct, and we doubt not that he is, oxygen, so far from being the agent of vitality, the producer of arterialized blood, is only the medium through which another and less ponderous element is received as the vitalizing principle, and that element is *electricity*.

The influence of electricity on the nerves of the stomach was strikingly illustrated by Dr. Philip, but strongly doubted by the skeptics in electrical force, until it was re-proved by the experiments of that gentleman, in connection with Mr. Brodie, before the members of the Royal Institution in London.

The eighth pair of nerves was separated, (formed by the pneumogastric, the glosso-pharyngeal, and the spinal accessory, *see nerves*, *page* 118,) and the secretion of the gastric juice was directly suspended.

A voltaic current of electricity was passed through the divided portion of the nerve next the stomach, when the secretion was immediately restored, as before the division.

From the result of this experiment, Dr. Philip contends that, by the mechanical application of the electric current, the stomach when otherwise inactive, and the lungs when in a state of torpor, may be excited into healthy and vigorous action.

Dr. Philip's experiment establishes two important principles connected with the theory we have essayed to establish:

First, that the functions of the stomach are under the influence of a power received through the nerves with which it is connected; *second*, that such power is either electricity, or an agent, the office of which may be performed by electricity.

When it is taken into consideration that, through our food and drink, we receive into the stomach a great amount of electric fluid, the conclusion that electricity does become the immediate agent in the production of vital power in that organ, is placed beyond the possibility of doubt.

We shall close our remarks on electricity, its connections with and influences and actions on living bodies, by some interesting reports on the connection between *electricity* and *cholera*, from St. Petersburg in Russia, and London in Great Britain.

The former report states that scientific men, from the outbreak and during the continuance of the fatal pestilence, noted the remarkable fact of the almost total absence of electricity from the atmosphere, and the almost total deprivation of electric power in those bodies which are ordinarily possessed of it in a condensed degree.

A magnet, for instance, of forty pounds' sustaining capacity, was found, while the disease was at its height, to be incapable of sustaining more than *four* or *five* pounds; and it was further found that, as the disease abated, the magnet was gradually restored to its original powers.

The London correspondence from J. C. Atkinson, Esq., member of the Royal College of Surgeons, addressed to the Editor of the Lancet, says:

"I am desirous of directing the attention of your numerous scientific readers to a very interesting phenomenon, more or less intimately connected with the collapse state of cholera, which seems hitherto to have escaped the observation of medical men, viz., animal electricity, or phosphorescence of the human body.

"My attention was first directed to the subject during the former visitation of that fearful disease in the metropolis.

"It was indeed singular to notice the quantity of electric fluid which continually discharged itself on the approach of any conducting body to the surface of the skin of a patient laboring under the collapse state, more especially if the patient had been previously enveloped in blankets: *streams of electricity*, many of them averaging *one inch and a half* in length, could readily be educted by the knuckle of the hand when directed to any part of the body; and these appeared, in color, effect, crackling noise, and luminous character, similar to that which we are all accustomed to observe when touching a Leyden jar.* I may remark the coincidence, that simultaneously with the heat of the body passing off, the *electricity was evolved*. And I am therefore led to ask the question, Are not heat, electric and galvanic fluids, one and the same thing? Does not the fact of the passing off

* The symptoms observed by Mr. Atkinson will not tend to clear the mist which obscures the medical world in relation to the causes of cholera. With us it has been most prevalent and fatal in a season of great drought, when the atmosphere has been deprived of its electricity.

of both imponderable substances, at one and the same time, strengthen this conclusion?

"In the treatment of cholera, all are agreed that *non-conducting* substances on the surface of the skin aid essentially in the cure; and during the disturbed state of the atmosphere, for the purpose of retaining the electricity continually eliminating in the system, we are told to wear woollen bandages, flannel, and gutta percha soles, so as to insulate as much as possible the body, to prevent the heat—the electric fluid—from passing off."

CHAPTER XV.

Opinions of Eminent Medical Men on Electricity, and its Effects on Disease.

Dr. Tuson, of London—The late John Abernethy—Professor Wisgrill, of Vienna—Braithwaite's Retrospect—Cases by Eminent Physicians in Europe—Aphonia, or Loss of Voice—Theodore Mandurick—Palsy, by Dr. Neligan—Hemiplegia, or Palsy of One Side, from the Head downwards, by M. Bemond—Paraplegia, or Palsy across the Body, by Dr. Constantine James—Tinnitus Aurium, or Ringing in the Ears, by Dr. Heoring—Dr. Finella on Deafness—Neuralgia, by Magendie—Sciatica, by Dr. E. Hermel—Asthma, Chronic Difficulty of Breathing, Anosmia, or Loss of Smell, and Amaurosis, by Dr. Wilson Philip—Chorea, (St. Vitus' Dance,) Facial Paralysis, (Palsy of the Face,) by Dr. Golding Bird—Tetanus, (Universal Cramp,) by Surgeon Hailey—Rheumatic and Local Palsy, by T. J. Vallance—Constipation, by Dr. W. Cumming—Removal of a Nævus, or Mother's Mark, from a Child, by J. Hilton, Esq., Guy's Hospital—Suspended Animation, Narcotism, Russell and Johnson, King's College Hospital, London—Mr. Corfe, Middlesex Hospital—S. P. James, Esq.—Dr. William Bird—Greenwich Avenue Calamity—Dr. Vanderpool.

Among those attached to old systems, electricity may and will meet with opponents: the system of Galileo in ancient times, and of the great Harvey at a much more modern period, experienced a bitterness of hostility which has few equals in the history of science.

In the time of the latter, the rabbis of medicine, like those of religion in Judea, who rejected the new and mild doctrine of the first great Teacher of Christianity, scorned the new lights which were offered them, and scoffed at and insulted its disciples.

Time, however, has insured its triumph, as it will assuredly that of medical electricity.

Many, if not all, the *supposed* failures in electricity, arise from errors committed in its application: the application of electricity is a peculiar art, the result of long practice and minute observation; its indiscriminate use, or imperfect application, will in many cases produce more evil than benefit.

In some cases ample diffusion will be necessary; in others, the utmost concentration of power. The electrician who would succeed in his practice, must understand anatomy so far as the course of the nerves and muscles is concerned; his diagnosis must be equally correct with that of the general physician; his judgment must be accurate as to time and position: in other words, he must know *when* and *where* to apply the electric current; he must be able to graduate the power of the shock to the nervous capabilities of his patient, lest by suddenly and highly exciting a weak nervous system, he may add to its present or cause a lasting debility; he must be endued with the spirit of perseverance, and permit no seeming initiatory disappointments to shake his faith in ultimate and permanent beneficial results.

Dr. Tuson, of London, F.R.S., says: " Electro-galvanism may be considered as a stimulant to the nervous system, a stimulant to the most minute fibrillæ, to the most delicate nervous texture, and likewise to the neurilema, or sheath of the nerves; promoting speedy absorption, so that should the sheath, or even investing membrane of any nervous fibre be thickened or enlarged, by extravasation or any other means, by stimulating the nerves, promoting absorption, and removing the obstruction, the part will assume a healthy action. In rheumatism, electro-galvanism will often prove of the greatest benefit.

"Electro-galvanism is an agent which produces absorption quicker than any medical means which we are acquainted with; this can be clearly proved by its application to indolent tumors, as it very frequently causes them to be absorbed most readily. After all other means have failed, electro-galvanism will completely cure some indolent tumors."

That distinguished surgeon, the late *John Abernethy*, said, "Electricity is a part of surgical practice that may be considered *unique;* all other means operate on the surface, but electricity will pervade the very centre of the body. It may be so managed as to be made to pervade a tumor in the very centre of the abdomen. It is a species of stimulation, and may be applied in various degrees of force."

Professor Wisgrill, of Vienna, says: "A revolution has now taken place in favor of electricity, which, after its wide celebrity at the commencement of the present century, had fallen into disuse, not from the insufficiency of the means, but from the mode in which they were employed."

"Electro-magnetic apparatus ought now to be in the possession of every surgeon."—*Braithwaite's Retrospect.*

The following cases of disease, differing in their form and symptoms, attended by the most eminent physicians in Europe, many of them of the most obstinate character, but all, after science and art had exerted their utmost powers and ransacked the pharmacopœias for fresh medical combinations, yielding to the effects of electricity, are offered as additional testimony in behalf of a remedial agent in nervous disease, which will one day become as universal as it is efficacious.

Aphonia.—Hooper defines this disease to be a suspension of the voice without syncope or coma, and divides it into three classes:

First, *Aphonia gutturalis*, when proceeding from a tumor about the fauces or glottis.

Second, *Aphonia trachealis*, when arising from a diseased condition of the trachea or windpipe.

Third, *Aphonia atonica*, when proceeding from paralysis or want of nervous energy. A case of the latter, as described in the *London Lancet*, May 27th, 1843, was successfully treated by electricity.

Theodore Mandurick, a Dalmatian, twenty-four years of age, of sanguine temperament and robust constitution, and who had usually enjoyed good health, killed one of his countrymen in a quarrel, for which offense he was incarcerated in the prison at Icardona.

Three days subsequent to his imprisonment, he was attacked with a violent fit of epilepsy, followed by entire loss of voice; to restore which local, external, and general bleedings, antiphlogistic measures of all kinds, were resorted to without effect.

In a few months he was removed to the central prison of Zara, where he was examined by the medical staff.

The tongue was somewhat enlarged, preternaturally reddened, though dry, and the blood-vessels around its base were much distended. The sense of taste was uninjured, but the movements of the tongue and larynx were performed with difficulty.

Leeches were now applied to the sides of the tongue, tartarized antimony, in both large and small doses, and drastic purgatives were employed, and a tartar emetic plaster was applied over the larynx; but all these means failed to restore a healthy action to the parts adjacent, and Mandurick was still compelled to keep his mouth partially open to maintain respiration, which function could only be performed by short and difficult inspirations.

About sixteen months subsequent to the attack, the voltaic pile was thought of, and a battery of fifty pair of plates employed.

On the first day two hundred shocks were given, and on the second three, but no perceptible effect followed. Two days were suffered to elapse, and a battery of seventy pair plates was then used, with which about three hundred shocks were given. The patient was found acutely sensitive to the action of electricity, and a lapse of five days was permitted to intervene before the fourth application, which consisted of four hundred shocks with the latter named instrument. Whether these were administered too precipitately, or whether his system had become more excitable by galvanism, the patient, after the last application, became much agitated, and subsequently fainted for a short time. Next day he suffered intense headache; his face was flushed, his eyes were lustrous, his pulse was full and strong, from which state he was relieved by bleeding; but he now for the first time gave utterance to hoarse sounds. After six more days, the battery of fifty pairs was again employed, and three hundred shocks given. The same treatment was repeated every two or three days, and then, at similar intervals, four hundred shocks were given with the seventy pair battery. The voice meanwhile, and the motor power of the tongue and larynx, gradually returned to their normal condition, and after the twelfth application the patient completely recovered.

The deduction drawn by the surgeon who reported the case is, that no nervous affection whatever should be regarded as incurable until electricity had in some form been tried and failed.

Dr. Neligan has had much experience in the use of electricity, in cases of palsy; and among other cases in which he has found it effectual, he cites the following:

One of almost complete palsy of the fore arm, succeeding to painter's colic. When the colic pains were removed and the bowels opened, magneto-electricity was applied. Though previously he could not stir his hands, they immediately closed upon the conductor. In the course of four weeks he was entirely restored with this agent.

A sailor, also under his treatment, had experienced a paralysis of the shoulder, by sleeping, for nights together, in wet clothes on deck. His right arm first began to feel heavy and numb; it pained him to stir it, and he gradually lost all power over it. Blisters and moxas proved of no advantage. Electro-magnetism was resorted to on the 20th of December, and by the 30th, he could use his arm nearly as well as ever. (See Monthly Journal of Med. Science, April, 1846, p. 225.)

Hemiplegia, or palsy of one side, from the head downwards.—A case of this disease, of considerable importance, is reported in the *Revue Med.*, Nov., 1834, of Madame B., where the hemiplegia was the result of apoplexy. Speech difficult, taste and hearing impaired, saliva escaping from the mouth, constipation obstinate, cramps in the paralyzed limb frequent. At length, œdema throughout the left side. From the first application of electricity Madame B. was enabled to stand, to stoop, and rise again. On the second day the œdema diminished, and perspiration was felt upon the left side; the hearing was improved, and her features became more regular. With twenty applications she had quite recovered, when she left Bordeaux; and M. Bermond, the operator, expresses it as his opinion, that two weeks longer would have removed every remaining trace of the disease.

Paraplegia, or palsy across the body.—Dr. Constantine James gives the details of an extreme case of paraplegia, in the *Gazette Medicale de Paris*, of 1848, in which electricity proved entirely successful. The patient was a girl of seventeen, who was first injured by falling at full length while walking. From this she suffered pain in the knees, and subsequently weakness. The usual remedies, local and general, were resorted to without relief; she was then placed under the water treatment at Néris, where she remained six months. From this complete paraplegia followed, and on her return to Paris the most powerful treatment was resorted to, but with little benefit. After three years from the first accident, electro-magnetism was applied. The lower extremities were now much wasted away, and without assistance she could not rise from the bed. The treatment was commenced with much care, being evidently resorted to as an experiment. Twenty operations enabled the patient to take some steps with the aid of a cane. The treatment was wholly suspended for a time, yet in the course of four months she was entirely restored. She has since married, and remains perfectly well.

Tinnitus Aurium, or ringing in the ears, which is often the precursor to deafness, is also speedily cured by electricity. Dr. Hoering cured a patient thus afflicted after recovering from typhus fever, who had been under other treatment for three months, without relief; twenty-two applications only being required for a complete cure.

Mr. M. Hoering reports a case in the *Encyclop. des Sc. Med.*, June, 1847, in which a man sixty years old was cured of deafness of a year's standing, by eighteen applications of electricity.

Dr. Finella has reported, to the Scientific Congress of Genoa, several cases of deafness cured by him with electricity. One was of a sexagenarian, who in his youth suffered from atorrhœa, afterward night blindness, and finally deafness. From the first operation a slight discharge from the ear took place. The same effect followed the second operation, with a slight improvement in hearing. On the third, both hearing and sight were improved. With twelve operations the cure became permanent. Other similar cases were treated with similar results. (See Annali Universi di Medicina, Dec., 1846.)

Another had become deaf from inflammation of the ear, following rheumatism, and was restored by eleven operations.

Neuralgia.—This singular complaint is quite common. It is nothing more nor less than a contraction of the nerves proceeding from cold. Besides being excessively painful, it resists ordinary remedies; the use of leeches and the lance, pills and poultices, seem of slight avail. Some have given to it, when in the facial nerves, the name of tic doloreux, and when in the sciatic the name sciatica. Others have represented the condition of pain or uneasiness, as allied to neuralgia, in whatever part.

We quote the following from the Medical Gazette, the Medico-Chirurg. Review, July, 1841:

M. Thelin had been subject to frequent attacks of most severe neuralgia, affecting the superior maxillary nerve of the left side, when he first consulted M. Magendie. The pain in the gums, lips, cheek, and ala nasi, was insupportable. The patient could scarcely utter a word, and as for performing mastication it was impossible. All methods of treatment had been tried in vain. But by having many of his teeth extracted, and being leeched and blistered and physicked for months and months at a time, his constitution had suffered severely. He consulted M. Magendie on the 5th of March, 1838. At one sitting of a few moments the pain was *chassé*. Since that period, whenever the neuralgia returned, he repaired to M. Magendie, and always left him cured of his sufferings. It is now several months since he had an attack.

M. James relates a number of instructive cases of neuralgic affections of the nerves, which occurred chiefly in the practice of M. Magendie, who is the great advocate of this mode of treating neuralgia, which were relieved by the use of electricity. (See Edinburgh Med. and Surg. Journal, July, 1841.)

Sciatica, or nervous disease of the nerve passing down the thigh and leg.—This form of neuralgia, so difficult to treat with the usual remedies, yields at once to the use of electricity. Of the many cases treated by Dr. E. Hermal, published in the *Annales Medico-Psychologiques*, March, 1844, and noticed in the London and Edinburgh Monthly Journal of Medical Science, June, 1844, we extract the following:

"A woman, at the Hôtel Dieu, aged 70 years, laboring under sciatica of a very aggravated character of six months' standing. One application caused copious sweatings and effected a cure.

"A man with sciatica of four months' standing was the subject of a single application. It is referred to as having produced a copious sweat.

"A butcher's boy at Hôtel Dieu, with double sciatica and paralysis, of five weeks' standing. The first application put the pain to an end, and was followed by involuntary discharge of urine during the night. Several applications were afterwards made, and in thirteen days he was cured, and in twenty-one days dismissed."

Asthma.—The observations of numerous practitioners combine in placing electricity among the first and most efficient remedies ever employed in this distressing disease.

Of the many cases referred to by Channing, in his notes of cures effected by Dr. Wilson Philip, we extract the following:

"1st. A blacksmith, aged 50, with severe habitual asthma of seven months' standing. Cough troublesome, with thick yellowish expectoration. After three applications of galvanism, for about ten minutes each time, he declared himself well, and resumed work. Several weeks later the disease was renewed by intoxication, and he was again relieved with equal facility. During ten months several slighter attacks occurred, following exposure, which were immediately relieved in the same manner.

"2d. A governess, aged 28, with asthma of four years' standing. The breathing was rendered easy in a few minutes by galvanism, and after the second application, continued so. Three weeks later, she experienced some return of dyspnœa, which was relieved by a blister, which had been previously tried with slight effect. During several months after she remained well.

"3d. A female domestic, aged 30, with asthma of two months' standing. She was relieved in a few minutes, and after a few applications remained well for several weeks.

"4th. A laborer, formerly a soldier, aged 68. He was unable to walk, save at a slow pace, and sometimes had been obliged wholly to abandon work. During his most severe attack, he has been relieved in a few minutes by galvanism, and after three weeks of daily applications, of ten minutes each, the relief became permanent. A sense of sinking in the stomach, in this as the previous case, after the application of electricity, came on, (probably from the stimulation of the organ,) which was removed by carbonate of iron. After a lapse of two years, this patient had experienced no return.

"5th. A female of domestic habits, aged 40, with asthma of five years' standing. The first application of galvanism gave great relief, but this proved unequal in subsequent administrations. Her attendance was irregular, and her consumption of malt liquor excessive. Her breathing and digestion were both improved, though the former continued oppressed."

The cures effected by Dr. Wilson Philip, as above stated, are of so interesting a character to the asthmatic invalid, that we have given them more space in our pages than we designed.

Anosmia (loss of the sense of smell;) *Amaurosis*, (partial loss of sight.)—The Dublin Quarterly Journal of Medical Science, for 1847, states that many cases of the above disease have been entirely cured by electricity, when all other remedial means had failed; and that many cases of most inveterate *amaurosis*, (a disease of the optic nerve,) which had resisted all the efforts of surgery and medicine, as blisters, moxas, nux vomica, belladonna, &c., at length yielded to the effects of electricity.

The principal physician in one of our charitable medical institutions in this city, (New-York,) whose means of observation are most extensive, stated to us, a few days since, that in his opinion, amaurosis could be cured by no other means than by the application of electricity, and that if the latter were judiciously applied it invariably restored the sight.

Dr. Golding Bird, presiding physician to the celebrated medical institution known as Guy's Hospital, London, says: "Electricity has by no means been fairly treated as a therapeutical agent, for it has either been exclusively referred to when all other remedies have failed—in fact, often exclusively, or nearly so, in hopeless cases—or its administration has been carelessly directed, and the mandate, 'Let the patient be electrified,' merely given without reference to the manner, form, or mode of the remedy being for an instant taken into consideration.

"Conscientiously convinced that the agent in question is a no less energetic than a valuable remedy in the treatment of disease, I feel most anxious to press its employment upon the practical physician, and to urge him to have recourse to it as a rational but fallible remedy, and not to regard it as one either expected or capable of effecting impossibilities. I again say, I shall advance nothing but what has been repeatedly tested under my own observation, and I hope to make out a strong case in favor of this long-neglected remedy."

Chorea, St. Vitus' Dance.—This disease is attributed to the relaxation of the muscles; oftentimes it arises from extreme excitability of the nervous system.

From the report made at Guy's Hospital, and published in the Medical Gazette, June 18th, 1847, p. 1065, we quote the following:

A little girl of eight years was admitted November 2d, with chorea, which had supervened upon rheumatism, and with which she had been afflicted for two weeks. "Her existing symptoms were continual involuntary jactitation of the legs and arms, with continual contractions of the muscles of the face. She complained of stiffness in the neck, and spoke with extreme difficulty. She took vinum ferri and sulphate of zinc, for some time; but getting no better, electricity was ordered, December 2d; December 18th she left the hospital quite free from all traces of chorea."

The next case was that of a boy twelve years old, with chorea of ten months' standing, which appeared to have arisen from the irritation of a tape-worm. Purgatives and sulphate of zinc were employed for two months without benefit. January 6th, Dr. Bird notes the symptoms as follows: "Involuntary movement of almost every muscle, so that he had considerable difficulty in walking, and was quite unable to support himself upon one leg. His arms were in constant motion, and he had so little control over his fingers that he could not retain any thing in his grasp, even for an instant; the muscles of his throat were also in a state of constant involuntary motion, so that his articulation was imperfect, and his words were frequently unintelligible; his head was constantly moving, with his neck alternately thrust forward and retracted in a jerking manner."

January 9th, much improved. Involuntary movements of the legs and arms much less. 13th, rapidly convalescing. Feb. 9th, presented well.

From thirty-six cases of this disease contained in one report, dependent on various causes, twenty-nine of which were cured by electricity, when all other treatment had proved ineffectual, we have only quoted two.

We may add, from information derived from the same source, that twenty-five were relieved and one left the hospital from alarm, and consequently had no chance of relief.

"The results of my trials of electricity in the cure and relief of chorea," (the dance of St. Vitus,) concludes Dr. Bird, "may thus be deemed very satisfactory.

"I am aware that others have not met with the same success. This fact is easily accounted for: they have merely sought the aid of r emedy in cases which obstinately resisted all other means, instead of using it as a primary remedy.

"Of all the remedies I have hitherto used, except perhaps the sulphate of zinc, electricity seems most successful in chorea, and I have invariably applied it whenever I possibly could do so, since I first saw it employed by my friend and colleague, Dr. Addison, who I believe first suggested its use in this disease, paralysis, rheumatism chronic and acute, and many cases of epilepsy."

Facial Paralysis, or palsy of the face.—Dr. Bird cites several cases of this kind, (see Medical Gazette, August 6th, 1847,) from which the following are selected: "A barrister, in full and influential practice, became the subject of paralysis of the portio dura on the left side, from exposing the cheek to a current of air from a broken window in a crowded court. He applied to me in a week or two afterwards; the paralysis continuing, and the distortion of the face being hideous. As his general health was excellent, I ordered him to apply currents from the electro-magnetic machine, which was done, and in a fortnight all distortion vanished.

"An instance lately occurred to me in the person of a clergyman, who had suffered from paralysis of the seventh pair of nerves a dozen years previously, and the paralysis had never completely disappeared. The face when I saw him was not symmetrical, the saliva often flowed from the corner of the mouth, and his intonation was impaired. He set sedulously to work with the electro-magnetic current, and I saw him some months afterwards entirely restored."

A case of Idiopathic Tetanus treated by Galvanism. By H. HAILEY, Esq., Newport, Pagnell.—In this case the patient was a boy twelve years old, in whom the exciting cause of the attack appeared to be the prolonged use of a cold bath, after walking rapidly in a very hot day. On the 14th of July, three days after the attack, when Mr. Hailey saw him, the symptoms were extremely well marked, and the patient's sufferings very severe. He was treated by the exhibition of active cathartics, large doses of opium, sinapisms to the spine, stimula enemata, &c., and the administration of brandy and beef tea was not omitted, but up to the 17th without any improvement. Upon this day, (Mr. Hailey tells us,) I administered several rather strong shocks from an electro-galvanic apparatus, first along the spine, then over the masseter muscles, and then in the course of the great sciatic nerves. This appeared to cause great pain through the whole system, and at first brought on the convulsions much stronger. The opium was discontinued altogether. In the course of a few hours he appeared more calm, took a mixture of beef tea and brandy, and the bowels not being acted upon, in the evening I prescribed another enema of castor oil and turpentine.

18th.—Has passed a better night; convulsions less frequent; has passed more urine. Bowels relieved. The galvanism was again administered, and in giving a shock in the course of the great sciatic nerve, he moved the right leg, and afterwards said he could for the first time feel it. A short time after its administration to-day, to the surprise of his friends, he got up in bed and asked for something to eat, but before it could be procured he fell back as rigid as heretofore. I ordered the abdomen and legs to be again well rubbed, a blister over each masseter muscle, and on each side of the spine over the region of the cervical plexus.

19th.—Has slept better. Convulsions less frequent; has taken more nourishment. Pulse small, feeble, 120; bowels relieved. The blisters having risen, I applied galvanism over each masseter muscle, and over the blisters on the spinal column, ordered the blisters to be kept open, and brandy, gruel, beef tea or port wine, to be administered when an opportunity occurred, and a blister to be applied over the loins.

20th.—He passed a better night, the paroxysms having occurred only twice during that period. Can open his mouth wider, and has eaten a small piece of pudding. Bowels constipated. Galvanism to be applied over the same parts as yesterday, and, in addition, on the blisters in the lumbar region.

21st.—Has passed a good night, not having had more than two convulsive fits since yesterday morning. Can raise his legs and slightly move his back ; can open his mouth wider. Bowels constipated and still very hard. Has masticated a little chicken. Ordered him ol. ricini ℥ss. to be taken directly, and quin. sulph. gr. ij. to be put upon the tongue every four hours, and galvanism to be applied over the same parts as yesterday.

22d.—Continues improving. To continue the same treatment as yesterday.

23d.—Much better. The bowels have acted spontaneously. Has slept well, and had but one convulsive fit in the course of the night. Can masticate his food. Ordered him out of bed for two hours, and continued medicine and galvanism as before.

25th.—Much better ; can stand on his legs with a little support. Continue medicine and galvanism.

27th.—Much better; bowels softer. Pulse between 80 and 90, and stronger. Bowels continue to act without the aid of medicine. Ordered him to continue galvanism, and take tonic mixture of sulphate of iron and quinine.

30th.—Has been out for a ride. Appetite very good; can masticate his food well. Has had no convulsive fits for the last two days; pulse 80, and strong.

August 7th.—Is able to walk about as usual, with the exception of complaining of great weakness of the legs and soreness of the feet; has discontinued all medicine. From this time he daily improved, having no return of the convulsions, and by September 1st was able to follow his usual avocations.

The chief interest in the case consists in the support which it affords to the humoral view of the pathology of tetanus, put forward by Dr. Todd in the Lumleian Lectures, published in the Medical Gazette last year, and in the influence of galvanism in reducing the tonic convulsions. As in the many other cases of idiopathic tetanus, the disease seemed to originate in exposure to cold and a check to perspiration—causes very favorable to the depravation of the blood. The great exertions which the patient made in walking would, no doubt, largely contribute to determine the influence of any morbid matter accumulating in his blood, upon the muscular and nervous systems.

The application of galvanism, a mode of treatment suggested some years ago, by Professor Matteucci of Pisa, seemed to have a very beneficial influence. It was administered on the seventh day of the attack, when the disease was quite at its height. Immediately after its application the symptoms began to abate, and the rigidity of the muscles and the convulsive attacks diminished steadily each succeeding day; and it is worthy of notice, that simultaneously with the application of galvanism, all opiate medicines were discontinued. —*Med. Gazette*, *Feb.* 22, 1850, p. 324.

From the London Medical Times, Nov. 15, 1851, p. 509, we select the following cases of rheumatic and local paralysis, treated by T. J. VALLANCE, Jun., Esq., by galvanism:—Alfred Cook, aged 26, a gardener, was attacked on the 4th of July, 1851, with acute rheumatic fever. He was treated in the usual manner, and was confined to his bed about a fortnight, suffering much in the muscles of his extremities and back. After he was able to leave his bed, he had great pain in his shoulders, wrists and loins, increased by the slightest motion, so that he was incapable of dressing or feeding himself. He continued in this condition up to the 29th of August, (nearly nine weeks,) during which period he was treated by tonics, occasional doses of Dover's powder, and turpentine frictions; these however had no apparent result. On the 29th I found his arms hanging useless by his side; the right was somewhat the worst; it felt cold, the skin tense and hard, and the muscles much atrophied; the hand he was unable to close. The metacarpal joint of the index-finger was much swollen; it felt hard, and it was very painful on pressure, or on any attempt to bend it. Thinking this a fair case for the application of galvanism, I resolved to try the battery, and accordingly passed a current from one hand to the other. The first effect produced was considerable faintness; the man however quickly rallied, and ten minutes having elapsed, I found he could close his hand perfectly, that the swelling was considerably diminished, and that all pain was gone. The same evening he undressed himself without assistance.

Aug. 30th.—Arms slightly painful on motion. The current was again passed with marked benefit.

Aug. 31st.—A good deal of pain in hip and knee, increased by movement.

Sept. 3d.—Slight returns of pain and immobility in the upper extremities, speedily removed by the passage of a current. On the 11th, the man returned to his work.

Case 2d.—Edward Conner, aged 60, a laborer, strong habit of body, has been prevented following his employment by rheumatism for three months; first seen by me August 30th, when he complained of violent pain in the shoulders and neck, which was so much affected that he was unable to turn his head; he complained also of great pain in the right clavicle, on examining which I found a considerable amount of periosteal induration, forming a large swelling near the sternal extremity. I pointed this out to my friend Mr. Beale, of Plaistow, and then, assisted by him, passed a current along the clavicle for about five minutes, during which time the man said he felt the pain leaving him, and at the end of that period the pain was gone. On reëxamining the part, the swelling had disappeared, but the man is still unable to lift his hand to his head.

By the application of galvanism daily, up to Sept. 5th, so much improvement has taken place, that the man says he shall go to work next week.

Case 3d.—30th Sept., 1851.—Sarah Whitaker, aged 70, states in the month of February, 1851, she fell from a flight of stairs, fractured two ribs and sprained her back, and was confined to her bed for seven or eight weeks afterwards, but never entirely recovered, having almost lost the use of her right shoulder and neck, so she is unable to turn her head; has suffered frequently from rheumatism. On examination, I found her very weak and thin, and the muscles of the right shoulder much smaller than those on the opposite side; there was no difference, however, in temperature or sensibility to the touch.

I passed an intermittent current through the back of the neck, which relieved the pain, and enabled her to turn her head. I afterwards passed the current from hand to hand for half an hour; it did not, however, produce so powerful an effect on her as it does on some persons. This is easily accounted for by her age, as I uniformly find young persons more susceptible to the influence of galvanism than are the old; it however considerably improved the power of motion in the shoulder.

Oct. 3d.—Battery used again with good effect.

4th.—The current repeated.

5th.—Better; repeat the current.

7th.—Much better; can now lift her hand to the back of her head, and feels better than she has done since her accident. The current was again applied, and motion improved.

9th.—Said she had nothing to complain of.

On the Treatment of Constipation by Electro-Galvanism. By Dr. W. CUMMING, of Edinburgh.—It is perhaps a bold assertion that few cases of constipation will resist the action of electro-galvanism; but the number of cases of various kinds in which I have used it with success, leads me to infer that in all except those arising from organic or mechanical causes, this agent will not only act as an aperient, but give such tone to the muscular and mucous tunics as will in time lead to the natural discharge of their functions.

The use of galvanism has been too extensively limited to paralyzed organs. The same influence that will restore vigor, either entirely or partially, to a muscle and to a set of muscles that have lost their power, will obviously, under due regulation, impart it to those in which it is diminished; and probably few will question that the muscular fibres or the intestinal canal have a function to perform not the least important of the various portions of that tube; that in torpor of the bowels they are, particularly, partially paralyzed, and that therefore we might *à priori* expect that galvanism, by supplying an appropriate stimulus, first directly, and then secondarily by its probable action on the sympathetic system, would have a beneficial operation. If this be true, (and if not theoretically, I am satisfied that it is practically so,) what innumerable wretched symptoms and feelings may not be removed, to which so many of both sexes are victims, and which all medical practitioners have daily to contend against as the accompaniments and consequence of *habitual constipation.*—*Med. Gazette, Dec.* 7, 1849, p. 972.

Removal of a Nævus by Platinum Wire, heated by a Galvanic Current, by J. HILTON Esq., F.R.S., at Guy's Hospital.—Mr. Hilton has been trying this plan of cutting and searing at the same time, upon a nævus of the flat kind, situated in the front of the ear of a child two months old. The operation was performed with Cruikshank's battery and a very thin wire, which was first intended to tie around half the tumor, which was about the size of a crown piece. But the wire ran so easily through it, that the whole was completely removed, and the parts are now fast cicatrizing. This is rather a quicker measure than the ligature, and just as secure, since hemorrhage is so rare.—*Lancet, Jan.* 31, 1852, p. 120.

Suspended Animation, Narcotism.—An infant a few months old, to whom, by mistake, some tincture of opium had been administered, was taken to King's Hospital, London, almost lifeless; respiration failed to such a degree, that for two minutes she did not breathe once. Mr. Russell and Mr. Johnson, the resident medical officers, applied the electric stream directly over the medulla oblongata. The first and immediate effect was to excite the respiration, and soon afterwards the whole spinal cord became affected, so that at each passage of the electric current the limbs were raised convulsively. Respiration was completely reëstablished by these means, but the child died several hours afterwards with congested lungs. (See Med. Gazette, Dec. 23, 1842.)

Mr. Corfe, of the Middlesex Hospital, has related an instance of the good effects of electricity under these circumstances: A man was admitted, having taken an ounce and a half of laudanum on the preceding evening, six hours previously. "In the first instance I ordered the administration of the stomach pump, at which period, to all appearances, he was a lifeless corpse; the pupils were contracted to a pin-hole in size, the pulse was intermitting, and not more than forty, the respirations convulsively performed at intervals of half a minute, the face livid, and the extremities bluish and cold. After the stomach had been relieved of its contents, green tea, with ammonia, was injected therein; flagellations with thin splints and wet towels, the cold douche, turpentine stupes and sinapisms to his calves and abdomen, were applied in succession without the least improvement in his condition. The bladder was relieved of six or eight ounces of light-colored urine by the catheter. I then thought of a most powerful remedy, which was attended with extraordinary success. I allude to the electro-magnetic battery, conjointly with electricity, which was set to work soon after four o'clock. The pulse became more steady, firm, and frequent, and the respirations more indicative of resuscitation. Our powerful electrical machine was got into full play before a large fire, and the jar filled, when some brilliant sparks and strong shocks were occasionally passed through his head, spine, thorax, and abdomen."—*Lancet, January* 27, 1844.

"The result of this was, that the man opened his eyes and his mouth too, abusing the operators for a pack of rascals, who were trying specimens on him. But incomparably the most satisfactory effect was produced by giving him a shock on the tip of his nose. To use a phrase of the ring, he rallied wonderfully under this—a hint worth taking."—*Med. Chir. Review, April*, 1844, p. 544.

A female, aged twenty-nine, had taken an ounce of laudanum an hour before; the stomach pump had been applied before she got to the hospital, where the application was repeated, and electricity employed by S. P. JAMES, Esq., who says she was in a state of the deepest insensibility when the operation was commenced, and that "when the sponge-directors were applied for a few minutes no sensible effect was produced, but soon afterwards the muscles of the neck began to quiver, when sensibility appeared gradually to return, and after twenty or thirty minutes the stimulus produced undoubted discomfort, evinced by shrugging of the shoulders and attempts to avoid contacts with the sponges; but the first marked influence of its effects was the ejection of a large quantity of fluid from the stomach. In another hour she appeared quite lively, answered questions distinctly, and in a moderately loud tone, though in a somewhat peevish manner. The galvanism was occasionally intermitted for a few moments, when she relapsed almost instantaneously, and dropped off in the midst of a sentence which she had commenced during the application of the stimulus.

"The pupils remained unaffected till about two hours had elapsed, when they became somewhat more dilated, and sensible to a strong light. All the symptoms gradually diminished, but it was absolutely necessary to re-apply it, at longer intervals, until half-past five P.M., when she seemed so far recovered as to allow of her removal to the ward. From the easy diffusibility and quick propagation of the galvanic fluid over the whole system, irritation capable of exciting action almost *ad libitum* can be applied to any part or even the whole of the body at one time, and that of a nature void of all the unpleasant results which necessarily follow bastinadoing, cold effusions, searing the part dolichos pruriens, and a whole catalogue of equally brutal resources, which, for the safety of the patient, have necessarily been resorted to before galvanism was adopted. Dipping the sponges of the directors on this occasion in moistened salt, assisted the passage of the current, and increased the conducting power to a striking degree. In ordinary cases where galvanism is used, the application, if strong, reddens the skin, and even produces some tumefaction, which remains often for hours; but in this instance, although the power was probably three or four times as strong as is generally used, not the slightest discoloration was observable. It should be noticed, that as soon as she was allowed to fall into a deep sleep, which she was occasionally permitted to do, the extraordinary influence of the battery was fully proved in rousing her instantly from the deepest narcotism to a fretful impatience; the pulse gradually lowered, became slower in its action, and irregular in its movements; but no sooner was this remarkable stimulus applied again than the pulse rallied, was regular, fuller, and quicker; and the respirations, previously labored, slow and unequal, became more frequent and deeper. The countenance also evinced in a striking manner the singular influenee of this agent. When she was admitted the cheeks were of a leaden hue, and the lips of a tawny color; but after the expira tion of one hour, with the use of the battery, they resumed somewhat of a natural tint."—*Lancet, June* 19, 1847, p. 639.

A case of Poisoning by Laudanum, successfully treated by keeping up artificial respiration by means of the galvanic battery. By WILLIAM BIRD, M.D.—"The patient was an infant. Mrs. B—— was confined by me on the 26th of January, 1852, with the subject of the present case; therefore the age is correctly stated at thirty-nine days.

"March 5, 1852.—This infant having a slight cough, his mother administered to him a small tea-spoonful of what she considered at the time to be a cough medicine; but almost immediately afterwards she discovered that the bottle contained laudanum, and that she had therefore committed a serious error. This occurred shortly before one P. M. A very small portion of the laudanum was spilled, the child swallowing the remainder. When I saw it at five P. M., the infant was almost in *articulo* *mortis*, cold, pulseless, and the skin and face and extremities blue; *dyspnœa* excessive; respiration taking place only by irregular, convulsive catches; pupils contracted to a mere point; the eyes rotated upwards under the brows: the child lay still and motionless; and, but for the occasional respiratory gasp, to all appearances dead. As the laudanum had been retained, and four hours had elapsed since its administration, I did not, from the appearance of the little patient, anticipate any thing but a speedy death; but in order that the best chance might be given to it, strong mustard cataplasms were immediately applied along the spine, and an infusion of coffee administered, containing a little compound spirit of ammonia. This could only be given by a teaspoonful at a time; and even then it was swallowed with considerable difficulty. While these remedies were being prepared, the nurse was directed to keep the child in constant agitation, and to rouse it as much as possible. After a time some little evidence of returning animation appeared; it occasionally moved a limb, and attempted to open its eyes; the respiration was a little less embarrassed, and he became more able to swallow the coffee. This was steadily given until between one and two ounces were administered. The mustard plaster by this time began to take effect, and so much counter-irritation was produced that I decided upon its removal for a time, lest vesication should be produced, which would wholly prevent the application of another.

"The child had now become somewhat uneasy, and its respirations were performed with more facility and regularity in consequence; but little consciousness showed itself. At six P. M., the case was relapsing again into its former condition. Another sinapism was applied to the chest and abdomen. Of course, the child was not allowed to remain still during a single moment.

"As it was clear that all the poison must have already passed into the circulation, it was useless to give an emetic; if administered, it would have probably failed, and if it had succeeded, it would only have caused the ejection of the antidotes, viz., the coffee and ammonia; and as it was evident that the treatment of the case would last many hours, if successful, but would fail if at all slackened for an instant, I determined upon bringing electricity to our aid. The stream of electricity was maintained, with only an occasional intermission, during several hours. As long as the battery kept in action, all went well, the child breathed steadily, regularly, and almost as if nothing were the matter. At times the stream would get weaker, in consequence of more acid being required, or from the vibrating spring for making and breaking the contact getting out of order; at these times the little patient would experience a serious relapse.

"At eleven P. M., it had a very narrow escape; the only sign of life was derived from auscultation; the heart was still found to beat, 'tap, tap,' about thirty times in a minute, faintly and just audibly. The battery at this nick of time was restored to action, and the aspect of the case again improved.

From this period until two A. M., it was constantly kept in action. At this period the electricity was slightly discontinued, as consciousness began to manifest itself: the little resuscitated patient appeared restless, uneasy, and in pain from the repeated sinapisms; it even attempted a feeble cry. In about ten minutes there were symptoms threatening a relapse; the battery was again used for a few minutes, and a stimulating enema of one drachm of spirits of turpentine, six drachms of castor oil, in about four ounces of strong infusion of coffee, was used, whilst some coffee, with a little brandy, was administered by the mouth. This was swallowed with difficulty; some of it got into the larynx, and produced a fit of dyspnœa, but there was not sufficient nervous energy to produce a cough. Half-past three A. M.—He was so much recovered that he no longer required the stimulus of the battery; he had continued to breathe with tolerable ease during the last half hour without its assistance. I left at four A. M., in charge of my pupil, Mr. Phelps, who watched it carefully until I came down at eight A. M. During the whole of this time the battery had been employed three times for short periods only; the last application was seven A. M., during ten minutes. I found it breathing naturally and with tolerable regularity; it would occasionally seem to catch in its breathing, as if a slight spasm of the glottis occurred; but by blowing in its face or shaking it, the inspiratory act would be induced, and all would again go on smoothly for some time, when a repetition of the spasms would call for similar treatment.

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

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

"8th.—Improved in all respects; ceased attendance."—*The Chemist, London.*

The foregoing cases have been presented in order to draw the attention of the medical profession to the necessity of an immediate application of the galvanic current in all those of a similar character, electricity being the most stimulating agent which can be employed. Sufficient evidence in its favor, as above, has been adduced by physicians in Europe, whose motives and character are above suspicion, and whose reputations, established in their respective countries, are appreciated in ours.

The loss of life that so frequently shrouds many rural habitations as well as those in our cities and villages in mourning, the result of railroad accidents, steam-boiler explosions, the falling of buildings, burning, snagging and collisions of steamboats, and the capsizing of sail-boats, stimulates us to give place to the following communication by a physician in reference to the Greenwich Avenue calamity of the 20th day of November, 1851, which shrouded our city in gloom; a day that will be long remembered by many of our citizens whose beloved ones, in the blossom of youth, were hurried to a premature grave.

The communication above alluded to, kindly furnished us by Dr. Vanderpool, is as follows:

"DR. HUFF—*Dear Sir:* In compliance with your request, I now give you a brief account of the use of the galvanic battery upon the injured children of the Greenwich Avenue catastrophe. I was perhaps thirty minutes later in attendance at the station-house than many other physicians; at this time I counted twenty-eight who appeared to be dead. A battery being soon introduced, was used upon several of these in connection with artificial respiration; but failing in any good result, I suggested its use upon a child who was livid and swollen, and who simply showed signs of life, but was breathless and entirely insensible to all ordinary stimulus. One pole of the battery was applied to the head and back of the neck, whilst the other was applied to the soles of the feet; in a few moments he moved his feet, and in a few more was so roused as to attempt a cry, which he soon accomplished. Respiration becoming established, he began to convalesce. In the evening I saw him before he was removed, and although very torpid, he would speak. He ultimately recovered.

"Yours truly,

"EDWARD VANDERPOOL, M.D.

"*New-York, July*, 1852."

We might, if we chose to draw on our experience in the successful application of electro-galvanism to cases in the cure of which all other remedial means have failed, increase the present work to a limit far beyond that which we purpose, but we pause on the threshold.

X

CHAPTER XVI.

Influences of Improper Food, &c., on the Human System.

Table of the Various Kinds of Food—Various Periods of Time occupied by them in the Digestive Process—Quantity and Quality of Food—Temperament—The Sanguine—The Lymphatic—The Nervous—The Bilious—Time not to be exceeded between Breakfast and Dinner—Fat and Oily Meats—Excessive Use of Pork—Soups—Pastry, Puddings, &c.—Fish, Water—Rest of Body and Mind necessary to Digestion—The Gastric Juice—Dr. Caldwell, of Kentucky--Table containing a Graduated Scale of the Nutrition contained in Various Kinds o Food.

ANXIOUS to afford any information in a work, the object of which is to present the philosophy as well as the remedial agents of disease, and the rational prevention as well as the cure, we insert a table showing the mean time consumed by the various articles of food in the process of digestion, and would recommend a careful perusal of it, and some attention to the practical results which it presents.

It is said that a Frenchman who had but recently landed at New-Orleans, and who had had no opportunity to form an opinion of the gastric capabilities of his new friends, very politely inquired, with a countenance exhibiting much astonishment, on seeing an *American* breakfast placed upon the table before one of our citizens, whether the varied and sumptuous meal was a *breakfast* or a *dinner ;* a just rebuke on the number of dishes of which we partake at our meals, without any reference to the digestive condition of the stomach, and with a rapidity which almost outstrips time itself, in the endeavor rather to *bolt* than *eat* the food.

The table, which we present below, will serve as a guide to the periods of time which particular foods consume in the digestive process:

Articles.	Preparation.	Time.
		h. m.
Apples, sour, hard,	Raw,	2 50
——, mellow,	Raw,	2
——, sweet, do.,	Raw,	1 30
Bass, striped, fresh,	Broiled,	3
Beans, pod,	Boiled,	2 30
Beef, fresh, lean, rare,	Roasted,	3
——, dry,	Roasted,	3 30
——, steak,	Broiled,	3
——, with salt only,	Boiled,	3 36
——, with mustard,	Boiled,	3 10
——, fresh, lean,	Fried,	4
——, old, hard, salted,	Boiled,	4 15
Beets,	Boiled,	3 45
Bread, wheat, fresh,	Baked,	3 30
——, corn,	Baked,	3 15
Butter,	Melted,	3 30
Cabbage head,	Raw,	2 30
——, with vinegar,	Raw,	2
——,	Boiled,	4 30
Cake, sponge,	Baked,	2 30
Carrot, orange,	Boiled,	3 15
Catfish,	Fried,	3 30
Cheese, old, strong,	Raw,	3 30
Chicken, full grown,	Fricasseed,	2 45
Codfish, cured, dry,	Boiled,	2
Corn, green, and beans,	Boiled,	3 45
—— bread,	Baked,	3 15
—— cake,	Baked,	3
Custard,	Baked,	2 45
Dumpling, apple,	Boiled,	3
Ducks, domesticated,	Roasted,	4
——, wild,	Roasted,	4 30
Eggs, fresh,	Boiled rare,	3
——,	Boiled hard,	3 30
——,	Fried,	3 30

Articles.	Preparation.	Time.
Eggs, fresh,	Raw,	2
Flounder, fresh,	Fried,	3 30
Fowl, domestic,	Boiled,	4
———,	Roasted,	4
Goose,	Roasted,	2 30
Lamb, fresh,	Broiled,	2 30
Liver, beef's, fresh,	Broiled,	2
Meat hashed with vegetables,	Warmed,	2 30
Milk,	Boiled,	2
——,	Raw,	2 15
Mutton, fresh,	Roasted,	3 15
———,	Broiled,	3
———,	Boiled,	3
Oysters, fresh,	Raw,	2 55
———,	Roasted,	3 15
———,	Stewed,	3 30
Parsnips,	Boiled,	2 30
Pig, sucking,	Roasted.	2 30
Pig's feet, soused,	Boiled,	1
Pork, fat and lean,	Roasted,	5 15
——, recently salted,	Boiled,	4 30
———,	Fried,	4 15
———,	Broiled,	3 15
———,	Raw,	3
——, steak,	Broiled,	3 15
Potatoes, Irish,	Boiled,	3 30
———,	Baked,	2 30
Rice,	Boiled,	1
Sago,	Boiled,	1 45
Salmon, salted,	Boiled,	4
Sausage, fresh,	Broiled,	3 20
Soup, beef, vegetables, and bread	Boiled,	4
——, chicken,	Boiled,	3
——, mutton,	Boiled,	3 30
——, oyster,	Boiled,	3 30
Suet, beef, fresh	Boiled,	5 30
——, mutton,	Boiled,	4 30
Tapioca,	Boiled,	2
Tripe, soused,	Boiled,	1
Trout, salmon, fresh,	Boiled,	1 30
———,	Fried,	1 30
Turkey, domesticated,	Roasted,	2 30
———,	Boiled,	2 25
———, wild,	Roasted,	2 18
Turnips, flat,	Boiled,	3 30
Veal, fresh,	Broiled,	4
———,	Fried,	4 30
Venison steak,	Broiled,	1 35

The *quantity*, equally with the *quality* of food necessary to support the system, varies with the age, occupation, temperament, climate, habit, amount of clothing, health, and disease.

The child in the rapid development of its animal organization, and its rapid arterial and venous circulation, demands more nourishment than the adult, whose system is matured, and whose consequent waste of vital power is less rapid.

The more laborious the occupation and consequent expenditure of muscular power, the greater will be the amount of nourishment required.

Temperament, or peculiar constitution of body, exerts no inconsiderable influence on the quantity and quality of food necessary to sustain the system. In the *sanguine*, distinguished by its fine white and red complexion, general plumpness of form, broad chest, and great hilarity of animal spirits, the circulation is rapid, the blood rich, and all the animal functions performed with great energy. There is in this form of temperament a general predisposition to inflammatory affections.

The food suitable to this physical condition should be of that kind which is not rapidly converted into blood by digestion, as soup, fish, mucilaginous vegetables, acidulous fruits, &c.

In the *lymphatic temperament*, indicated by general paleness of skin, inaptitude to mental or corporeal exertion, great deficiency of nervous power, and, in some cases, extreme obesity or fatness, the arterial system as well as the venous is inactive.

Animal food is indicated by this temperament, wine and spices; indeed, any kind of diet which will invigorate the organic functions by stimulating the nerves on which they are dependent.

In the *nervous temperament*, indicated by a thin skin, large cerebral (or brain) development, small muscular system, and generally more than usual intellectual power, the expenditure of muscular energy is prodigious; the well developed and active nervous system excites that of the muscles beyond its natural capabilities; the physical frame is weak, but, driven onward by the superior force of the nerves, performs its actions with great rapidity.

Light nourishing food is best adapted to this temperament, as white meats, fowl and fish, farinaceous and mucilaginous aliments; a diet that will nourish the muscular without exciting the nervous system.

In the *bilious temperament*, indicated by a bilious color of the skin, predominant *venous* circulation, and inactivity, unless when roused by some powerful excitement, the diet should be nourishing, but not too exciting. Fat and oily meats should be especially avoided.

CLIMATE indicates particular kinds of diet. In cold, northern climates, or in the winters of those in the temperate zones, food of a much more stimulating nature may be taken with impunity than in southern climes, or in the summers of the temperate. In warm latitudes much less animal food is requisite than in colder ones, where a large supply is necessary, especially if great exercise be taken.

Five or six hours should generally intervene between the periods of eating. Digestion occupies from three to four hours, and the stomach, like other muscular organs, requires repose to prepare for fresh exertion. If one meal follows another too rapidly, the latter will run into *fermentation*; for the whole of the gastric juice secreted (the only preventive of fermentation in the stomach) will have been expended on the former, and a fresh supply requires considerable time for its proper secretion.

For those actively engaged during the day, an early breakfast, dinner, and supper, will most conduce to vigorous health; for those who violate the laws of nature by turning day into night, a *late* breakfast and dinner.

Persons who eat late suppers should breakfast and dine late the succeeding day

The time elapsing between breakfast and dinner should not exceed five or six hours; for youth, and persons taking great exercise, the period may be shortened.

When dinner is early, some weak tea, milk, or water, with a small quantity of bread and butter, may form the evening meal; but when the *dinner* is *late*, no food should succeed it. If *any* supper is taken, it should be of the most light kind, as biscuit, a little arrow root or sago, and even these *one or two hours before retiring to rest.*

Fat and oily meats are the most indigestible among the articles of animal food. The excessive use of *pork* will give rise to gout and scrofula.

Referring to the table, it will be seen that five and a quarter hours are consumed in digesting this kind of animal food.

In the next rank we may place vegetables, which are apt to run into acetous fermentation.

Soups are acted upon by the gastric juices of the stomach with great difficulty, and produce the most severe forms of dyspepsia.

Pastry, puddings, rich cake and their relatives, are the most indigestible of all food prepared to indulge the pampered appetite; children should never be allowed to touch them, with the exception of boiled rice, plain Indian meal pudding, and some other of the more plain and simple kinds.

Fish holds an intermediate place between warm-blooded animal food and vegetable; it is far less nutricious than beef or mutton. Halibut is the most digestible of salt water fish; perch of fresh water.

Water, among the fluids, is the best promoter of digestion, as it is the best conservator of the morals and the happiness of society. The more stimulating beverages are always prejudicial.

We cannot take leave of this important subject without adverting to the conditions necessary to insure and promote a healthy digestion. The determination of the circulating fluids to the mucous coat of the stomach, and the viscera immediately connected with it, during the process of digestion, imperiously requires that the function should not be interfered with by moral or physical interruption.

Rest of body and of mind, both preceding and subsequently to digestion, for a short time, are essential to its healthy condition. *Whatever forces the nervous energy or the circulation, by calling into action other functions, either mental or physical, from the digestive organs,* is highly injurious to a proper digestion.

The gastric juice necessary to the digestion of a hearty meal, is never secreted in less than an hour or an hour and a half after such meal is taken. Repose is necessary and beneficial during the interval.

Hilarity and ease of mind promote digestion; while care and its relatives impede it.

Dr. Caldwell, an able writer on physiology, remarks, *truly*, that indigestion commences as often in the brain as in the stomach. The stock-jobber, the speculator and the student, are equally liable to its attacks: in these departments of life, the brain is in a continual state of over-exertion.

The quantity of food taken should have strict reference to the state of the digestive organs. If the latter be weak or diseased, a small amount of food only should be taken.

We are convinced that many of the diseases of childhood are produced by violating this law; that one third of the infant population, whose deaths swell our public obituary notices, are destroyed by the mistaken indulgence of parents and the ignorance of nurses.

The stomach, *crammed* beyond its powers, becomes oppressed, obstinate indigestion ensues; the brain, by its nerves of communication with the stomach, quickly sympathizes with that organ; the circulation through the former becomes impeded.

We shall close our remarks on digestion by presenting our readers with the following table, which determines the amount of *nutrition* in the various articles enumerated. We may observe, for the benefit of those unacquainted with animal chemistry, that *nitrogen* and *water* contain no nutrition.

One hundred Parts.	Dry Matter.	Carbon.	Nitrogen.	Water.
Arrow-root,	81.8	36.4	——	18.2
Beans,	85.89	38.24	——	14.11
Beef, fresh,	25	2.957	3.752	75
Bread, rye,	67.79	30.674	——	32.21
Butter,	100	65.6	——	——
Cabbage,	7.7	——	0.28	92.3
Carrot,	12.4	——	0.30	87.6
Cherries,	25.15	——	——	74.85
Chickens,	22.7	——	——	77.3
Codfish,	20	——	——	80
Cucumbers,	2.86	——	——	97.14
Eggs, whites,	20	——	——	80
——, yolk,	46.23	——	——	53.77
Lard, hog's,	100	79.098	——	——
Milk, cow's,	12.98	——	——	87.02
Oats,	79.2	40.154	1.742	20.8
Oatmeal,	93.4	——	——	6.6
Olive-oil,	100	77.50	——	——
Oysters,	12.6	——	——	87.4
Peaches,	19.76	——	——	80.24
Pears,	16.12	——	——	83.88
Peas,	84	35.743	——	16
Plums, greengage,	28.90	——	——	71.10
Potatoes,	24.1	10.604	0.3615	75.9
Rye,	83.4	38.530	1.417	16.6
Suet, mutton,	100	78.996	——	——
Starch, potato,	82	36.44	——	18
——, wheat,	85.2	37.5	——	14.8
Sugar, maple,	——	42.1	——	——
——, refined,	——	42.5	——	——
——, brown,	——	40.88	——	——
Turnips,	7.5	3.2175	0.1275	92.5
Veal, roasted,	——	52.52	14.70	——
Wheat,	85.5	39.415	1.966	14.5

CHAPTER XVII.

Influence of Alcohol on the Human System.

First Effect of Alcohol on the Mucous Lining of the Stomach—Enters the Veins of the Stomach—Is mixed with the Blood—Post-mortem Examination of Drunkards—What is the Condition of the Blood in Intemperates?—Alcoholic Congestion of the Brain—Nervous System of the Inebriate—The Depression of the Vital Powers—The Tremulous Hand—Effects of Dram Drinking on the Muscular System—Spontaneous Combustion from Drinking—Many Cases Recorded—Is Alcohol a Poison?—Figure of Antiquity—Mr. Fyfe, of Edinburgh—Who were the Principal Victims to the Cholera?—Typhoid Ship Fever—Picture of the Physical Appearance of the Confirmed Drunkard—Murder, Manslaughter, Suicide—Difficulty of applying a Remedy in the Present State of our Laws.

WHEN alcoholic drinks have been taken into the stomach, in any considerable quantity, the first effect produced is a stimulation of the mucous or lining membrane of the stomach, which is denoted by a sense of warmth in that organ. By this stimulation the blood is attracted to the mucous membrane, with which the stimulating fluid is in contact, its color becomes reddened, and a state of congestion is produced.

But the alcohol is speedily removed from the stomach by the activity of the absorbents; it enters the veins of the stomach, and is intermingled with the blood, preserving still the form of alcohol. Through the venous system it is carried to the right side of the heart with the returning current of blood. From the right chambers of the heart it is propelled through the pulmonary artery into the lungs, where in the air-cells a portion of it becomes mingled with the atmosphere during the process of aërating the blood. It is this commingling of the alcohol and the air in respiration, which, for the most part, loads the breath of brandy drinkers with the odor of that liquor. But only a portion of the alcohol taken into the circulation is thus exhaled through the lungs; the balance is carried through the pulmonary veins to the left side of the heart, and from thence it is propelled through the arteries to every part of the body: in this way it is brought into immediate contact with all the tissues of the organism. What becomes of the alcohol after it has been mingled with the blood and carried throughout the body? A portion of it is consumed by the vital processes, another portion is secreted by the kidneys and perhaps by the liver, and the balance is exhaled by the skin and lungs. What effect does alcohol produce upon the tissues through which it circulates commingled with the blood? Its primary influence is undoubtedly that of a stimulant upon all of them. Witness the increased frequency and force of the heart's contractions, the increased rapidity of the circulation of the blood, and the increased activity in the movements of respiration produced by it. These effects of a single glass of ardent spirits are mostly transient in their character. The congestion of the stomach usually subsides soon after the disappearance of the irritant which produces it. The activity of the circulation of the blood declines as the alcohol is eliminated or removed from the body, and this subsidence continues not only till the healthy standard has been gained, but passes even beyond it, and a state of depression, fully corresponding in degree to the previous excitement, is developed.

Having considered some of the most obvious effects of a single glass of ardent spirits, let us now proceed to consider what consequences are produced if the doses of alcohol are habitually repeated at short intervals; in other words, let us now examine into the consequences of spirit drinking as they are developed in the intemperate.

1. It is a fact well known to all who are much engaged in making post-mortem examinations, that the stomachs of old spirit drinkers are generally more or less diseased. On dissecting such cases, that organ is commonly found to be increased in size and capacity, from the large quantity of fluids which had habitually been poured into it. Its mucous or lining membrane is usually found to be thickened, softened, and more or less reddened. The reddening may be confined to isolated spots, or be spread uniformly over its whole surface. So constantly are these lesions found on examining the bodies of old drinkers, particularly if death has occurred suddenly, that some pathologists have familiarly christened them the "*rum stomach!*" Occasionally even ulcers are discovered in that organ on making such dissections. The morbid alterations in the appearance

and structure of the gastric mucous membrane, just described, are due to a slow inflammatory process, which had been produced at the outset, and kept up after such production, by the irritating quality of the fluids (alcoholic) with which that delicate membrane had habitually been bathed. That such results are produced by a free use of alcoholic drinks there is no room for doubt. The stomach becomes unfitted in a greater or less degree, according to the severity of the alcoholic lesions, for the performance of its proper office in the digestion of food. The miserable sufferer has loss of appetite, nausea and vomiting, unquenchable thirst, with pain and tenderness in the affected organ. The stomach is surcharged with gases and acid fluid, because even the little food he consumes, instead of being properly digested, undergoes the putrefactive process, among the products of which acetic acid and several gases may be enumerated. Thus the sufferings are greatly increased, and thus the symptoms of the worst forms of dyspepsia are developed in intemperate persons.

2. Again, on dissecting the bodies of such persons, the liver is generally found to be diseased to a greater or less extent. We often discover its size to be greatly increased, and that its color is changed from the healthy reddish brown to a pale yellow. On further examination we ascertain that the increase in size and the altered color depend upon a deposit of fatty matter in the tissue of the organ, which seriously impairs its functions. The bile is

not properly separated from the blood, or if it is separated, resorption occurs, and the current of life wherever it flows is impregnated with the biliary secretion. Hence occurs the sallow tinge and the jaundiced hue which we so often see in the countenances of drunkards. We might enumerate other types of the "*rum liver*," but this is sufficient for our present purpose. How alcoholic stimulants produce these alterations in the structure of the liver, we shall endeavor to state presently.

3. What is the condition of the blood in intemperate persons? That it contains alcohol we have already mentioned; and this is not a theoretical idea, nor a deduction of reason alone, but is susceptible of rigid proof by experiment. Again, not only is the blood of drunkards impregnated with spirit, but the relative proportion of its component parts is materially altered. Chemical analysis has abundantly shown that the blood of old drinkers contains a much larger proportion of oily and fatty matter than in health. "In fine, all authors are agreed, that the blood of dram-drinkers contains a much larger proportion of carbon than that of healthy individuals. Schoolan has estimated the excess of carbon in the blood of drunkards to be not less than 30 per cent." But, says Dr. Huss, "This result, however, holds good only for a certain period of the dram-drinker's life, viz., as long as the nutritive functions continue uninjured. During this time the subject remains stout and plump; but as the digestive powers

begin to fail, and the appetite diminishes while the craving for brandy is increased, the fat deposited in the cellular tissue is re-absorbed, and emaciation begins. As this progresses, the patient becomes generally cachectic, the serum is augmented, the proportion of blood globules is diminished, and the blood when drawn shows less and less disposition to coagulate. Still, even in such cases, I have detected the oil globules in the blood of both sides of the heart." (Dr. Huss on Alcoholismus Chronicus, p. 206.)

Now we are better able to understand how the drunkard's fatty liver is produced. That organ is incapable of fulfilling its office of cleansing the blood, which is brought to it overloaded with oily particles and other products of carbon. This fat is partly deposited in the liver itself, and partly carried forward into the general current of the circulation, to accumulate in other organs and tissues. It is by the prolongation of this process of fatty deposition, that the drunkard's liver reaches the enormous size which it sometimes attains.

4. But indulgence in the use of spirituous drinks not only produces a diseased condition of the stomach, the liver, and the blood; it also deranges the structure and functions of the nervous system, including the brain and spinal cord. It is indeed upon these organs that the worst consequences are produced; consequences, too, which, although earliest in their appearance, are too often overlooked even by practised observers.

We have already mentioned that when alcohol is circulating through the veins and arteries of the body commingled with the blood, the action of the heart is quickened and the circulation accelerated. Now it necessarily results from this, that more than a healthy quantity of blood is sent to the brain, and that a congested condition of the brain and its membranes is produced. If the supply of spirit in the blood be kept up by dram-drinking, this congested state of the brain will be constantly maintained. Hence we find, on examining the brains of drunkards after death, the cerebral vessels loaded with blood, and all the smaller blood-vessels increased in size or dilated, from the protracted, unnatural internal pressure to which they have been subjected. On slicing up the brain, in many cases, this dilatation of the smaller veins and arteries which traverse the organ is found so well marked, that a section presents a "*cribriform*" or *sieve-like* appearance, called by pathological anatomists the "*état criblé du cerveau*," or "sieve-like condition of the brain." But it should be borne in mind, that this congestion, with dilatation of the cerebral vessels, is produced and maintained with *impure* blood, that is, with blood rendered unhealthy because it contains alcohol, and a great excess of fatty particles and carbonaceous matter generally. Hence the consequences of alcoholic congestion of the brain, as developed in the deranged structure and functions of that delicate organ, have a two-fold origin. They are such as result, first, from ordinary cerebral congestion, and second, from the impurities of the blood already mentioned: of these the former tends most strongly to produce *lesions* of *structure*, and the latter *lesions* of *function*.

The consequences of chronic alcoholic congestion of the brain, which are most frequently met with on dissecting the intemperate, are the following: old inflammatory thickening of the membranes of the brain; effusion of the serum or watery portion of the blood beneath the membranes and over the surface of the organ; effusion of blood itself upon the brain, from rupture of the distended vessels; chronic dilatation of the vessels, which has already been alluded to; softening of the substance of the brain, particularly of the surface of the convolutions, or the gray cerebral matter, and of the cerebellum or little brain. Sometimes the brains of intemperate persons are found to be indurated or hardened, instead of being softened; neither can we wonder at the production of these opposite conditions of the cerebral substance by the same deleterious agent, (alcohol,) when we consider that both induration and softening are common results of various grades of congestion and inflammation, in all the tissues of the body. The above are the most common lesions of structure discovered in the brains of spirit drinkers.

Again, the nervous system of the inebriate exhibits certain lesions of *function* which are quite as well marked as the lesions of structure just mentioned. That an adequate supply of healthy blood is necessary for the proper performance of the functions of the brain, is an undeniable proposition. That constant irritation of the brain by alcohol, commingled with its nutrient blood, is followed, sooner or later, by depression of its energies, is equally true. Now the blood of drunkards, in addition to alcohol, contains so much carbon, that it cannot be adequately arterialized in the lungs, and thus their arterial blood is loaded more or less with the peculiar constituents of the venous, and is therefore in a morbid condition in this respect. From this there results a very important consequence: for the imperfectly arterialized blood is unable to restore the depression of the cerebral function occasioned directly by alcohol. Both morbid states of the drunkard's blood therefore conduce to the same end—*the lowering of the vital powers of his brain and nervous system.*

It is this depression of the vital powers which renders the recuperative energies of the system so feeble, and attacks of acute disorders so fatal, in intemperate persons. Indeed, not unfrequently this diminution of the vital powers goes on to such an extent, as to become almost the sole immediate cause of death; or in other words, death occurs without the intervention of an acute disorder. Such people, according to our experience, always die suddenly, and the post-mortem examination, however skilfully made, reveals no structural changes in any organ, except those occasioned by alcohol; lesions which had been produced slowly and had existed for some time antecedent to death.

We have repeatedly met with instances where persons of long-standing intemperate habits, after complaining for a brief period of unusual debility, and even without complaining at all, have suddenly fallen down and immediately expired. We have carefully examined the various organs of their bodies, and by such examinations have been constrained to believe, that death had been occasioned by a sudden extinction of the previously enfeebled vital powers. This opinion is strengthened by the fact, that, in such cases, but little or no muscular rigidity appears subsequent to death. Many of the so-called cases of apoplexy are probably of this sort.

The tremulous hand, the impaired memory, the confusion of ideas, and the want of ability to concentrate thought upon a given subject, are the earliest evidences of the deleterious influence of alcohol upon the human brain. Next to these appear muscular debility, strange sensations, and numbness in different parts of the body, particularly in the feet, legs, and hands, impairment of vision, indistinctness of speech, great increase of the muscular tremulousness, cramps and convulsive movements, epilepsy, great impairment of the intellectual faculties, delirium tremens, insanity, idiocy, and death. Let no skeptic or unwary moderate drinker consider this picture to be overdrawn, for the statement of facts we have made is brief, and therefore must be incomplete.

Death is sometimes occasioned by a large quantity of ardent spirits taken at one time into the stomach, either through sheer bravado, or in consequence of a bet, or at the solicitation of an injudicious friend. In such cases the lesions exhibited on dissection vary much, according to the condition of the subject previous to the fatal occurrence. If the subject be one of temperate habits, we find the mucous membrane of the stomach congested and reddened, the lungs and abdominal viscera generally exhibiting venous congestion, and the brain also congested. The odor of alcohol is commonly perceptible in the contents of the stomach, and sometimes can be detected in the brain and lungs. If some time has elapsed between the drinking of the poison and the fatal event, the odor of alcohol may be wanting in the stomach, because it has mostly been removed from that organ by the activity of its absorbent vessels. If on the other hand the subject be one of intemperate habits, the gastric mucous membrane is almost blackened in spots of varying size, from effusion of blood into or beneath that membrane, the lungs are strongly congested, and may even exhibit pulmonary apoplexy, and besides other lesions the brain exhibits more congestion than in the former case. There is, however, a general similarity in the symptoms presented in all cases of fatal poisoning by an overdose of ardent spirits. The subject passes from a state of drunken stupor into total unconsciousness, stertorous breathing commences, and after the lapse of several hours, he expires with or without convulsive movements. The cause of death, in all such cases, is the chemicovital action of alcohol upon the blood and the various organs of the body, and particularly upon the nervous system.

5th. Under the influence of dram-drinking, the *muscular* system undergoes certain alterations in structure and appearance, which should not be passed over in silence. In old drunkards, especially if they are also old in years, the muscles, or principal organs of locomotion, are found to be smaller, paler, softer, and more flabby than in the healthy state. This atrophy appears to depend, first, upon the imperfect nutrition of those organs resulting from the poor quality and impure state of the blood; and, second, upon the disuse of the muscles, which naturally succeeds the depression of the vital powers. Examination of such muscles with the microscope often shows that particles of oily or fatty matter have usurped the place of true muscular fibre. Even in intemperate persons of a stout and plump appearance, it has been found that the muscles are wasted, pale, and flabby, and that the size and rotundity of limb and figure are produced by a morbid deposition of fat in the cellular tissue. Need we wonder then that such persons are incapable of enduring severe muscular exercise, and that they rapidly succumb to hardship and privation? Is it not rather a wonder that their diseased organisms are capable of enduring so much as they are?

We have thus stated in a general way the morbid effects of alcoholic drinks upon the stomach and brain: we have shown that the quantity of carbonaceous matter in the blood becomes largely increased under their protracted use, and that the quantity of fat in the liver, muscles, and general cellular tissue, is greatly augmented. Now let us ask, Does this accumulation and metamorphosis of the natural tissues into fatty and carbonaceous matter ever proceed to such an extent that the human body becomes combustible, that is, capable of being burned up when once ignited, like fuel after being set on fire? This question can be answered in the affirmative. A considerable number of well-authenticated cases are now on record, of what has been termed the spontaneous combustion of the human body. The learned Orfila thus describes the phenomena which accompany it: "A light-blue flame appears over the part about to be attacked: this flame is not readily extinguished by water, and, indeed, frequently the addition of this liquid only serves to increase its activity. Deep eschars now form in the part affected, accompanied by convulsions, delirium, vomiting, and diarrhœa, followed by a peculiar state of putrefaction and death. The process is said to advance with extreme rapidity, but the body is never entirely consumed: some parts are only half burnt, while others are completely incinerated, a carbonaceous, fetid, unctuous ash remaining. The hands and feet commonly escape destruction, while the trunk is usually entirely dissipated. The wooden and other combustible articles of furniture situated near the individual, are either uninjured or but imperfectly consumed; the clothes, however, covering the body, are commonly destroyed. The walls and furniture of the apartment are covered with a thick, greasy soot, and the air is impregnated with an offensive empyreumatic odor. This phenomenon is stated to have been chiefly observed in corpulent females, advanced in life, and *especially in those subjects who had been long addicted to the abuse of spirituous liquors*." Says Dr. Guy, another eminent writer: "The cases on record may be fairly allowed to prove an unusual degree of combustibility of the human body, occurring in rare instances, and, for the most part, in corpulent *spirit-drinking* females, merely requiring to be set on fire, and needing no other fuel but their clothes or night-dress." (Vide Guy's Forensic Medicine, p. 497.)

Many persons will doubtless consider the above proposition as a very startling one, and for their benefit, we will now proceed to the narration of several cases of the so-called spontaneous combustion.

A female, aged about thirty-nine, of intemperate habits, but apparently robust and healthy, lived in an upper room by herself. On the evening of Dec. 31st, she was seen to be intoxicated in her room by an acquaintance, who left her at a late hour of the night. In the morning, on calling, the same person could not gain admittance, and on waiting until eleven o'clock, she contrived to get in at a back window, where she discovered the remains of the body near the middle of the floor, in which a hole was burnt entirely through, about four feet in diameter, the bones lying beneath. The flesh of the whole body was consumed, except a small portion on the skull, on one shoulder, and on the lower part of one leg and foot, which was burnt off in its smallest part, as even as if it had been cut off, and lay by itself on the floor. The stocking was burnt off as far as the leg, and no farther. The bones, some of which were black and others white, were so thoroughly burnt as to crumble to dust between the fingers. The abdominal viscera remained unconsumed. One of the sleepers which lay under the shoulders was burnt almost through; part of the head lay on the planks at the edge of the hole, and near it was a candlestick, with part of a candle in it, thrown down, but it did not appear to have touched any part of the body, or to have set any thing on fire. The tallow was melted off the wick, which remained unscorched by the fire, as also a screen which was standing near, and almost touched the hole. The leg of a rush-bottomed chair, and about half of the bottom, were burnt so far as they were within the compass of the hole in the floor, and no farther. The ceiling of the room, which was white-washed plaster, was as black as if covered with lampblack, as also part of the wall and windows; and the heat had been so great as to extract the turpentine from the boards and the wainscot. After all this the fire went entirely out, so that when the body was found, not a spark remained. (Guy's Forensic Medicine, p. 500.)

A fisherman's wife, named Grace Pett, of the parish of St. Clement's, had been in the habit for several years of going down stairs every night, after she was half undressed, to smoke a pipe. She did this on the 9th of April, 1774. Her daughter, who occupied part of her bed, had fallen asleep, and did not miss her mother till she awoke early in the morning. Upon dressing herself, and going down stairs, she found her mother's body lying on the right side with her head against the grate, and extended over the hearth, with her legs on the deal floor, and appearing like a block of wood burning with a glowing fire without flame. Upon quenching the fire with two bowls of water, the neighbors, whom the cries of the daughter had brought in, were almost stifled with the smell. The trunk of the unfortunate woman was nearly consumed, and appeared like a heap of charcoal covered with white ashes. The head, arms, legs, and thighs, were also much burned. There was no fire whatever in the grate, and the candle was burned out in the socket of the candlestick, which stood by her. The clothes of a child on one side of her, and a paper screen on the other, were untouched; and the deal floor was neither singed nor discolored. It was said that the woman had drank plentifully of gin over night, in welcoming a daughter who had recently returned from Gibraltar. (Op. cit., pp. 496–7; vide also Brewster's Natural Magic, pp. 324–5.)

The following case was originally reported by Dr. Peter Schofield, of Upper Canada, and is quoted in Dr. Nott's Temperance Lectures, from which we now take it: The subject, says Dr.

Schofield, was a "young man, about twenty-five years of age. He had been an habitual drinker for many years. I saw him about nine o'clock in the evening on which it happened; he was then, as usual, not drunk, but full of liquor. About eleven o'clock the same evening, I was called to see him. I found him literally roasted from the crown of his head to the soles of his feet. He was found in a blacksmith's shop, just across from where he had been. The owner, all of a sudden, discovered an extensive light in his shop, as though the whole building was in one general flame. He ran with the greatest precipitancy, and on throwing open the door, discovered a man standing erect in the midst of a widely extended silver-colored flame, bearing, as he described it, exactly the appearance of the wick of a burning candle, in the midst of its own flame. He seized him (the drunkard) by the shoulder, and jerked him to the door, upon which the flame was instantly extinguished. There was no fire in the shop, neither was there any possibility of fire having been communicated to him from any external source. It was purely a case of spontaneous ignition. A general sloughing soon came on, and his flesh was consumed or removed in the dressing, leaving the bones and a few of the larger blood-vessels; the blood nevertheless rallied round the heart, and maintained the vital spark until the thirteenth day, when he died, not only the most loathsome, ill-featured, and dreadful picture that was ever presented to human view; but his shrieks, his cries, and his lamentations also were enough to rend a heart of adamant. He complained of no pain of body; his flesh was gone. He said he was suffering the torments of hell; that he was just upon the threshold, and should soon enter its dismal caverns; and in this frame of mind he gave up the ghost. Oh! the death of a drunkard! Well may it be said to beggar all description. I have seen other drunkards die, but never in a manner so awful and affecting." (Op. cit., p. 200.)

The evidences before the medical world are too numerous and respectable to admit of a doubt that *spontaneous combustion*, the result of alcoholic drinking to excess, *does* occur, and probably much more frequently than is avowed or acknowledged by the friends of the sufferers.

Should it be argued by the skeptic, who doubts or denies the possibility of spontaneous combustion ever taking place, that most, if not all the cases above recorded are said to have taken place at too great a distance to test the evidence upon which they rest, it may be answered that the case of Dr. Schofield, occurring in Canada, does not come within the range of this demurrer; yet the evidence upon which that case is recorded is equally satisfactory and conclusive as that of those said to have taken place in Europe, and its consequences even more awfully terrific.

In addition to the three cases already related, the following schedule, for which we are also indebted to Dr. Nott, contains eighteen cases of spontaneous combustion. All but one of them have been taken from the "Dictionnaire Medicine," a French work of high authority :

No	Time.	Combustion entire, except—	Intermediate Cause.	Drunkard on what.	Situation of Remains.	Age.
1	1692	Part of skull and fingers.		Spirits for three years.	Upon a chair.	
2	1763	Skull, part of face and fingers.	A lamp.	Camphorated spirits.	On the floor.	62
3	—	Thigh and one leg.	Light aside of bed.	Pint of rum per day.	Near bed on floor.	50
4	—	A few bones.		Habitual.		50
5	—	Skull and fingers.		Brandy her only drink.		
6	1744	Part of head and limbs.	A pipe.	Habitual.	Near chimney.	60
7	1745	Do. do.	A fire.	Do.	On hearth.	
8	1749	A black skeleton.	A fire on hearth.	Brandy for years.	On a chair by the fire.	80
9	1779	Hand and foot and a few bones.	Foot stoves.	Habitual.		
10	1782	Do. do. do.	A fire on hearth.	Do.	On hearth.	62
11	1820	Skull and portion of skin.	A candle.	Wine and Cologne.	In bed.	90
12	1830	Right leg.	Do.	Do. do.	Same bed together.	66
13	—	Few parts of body.	A pipe.		Floor.	very old.
14	1786	Right arm and skin of thigh.	A lamp.		Floor, lived four days.	
15	1799	Complete.		Brandy.	On a bench.	
16	—	Hand and thigh only burnt.			Cured.	
17	—	One finger only.	A candle.		Do.	17
18	1829	Muscles of thighs.	Foot stove.	Spirits.	Chair.	51

Is alcohol a poison? In order to answer this question satisfactorily, it is necessary to define beforehand what we mean by the term poison. The following is as good a definition as any we have seen: "A poison is any substance which, when applied to the body externally, or in any way introduced into the system, without acting mechanically, but by its own inherent qualities, is capable of destroying life." Now, is alcohol, when it has been introduced into the system, capable of destroying life by its own inherent qualities? To this question we must give an affirmative answer; for numerous cases have occurred where sudden death has been produced by drinking a large quantity of ardent spirits; nay, even within the personal knowledge of most of us, cases of this sort have happened. Alcohol is, therefore, a poison.

But an objector may say, that alcohol is a poison only when it is taken in large quantity, and that when taken in moderate quantity, it is harmless. But is it true that alcohol is harmless when used in moderation? We think we have already abundantly shown that it is not harmless, that it slowly undermines the constitution and prostrates the vital powers. Is arsenic none the less a poison because, when taken in medicinal doses, it does not produce death? Must we say that the sulphate and acetate of copper are not poisons, because a person can swallow a small quantity of them without being killed thereby?

The figure of antiquity which represented a vulture tearing from the body the liver of Prometheus, while a fire was consuming his entrails, was doubtless meant to show the effect of intoxicating drinks on that important viscus. Among all the vital organs, there is none so susceptible of the physical effects of alcohol as this. Inflammation, induration, cancer, decay, loss of substance, are some among the many deplorable consequences of intemperance on the liver. Mr. Fyfe, an eminent anatomist and surgeon at Edinburgh, Scotland, found the liver of an inebriate, upon a post-mortem examination, to weigh fifty pounds!

What must have been the deformity occasioned; what the effect of such an enormous morbid mass pressing on the other organs of vitality? Imagination loses her power in the awful contemplation.

Intemperance predisposes the system for the reception of any and every disease—whether contagious or not—that flesh is heir to. We contend that the primary seat of disease is in the nerves, and that if they be deprived of their power, from whatever cause, the system is fully exposed to attacks from within or without.

Who were the principal victims to the cholera? Among whom has the malignant, typhoid ship fever principally prevailed?

Let the tombs which inclose the silent remains of ebriety answer the questions; the wailings of the widow and the fatherless bear record to the truth of the reply.

We have detailed the effects of alcohol on the system separately, in order to make them more clearly perceptible. They are, however, more usually combined, and then—but we pause for a moment on the threshold of human deformity, ere we lift the veil which conceals the withering remnants of her shipwrecked, mutilated victims.

Who is that tottering along, as if in the decrepitude of age; his countenance sallow; his cheek sunk and hollow; his voice like the echoes of the sepulchre; his arm trembling as if just recovering from paralysis; his extremities scarcely able to bear the weight of the feeble frame which demands their support; a countenance exhibiting the rapid decay of a once mighty intellect; an eye staring with an idiot-like gaze on vacancy, and a frame bending to that earth which must soon receive all that it possesses of mortality? The gay, the young, the accomplished Lothario, who revelled in the halls of folly, drank deeply of the midnight bowl, rejected the frequent warnings and admonition of nature, spurned her edicts, disobeyed her laws, and must suffer the penalties she inflicts—the inebriate.

It would be well, at least less deplorable, were the diseases engendered or called into action by the use of alcohol, confined to the intemperate himself. If through successive generations, in a moral sense, the iniquities of one race are visited on another; in a physical sense, the fact is strikingly exemplified in the posterity of the drunkard. Scrofula, insanity, predisposition to consumption, imbecility, are not the least among the evils that the drunkard may entail on coming generations.

Is the love of alcohol a natural taste? It is completely artificial. The first draught from the alcoholic cup is disgusting; it is only by continued repetition, and its exciting action on the stomach and the brain, that at length it becomes pleasurable. There are drinkers, and hard drinkers too, to whom spirituous potations, in *taste*, are ever disgusting; but the laugh or the jeer of a convivial companion is worse to them than the natural disgust which they feel to the draught, or the prospective destruction of health. Shocking indecision, miserable morality! But what are the physical sufferings to the individual, compared to those inflicted on society from this deplorable failing? Enter for a moment into the dwelling which contains the wife and children of the drunkard; see them turned on the cold and cheerless charities of the world, or crying around the agonized mother for the bread which she cannot give them. They sink into slumber from the mere exhaustion of nature, the bare floor for their bed, the ceiling for their covering. The fond parent gazes on her faint and sleeping offspring; the chords of her affections, stretched to their utmost point, ready to disfranchise the spirit from its earthly tabernacle, still bind her to the cherished pledges of her fond affections. She confides them to the care of Heaven, and prepares herself to watch through the livelong night for the return of him to whom, in the depth of degradation, she yet clings, in the hope of a moral regeneration. Perhaps, far past the midnight hour, he returns, but what a spectacle for the wife and mother! Horror is depicted on his countenance; he flies as if pursued by a demon, retires in agony to some corner of the room, dreading the imaginary phantom that pursues him; he looks wildly around; clings, in his horrific imaginings, to the weak frame of the being whose happiness he has shipwrecked, for protection; shrinks within himself under the total paralysis of feeling; with fixed gaze stares on vacuity, and becomes a mental blot, if not a blank, in creation. Sleep, the refuge of the weary, to him is denied; the nerves of muscular motion alone retain some small degree of functional power, as may be observed in the twitchings of the extremities; those of intellect are suspended, if not destroyed. Such is the victim of delirium tremens, whose earthly career is terminated by spasmodic convulsions beyond description, or whose strength slowly returns to prepare for a similar conflict.

Cases there are too numerous amongst us, in which the inebriate, smarting under the visitations of that still, small voice that dissipation has not completely hushed, with a mind too weak to bear the stings of just self-reproach, hurries from the bottle to the gaming table. He plays, reckless of the stake, and loses it; hazards another, and loses all. Maddened at the result, he rushes from the den of infamy, approaches the door of his dwelling, but does not enter; seeks again the intoxicating bowl in some low, miserable, depraved abode of licentiousness; finally loses every feeling of self-respect, and becomes a disgusting, loathsome, abandoned drunkard.

The cry of midnight murder breaks in on the silence and repose of night; scream succeeding scream is borne on the winds to our dwellings! Our police records tell the morning tale: the drunkard has become the assassin; the body of his bleeding victim—perhaps the wife of his bosom—is awaiting the result of an inquest which may cause the maddened murderer to expiate his crime on the gallows, or consign him, for life, to a State's prison.

Murder, manslaughter, suicide, are frequently the immediate effects of drunkenness. Gambling and theft are legitimately connected with it. Depravity of every kind, from the most revolting crimes committed at the "Five Points," to the more fashionable vices which undermine the fabric of society, owes its existence to the drunkard's bowl.

To apply a remedy to an evil which extends through every grade of society; which unblushingly stalks forth at noonday, supported by wealth and clothed in poverty; for the criminal effect of which the culprit is punished by the judge, who, himself, freely indulges in the temptation; which debases humanity, destroys intellect, undermines the moral energies of a people and the physical condition of the unborn future, seems to present a moral and political problem not easy of solution.

While no inconsiderable part of our city revenues are derived from licensing the retail marts of destruction, where alcohol—pure, and drugged to excess by vegetable poisonous narcotics, as henbane, tobacco, cocculus indicus, or bayberries, prussic acid, opium, and other vegetable narcotics—is sold; while a grocery store, licensed to sell the stimulating draught, stares us in the face at every corner of our streets; while the rapacity for political influence controls the licensing of the most degraded hovels of humanity in which alcohol is retailed; while the power to propagate the evil to its most minute ramifications can be purchased from our municipal authorities to enrich the treasuries of our cities and counties, every moral influence which can be exerted against the degrading vice of drunkenness must necessarily be limited.

An inebriate commits murder; is tried for the act, condemned, and executed. The law does not admit the crime of drunkenness to palliate that of murder: the deed has been committed, the penalty must be paid.

We dissent from believing in the righteousness of such a judgment. Where, we ask, is the moral, civil, or political justice of that law which visits the last sanguinary punishment on the criminal, and legalizes the sale of that which excites to the commission of the crime? Let the framers and administrators of our criminal laws answer the question.

CHAPTER XVIII.

Effects of Tobacco on the Human System.

Pernicious Effect on the Nervous System—Acts Directly on the Nerves of the Stomach—Loss of Muscular Power—Case depicting the Effects of Tobacco—Amaurosis (Dimness of Sight) caused by Tobacco—Dr. Chapman on the Effect of Tobacco—Effects of Tobacco Injections—Snuff Plasters for Children—Great Danger in their Use—Tobacco Equally Injurious to the Stomach, Heart, Lungs, Brain, and Nervous System generally.

WE know not of any stimulant and sedative which exerts a more pernicious effect on the nervous system generally, and particularly on the organic nerves of the stomach, than that which lends its name to this chapter.

It is a singular circumstance, that might be supposed to weigh powerfully against the almost universal use of this narcotic herb, in smoking and chewing, that the first attempts to use it are attended with feelings of the most ineffable disgust; that the tyro in a practice "more honored in the breach than the observance," resolves and re-resolves to shun a habit the first approaches to which are marked with nausea and the most debilitating symptoms, as cold sweats, faintings and vomitings. But unfortunately, as in the case of all other stimulants, the primary effects wear off as the organ becomes accustomed to the stimulus, and the destructive habit, after a few feeble subsequent resolutions have been broken, becomes at length confirmed.

We know that this herb acts directly on the nerves of the stomach, and through them on the whole nervous system; that, administered in the form of an injection, it prostrates nervous and muscular power, producing on all occasions faintings, and in some immediate death; that it causes loss of appetite, indigestion, stupor, and all those conditions produced by the action of vegetable narcotic poisons on the nervous system.

Loss of muscular power is the inevitable result of intense chewing or smoking of this herb. To those predisposed to consumption, the ptyalism which it produces hurries on the disease.

We are acquainted with a gentleman who some years since appeared to be wasting away without any specific disease: his evenings were pleasant and gay, his conversation instructive and enlivening, and his general appearance, save a shrinking of the muscles and a cadaverous hue of countenance, that of a man in health; but the *morning* found him listless and inactive, the tongue furred, the hands hot, the pulse fluttering, weak and accelerated—we may add, with a general prostration of the vital functions.

His friends became alarmed, physicians of eminence were consulted: by some he was pronounced to be in a rapid consumption; others were of the opinion that the disease lay in the liver; while a third declared it to be a peculiar species of neuralgia. In conversing with him one evening on the distinct peculiarities of his evening and morning sensations, we inquired if he ate suppers. No, was the direct reply. We then further inquired if any alcoholic stimulus was taken in the evening. Nothing stronger than cider, and only one glass of that, was the answer. Our friend was at the time smoking. It immediately occurred to us that the numberless and various symptoms presented, which seemed to baffle all attempts at a correct diagnosis, might arise from the effects of tobacco on the nervo-muscular system, and through it on the organic vital functions. Upon asking how many cigars he smoked per day in addition to constant chewing, we were answered, "About *eight* or *nine*."

We had now no doubt of the cause of his disease: it stared us in the face.

We advised him to abstain gradually from the entire use of tobacco, and he would regain his health. Our advice was followed: he is now, after a lapse of thirteen years, in the possession of robust health, and a physical frame equal to that of any man of equal stature, a good appetite, an overflow of natural spirits; and morning finds him in the enjoyment of that health with which he retired to rest on the preceding evening.

Says Dr. Prout, in his book on "Diseases of the Stomach and Urinary Organs": "There is an article much used in various ways, though not as an aliment, the deleterious effects of which on the assimilating organs, etc., require to be briefly noticed, viz.: *Tobacco*. Although confessedly one of the most virulent poisons in nature, yet such is the fascinating influence of this noxious weed, that mankind resort to it in every mode they can devise, to insure its stupefying and pernicious agency. Tobacco disorders the assimilating functions in general, but particularly, as I believe, the assimilation of the saccharine principle. I have never, indeed, been able to trace the development of oxalic acid to the use of tobacco; but that some analogous and equally poisonous principle (probably of an acid nature) is generated in certain individuals by its abuse, is evident from their cachectic looks, and from the dark, and often greenish-yellow tint of their blood. The severe and peculiar dyspeptic symptoms sometimes produced by inveterate snuff-taking are well known; and I have more than once seen such cases terminate fatally, with malignant disease of the stomach and liver. Great smokers, also, especially those who employ short pipes and cigars, are said to be liable to cancerous affections of the lips. But it happens with tobacco, as with deleterious articles of diet: the strong and healthy suffer comparatively little, while the weak and predisposed to disease fall victims to its poisonous operation. Surely, if the dictates of reason were allowed to prevail, an article so injurious to the health, and so offensive in all its forms and modes of employment, would speedily be banished from common use." (Op. cit. pp. 42–3.)

Druitt (Principles of Modern Surgery, p. 353) says: "Amaurosis is liable to be induced by certain narcotico-acrid poisons, such as belladonna, and especially by tobacco, whether administered in poisonously large doses by accident, or used slowly and frequently in the form of snuff or smoke."

Dr. Chapman, of Philadelphia, has met with several instances of mental disorder, closely resembling delirium tremens, which resulted from the excessive use of tobacco, and which subsided in a few days after it had been abandoned.

The debilitating effects of tobacco on the nervo-muscular system, the complete exhaustion in the former and relaxation in the latter, which it produces, are in no cases more fully displayed than where used to reduce muscular rigidity in cases of hernia or rupture.

As a last resort previously to a surgical operation, when every other means have been exerted to replace the strangulated bowel, tobacco injections are given: the patient faints from the destruction of vitalizing power in the nervous system, a general relaxation of the muscles takes place, and at times the protruding bowel is returned through the muscles which have contracted upon it, with scarcely a visible effort on the part of the operator.

It is not an uncommon practice, particularly in country places, and among those who seldom call in medical advice, to resort to those curative means, in disease, which have been handed down as heirlooms through generations, by some one, probably a female branch of the family, who possessed, or supposed she possessed, a superior knowledge of the medical art. Among these is that of applying snuff plasters to the stomach of children in the hooping cough, croup, and similar diseases, in order to produce vomiting: the plaster is prepared by spreading tallow on a rag, and sprinkling it over with Scotch snuff; the plaster so formed is laid on the stomach; within ten minutes, the countenance of the child assumes a pallid hue, the most dreadful nervous and muscular prostration follows, and vomiting ensues. So powerful is the influence of tobacco in this form, even when applied externally, on the nerves of sensation which lie on the surface, that it is immediately carried to those of muscular motion, and would, if not removed, produce death.

The treatment is attended with great danger, especially if the child is not very closely watched.

If the effects of this narcotic herb are thus powerful on the stomach, they are equally so and more injurious on the heart and lungs: in the former, by their action on the nerves supplied from the spinal cord and the great sympathetic, the most violent palpitations are produced, and by sympathy, the most feeble and difficult respiration in the lungs. Tobacco, like alcohol, is also an intoxicant in whatever form it is taken; it creates thirst, and is thus apt to lead to the use of alcoholic drinks; it has a benumbing, withering effect on the intellectual powers; it demoralizes the feelings; and the habit of taking it, especially by chewing, is at best dirty and idle. It should be used only as a drug—not indulged in as a luxury.

CHAPTER XIX.

Influence of Mind over Matter, in the Production and Cure of Disease.

Mysterious but Visible Effects of Mind on Matter—Of the Essence of Mind Nothing is Known—The Connection between Mind and Matter established in this Chapter—The Blood the Primary Conductor—Iron one of the Constituents of the Blood—One of the most Powerful Conductors of Electricity—Nerves in Close Connection with the Arteries—It is from the Brain the Heart and Lungs receive their Motion—Electricity inhaled with the Oxygen that Causes the Blood to Circulate—Physiological Evidence of this Fact—Medical Profession too apt to Look on Proximate Causes—Empiricism Exposed—Oxygen and Electricity the only Purifiers of the Blood—The Nerves and not the Blood, the Primary Seats of Disease—Sudden Anger will Produce Apoplexy and Death—Cause—Subjects most Likely for Insanity—Cases—Consequences of Unpleasant News on the Mind—The Advocates for the Old Theory of Disease—The Cause, in its diminished Influence, which produces Insanity—Degrees of Pain arising from different States of Electricity—Man but the Reflected Image of Nature—Effects of a Sudden Gust of Night Air—Percentage of Electricity in the Nervous System—Fifty per cent. under Mental Control—Fifty per cent. under the Control of the *Involuntary* Nerves—Sudden Effects on the Brain from Increased Electricity on the Arrival of Alarming News—Cases—Causes—Operations on the Production of Disease having their Origin in Mental Impressions—Cases—Influence of the Mind over the Body—Imagination may Form the Natural Disposition, either for Good or Evil—Case Related by the Late Rev. Dr. Rudd, of Utica—Effects of Imagination on Physical Formation.

We now approach the consideration of the mysterious, but not less visible effects of mind on matter, and the inquiry whether electricity is not the connecting agent between emotion and certain states of animal condition in disease.

Of the essence of mind we have previously expressed our ignorance, and a desire to avoid entering on a fruitless analysis of that mysterious principle which shed its intellectual light on the dwellers in Eden, has accompanied the succeeding generations of humanity, and will outlive, in a purer condition, in another and better state of being, the last tottering vital frame that lingers on the verge of a material world.

That there is a connection between mind and matter, that the former influences the latter in the same individual; that the embryo, ere it bursts into existence, is influenced by any sudden mental shock received by its maternal parent; that physical, unmistakable signs of such shocks have existed and do exist, we shall establish in this chapter.

We know not of any agent capable of effecting the connection to which we have alluded, other than that of electricity.

In a former chapter we have established the similarity in production and effect, between the nervous and the electric current. In the connection which establishes the power of mind over matter, we are inclined to believe the *blood* is the primary conductor, more especially that portion of it which passes from the lungs to the left chamber of the heart, termed *arterial.*

In reference to the conditions of electricity, the arterial may be called the positive, the venous the negative blood. Chemistry by her analysis has long since declared that iron is one of the constituents of the circulating fluid; and natural philosophy has demonstrated that this metal is a powerful conductor of electricity.

In speaking of the nerves, we said that many of them were in close connection with the arteries; large nervous plexuses or webs covering some of the more important among the blood-vessels.

If iron be a conductor of electricity and an element of the arterial fluid, if the nerves entwine around the canals which convey the former to the utmost ramifications of the system, why may not the blood receive its electricity from the atmosphere as it passes through the lungs, and in this new condition, as it winds along the arterial system, discharge its electricity into the *nerves* of involuntary motion by which the latter is surrounded?

It is from the base of the brain, the cerebellum and the medulla oblongata, that the heart and lungs receive their motion, the fountains of organic life and involuntary motion. It is the involuntary nerves issuing from these two divisions of a great centre, that cause the heart to pulsate and the lungs to contract and expand.

It is the electricity inhaled from the atmosphere at each inspiration of the latter organs, that causes the blood to circulate through its canals, and excites the nervous power of the brain.

That the involuntary nerves at the base of the brain cause the heart to throb and the lungs to expand and contract, and yet do not carry on the circulation, may appear paradoxical, but is susceptible of physiological proof.

If the spinal cord is divided *below* the region of the heart and lungs, the extremities and other parts below the section are paralyzed: they may be broken in pieces, but no pain will be experienced; yet the blood flows through them with its usual velocity. What more conclusive proof can be offered that the circulation is not dependent on any invested power at the base of the brain? If it were so, the current would stop when the spinal cord was divided, as the nerves which supply the extremities *below* the section are cut off from any influence of the cerebellum or medulla oblongata.

If the spinal cord be divided above the heart and lungs, both organs will become immediately paralyzed; yet the last air received into the lungs having communicated its electricity to the blood, the current of the latter will be carried on *after the paralysis*, nor cease until it returns to the right chamber of the heart.

We are here furnished with irrefutable evidence that the heart and lungs are obedient to the nervous action of the cerebellum and medulla oblongata, and that the blood is dependent for its circulation on the electricity contained in the atmospheric air which is inhaled into the lungs. The electric fiuid carried along the nervous system reaches the anterior lobe of the brain, exciting the intellectual functions.

If, as we have before stated, the electric fluid stimulates the nervous system, which latter reacts upon the muscular circulating and respiratory functions, freedom from disease will be in a great measure dependent on the quantity of electricity contained in the system. When equalized, the result will be health; when deranged and disturbed, the natural result will be disease. The degree of the latter will be virulent or the reverse in the ratio in which the electric agent is disturbed or diminished.

The medical profession have hitherto been too prone to look on the proximate instead of the remote cause of disease; to watch the pulsations at the wrist and the movements of the circulating fluid as indexes to all diseases in the system or to which it is liable: hence the empirical phraseology, "The blood is the source of disease," "The blood is the life," "Purify the blood if you would enjoy health; purge the system that all impure matter may be removed from the blood," placarded in large letters to catch the unwary, at every corner of our city, (New-York,) and the still more fatal nostrums of which the above are but the significant heralds.

This farrago of empiricism has no foundation in physiological truth: the blood, in itself, has no impurities.

It can only be rendered impure by a disturbed circulation, and the latter would be dependent on the greater or less admixture of the electric fluid imparted to it in its passage through the lungs.

Oxygen and electricity are the purifiers of the blood: the whole of the vital fluid passes through the lungs every few minutes; if any thing arrests its progress so that it cannot reach the lungs, it is necessarily rendered impure from the want of those aërial elements upon which its purity is dependent, and will in that case produce inflammation, and finally ulceration and corruption.

If our theory is correct, the nerves, and not the blood, are the primary seats of disease, the causes of such disease being a derangement in the electricity of the system. Philosophy is sometimes obscured in an array of words differing in their literal construction, but meaning the same thing: the schools are willing to admit the principle if they are suffered to baptize it in their own nomenclature. Thus the metaphysicians assigned to what has lately been called the vital principle, the terms vis medicatrix naturæ, vis vitæ, vis insita, &c., as if a change in phraseology could alter a fixed principle. We hold the vital principle to be *electricity*, an element of the system without which it would perish and decay; the purifier of the blood, the great agent in imparting healthy action to the functions of organic life.* If the want of a proper

* A very intelligent friend of ours yesterday related the following circumstance: "I have always," said he, "when opportunity offered, presented myself to mesmerizers or psychologists for experiment, but they have never yet succeeded in making any impression upon me. The following occurrence seems to present a reason for these repeated failures. Some time since, within two years, a legal friend of mine in the country was attacked with hemiplegia or palsy on one side: the face was greatly distorted.

"Being one day in company with him when the facial muscles seemed much agitated, I related to him, in the attempt to divert his mind from a subject to him truly painful, the fact to which I have adverted, that mesmerism or animal magnetism had no effect on me. 'It may arise,' replied he, 'from your system always being in a *highly* positive state; you may be fully degree of electricity in the system be the cause of disease, and this subtle agent pervades every portion of the nervous system, the nerves of intellect in the brain proper and those of respiration and muscular motion in the medulla oblongata, the cerebellum and the spinal cord, it must of course be apparent that *mental impressions* will through its agency produce disease.

We know that sudden and violent paroxysms of anger will produce apoplexy and death: these fatal effects are produced by pressure on the brain, *pressure of blood.* The violent action of the brain concentrates the electric fluid from every part of the system on that sensitive and delicate organ; the blood follows it, the vessels of the head are surcharged with the circulating fluid; they press on its delicate texture, or the circulation becomes impeded from the vast accumulation of the vital fluid; congestion follows, and death closes the scene. In such a case as that to which we have alluded, the lower extremities will be found upon examination to be COLD; electricity and the blood have forsaken them. *In all states of high nervous*

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charged with the electric fluid, which would of course account for the failures to which you allude. But make a few passes over my face; if I am right in my conjectures, you have power to relieve me.'

"Totally unconscious of possessing such power, yet willing, if possible, to do any thing which might relieve the sufferer, bodily or mentally, I complied. He immediately exclaimed, 'It is as I thought; the shock of electricity is as great from you as I have frequently experienced in that from a Leyden jar, and it has very considerably relieved me.'"

susceptibility, the extremities are invariably cold from the cause above named.

Who compose the class of individuals most subject to insanity in its various forms, and what are the causes and effects of this mental malady?

It is a common and just saying that fools (meaning persons of inferior intellectual power) seldom go mad. It is men who can concentrate the nervous power of the brain on a single object; who can look with an unblenching eye on the demon of ruin as he approaches them, or on the destroying angel as he passes his fatal wand over the land of promise and affection; who can brood over the consequences of the ruin in the intensity of silence and suffering; who permit no scalding tear to relieve the mental concentration which sees nothing in its morning and evening visions but the image of the loved idol whom the hand of death has torn from its embrace; it is such men as these, who betray no outward signs of emotion, until the brain awakes from a paralysis occasioned by the intensity of its previous action, and reason has surrendered her throne to the wanderings of intellect, that fill our public and private lunatic asylums.

A melancholy illustration of the above physiological facts is recalled to our memory at this moment. A beautiful young girl, (Miss V., of New-Brunswick, in New-Jersey,) some years since, was married to a young man of early promise, but who eventually became a drunkard. When all other means of correction had failed, she returned to her mother's house, (her father was not living.)

Enraged at not finding her on his return home late one night from a bacchanalian revel, the husband, maddened with drink, armed himself with a dagger and rushed wildly to the abode of his wife.

She was engaged in conversation when he entered the room, with her back towards the door; rushing towards her, he seized her flowing locks with his left hand, while with his right he plunged the fatal dagger in her bosom several times, and fled from the house. As the beautiful corpse lay weltering in her blood, her brother, a young man of high nervous temperament and large brain, (Mr. V.,) entered the room: the sight was enough; he at once, as if instinctively, knew the cause, and flying to the jail in which the murderer was secured, demanded admittance. It was necessarily refused.

The victim was consigned to the tomb. The brother conversed but little: there was a fixed mental abstraction about him on which no words of kindness or consolation produced any effect; by a slight incination of the head he would recognize the intention of the speaker, then sink into the abyss of silence and thought. The tragedy occurred during the intensity of winter.

Mr. V. was missed one evening from the family circle; the worst apprehensions were entertained. The river's banks were searched for his body, his friends and neighbors supposing he had committed suicide. After a search of several hours, a suggestion led the searching party to the grave of Miss V., and there, with the cold wind of winter howling around him, the earth his footstool and the heavens for his only canopy, sat the brother, in silence, over the tomb which contained the remains of his earthly idolatry. His friends approached; the cold had partially stiffened his limbs. He was addressed, but no sign of vocal recognition was returned: his gaze was fixed on vacuity, the head being slightly drawn backward as if his visual attention was fixed on the heavens. *He was a maniac!* The concentration of electricity and nervous fluid on the brain had destroyed its function, Mind.

The cause of insanity, in such cases as the above, does not arise in consequence of the system *generally* being surcharged with blood or electricity, but upon their concentration on one part—the Brain.

We will suppose the mind gradually to have regained its wonted equilibrium: some sudden disaster, either the loss of fortune or of friends, occurs. What is the effect? The mind retires within itself; its manifestations, by which only we know its existence, are fled. It happens in some cases, where the news is of a terrific character, as the midnight assassination of some friend or relative, on whom our affections had been concentrated, or the sudden and total wreck of worldly fortune in the midst of supposed affluence, that the concentration of nervous and electric force on the brain becomes so excessive that its powers are deranged, its physical organization destroyed, and instantaneous death follows.

If the electro-nervous power be great in the brain, and weak in any other of the vital organs, the effect of the passions and emotions we have above described would be seen on the organs where such power was deficient.

We will take the *liver* to illustrate our position, and suppose that an emotion occasioned by some sudden and painful communication is carried by the electro-nervous fluid to the brain, but finds that organ sufficiently charged to resist further ingress: it now directs its path and its influences to the *liver:* the functions of that organ become disordered; the gall bladder pours out an unusual quantity of bile, a great portion of which is taken up by the lacteals and other absorbents, and carried to the surface; the skin becomes *yellow,* the bowels costive, the spirits depressed; the patient is suffering under *jaundice.*

Applying the above reasoning to the brain and *lungs*, in a corresponding relative electro-nervous condition, the latter would become first irritated, subsequently inflamed, giving rise to tubercles, organic ulceration and death.

Were the *stomach* in the situation of the liver and lungs above described, its blood-vessels would become suddenly gorged; dyspepsia, the result of disturbed nervous action, would supervene, or irritation and inflammation, succeeded by *congestion*, perhaps death.

There is no organ in the system which, in the negative state of electro-nervous power we have described, may not, by its sudden and superabundant increase, be thrown into that impaired derangement of function to which we apply the term disease. The spine, the kidneys, the heart, the spleen, the glandular system, the muscles, and even the bones, as in cases of softening, are subject to this law, which is universal both in its physical and mental application.

From what has been said, it is evident that mental impressions will produce physical disease, and that the intermediate agent which thus connects the cause with the effect, is electricity.

We shall now examine the influence which *physical* impressions exert on nervous force. We mean physical impressions from the external universe.

The advocates for the old theory of disease will not deny, with us, that mental and physical impressions are causes of disease; but they argue that there are two causes, one afar off, the other near; or, to use technical language, remote and proximate. We have already shown how the nervous power residing in the brain summons electricity from the distant nerves of the system, and produces the varied forms of insanity. There is only one proximate cause of disease, whether mental or physical: it is that caused by a disturbance of the proper distribution of the regular balance of electricity in the system. This electrical force is in the nerves, not in the vital fluid: the former are in all cases, physical or mental, the primary seats of disease.

The cause which produces insanity, in its diminished influence gives rise to headache, and to any state of cerebral excitement. A corresponding cause, *the derangement of the electro-nervous fluid*, produces affections of the spine and hip, dyspepsia, liver disease, cholera, cholera morbus, cholera infantum, dysentery, pleurisy, etc.

Electricity, when equally diffused through the system, produces the most perfect health; when disturbed, disease, proportioned to the greater or lesser derangement.

There are several degrees and kinds of pain proceeding from different states of electricity. A negative or *diminished* state of electricity existing in an organ, when increased by any sudden impression followed by an increase of blood, produces pain followed by *inflammation*. A positive state of electricity, or that which repels the blood, causes pain equally severe, as in a powerful electric shock given to the system, but no inflammation; a mixture of both the electric forces, positive and negative, gives rise to a pricking, burning or tingling sensation, exceedingly unpleasant.

Man is but the reflected image of external nature in her storms and her tempests, her calms and her sunshines. Her convulsions, if not the same in quantity, force and quality, are yet the same in *kind* as those to which humanity is subject: as the former arise from peculiar concentrations of electric force, which roll along the canopy of heaven or in the deep caverns of the earth, mental and bodily disease in man arise from the same cause, diminished only in degree.

Among the causes which may disturb the balance of the electro-nervous force necessary to sustain and regulate the functions of organic life, the absence of *warmth or heat* is one of the most powerful. In a cold moist atmosphere, the electric spark is evolved from the machine with great labor and difficulty. Cold is a repellant of electricity. By placing the foot in a cold damp place, the electric fluid may be driven from that limb to the brain, and in its final results, produce insanity; it may be sent to the lungs and give rise to inflammation, suppuration, and subsequently to *consumption.* In all cases where the electro-nervous fluid is driven from the circumference, *it concentrates on the weakest internal vital organ*, and the blood follows it, producing disease and at times death.

A sudden gust of the night air, acting on a perspiring surface, frequently sends the electric fluid, followed by an increased flow of blood, on to the bronchial tubes and lungs of children, and that painful, rapid and devastating disease, *croup*, is the result.

Alcohol increases the nervous action of the brain: the electricity of the system, in concentrating on that organ, carries the blood with it; the nervous force of the brain becomes increased and deranged with that of the nerves, and "delirium tremens" succeeds.

We thus see how mental and physical impressions derange the electricity of the system, and by destroying its just equilibrium, produce partial organic disease.

If we calculate the whole electricity of the nerves at one hundred per cent., fifty per cent. of which is under the control of the mind, and belongs to the voluntary nerves and muscles, while the residue is under the control of the involuntary nerves which appertain to organic life, it needs no argument to prove that if the whole of the fifty per cent., which in its proper distribution would equally pervade every part of the system, were concentrated on any particular point of either, it would destroy the organ placed at such point.

Such is too frequently the case. Some sudden, alarming news reaches the seat of mind: the whole fifty per cent. of the electro-nervous fluid rushes towards the brain, followed by a column of blood from all parts of the system, and either apoplexy or death ensues.

The mental impression, acting on the voluntary nervous force, would cause the mind to fall back on itself, and a state totally passive would succeed.

The same fatal effect might be produced by excessive eating or drinking, or any other external or internal physical impression acting on the *involuntary* force, which is partially if not wholly independent of Mind.

The following cases are presented as illustrating the influence of mental impression over mental and physical disease. The following was reported many years ago, of some Pittsfield medical students trying an odd sort of an experiment on a good-natured countryman. It appears that this man was in the habit of bringing fruit to the college for sale on certain days of the week. One day, when within three miles of the town, he met a couple of students on the road. They stopped and bought some fruit. "Why, John," said one, "what is the matter with you? You look so queer about the eyes!"

"Yes," said the other student, "I noticed that John looked uncommonly pale when I first saw him. Is there any thing the matter, my boy?"

"Well, I guess not," said John; "I never felt better in my life."

"You've been unwell, then, and got over it, perhaps?" suggested the first student.

"Not in the least—I'm all right, and in something of a hurry; so, good bye;" and John continued his journey.

About a mile further towards town, he met three more students, and the same scene was repeated as with the first two. Poor John, not suspecting the plot, began to imagine that he was a little ill; so he replied, "I do feel queerish about the head."

"I thought something was the matter," said one of the second party, "your eyes have such a languid and singular look; it is in my opinion the premonitory symptoms of an intermittent fever. If I were in your place I would abandon my journey to town, go straight home and take a couple of blue pills."

But John was determined to sell his fruit. "No," said he, "I think I'll be able to stand it till I sell out."

Just as he entered the village he met, solitary and alone, a grave and sedate young man, whose term of study had nearly expired. This was a student for whom John had the greatest respect and consideration. He was different from his fellows, inasmuch as he never joined them in their numerous jollifications and sprees, but was constantly occupied with his books. When this young man began to talk to John about the singular appearance of his eyes, premonitory symptoms of fever, &c., he became really alarmed, and frankly acknowledged that he did feel unwell. However, he still persisted in his journey, saying he would start home within an hour. The sedate student advised him to turn back at once, as perhaps he might become seriously ill sooner than he expected. But John nevertheless continued his journey. Arriving in town, his fruit was sold off within an hour, the medical students and some of the town people crowding around his wagon, and buying freely. But each one took pains to repeat the same opinions relative to John's singular look about the eyes, and the probable cause thereof, viz., premonitory symptoms of an attack of fever.

To shorten the story, we will add that, in less than two hours' time, poor John was put to bed in the tavern, and by nine o'clock at night he was really and truly in a raging fever. His illness was beyond doubt purely the effect of imagination; and it established a theory which had previously been in dispute between many of the old professors of the college.

Diseases having their origin in *mental* impressions, are produced by an increase of fifty per cent. in the *voluntary* nervous force; those originating under external physical impressions, by fifty per cent. of involuntary force over which the mind has no control. The effect of these electro-nervous forces to a certain amount on a muscle, would give rise to *pain:* if increased, *inflammation* would ensue, and by still greater increase of force, *mortification.* A corresponding result would follow the application of these forces, graduated as above, on any of the organs in the system.

The following cases are illustrative of this physiological fact. The first is related by Dr. J. K. Mitchell, a physician of some eminence in Philadelphia, to his class last winter, while lecturing upon diseases of the heart:

"In the early part of his medical career, Dr. M. accompanied as surgeon a packet that sailed between Liverpool and one of our Southern ports. On the return voyage, soon after leaving Liverpool, while the doctor and the captain of the vessel, a weather-beaten son of Neptune, but possessed of uncommon fine feelings and strong impulses, were conversing in the latter's state-room, the captain opened a large chest, and carefully took out a number of articles of various descriptions, which he arranged upon a table. Dr. M., surprised at the array of costly jewels, ornaments, dresses, and all the varied paraphernalia of which ladies are naturally fond, inquired of the captain his object in having so many valuable purchases.

"The sailor, in reply, said that for seven or eight years he had been devotedly attached to a lady, to whom he had several times made proposals of marriage, but was as often rejected; that her refusal to wed him, however, had only stimulated his love to greater exertion; and that, finally, upon renewing his offer, declaring in the ardency of his passion that without her society life was not worth living, she consented to become his bride upon his return from his next voyage. He was so overjoyed at the prospect of a marriage from which, in the warmth of his feelings, he probably anticipated more happiness than is generally allotted to mortals, that he spent all his ready money while in London for bridal gifts. After gazing at them fondly for some time, and remarking on them in turn, 'I think this will please Annie,' and 'I am sure she will like that,' he replaced them with the utmost care. This ceremony he repeated every day during the voyage, and the doctor often observed a tear glistening in his eye as he spoke of the pleasure he would have in presenting them to his affianced bride.

"On reaching his destination, the captain arrayed himself with more than usual precision, and disembarked as soon as possible to hasten to his love. As he was about to step into the carriage awaiting him, he was called aside by two gentlemen who desired to make a communication, the purport of which was that the lady had proved unfaithful to the trust reposed in her, and married another, with whom she had decamped shortly before. Instantly the captain was observed to clap his hand to his breast, and fall heavily to the ground. He was taken up and conveyed to his room on the vessel. Dr. M. was immediately summoned, but before he reached the poor captain, he was dead. A post-mortem examination revealed the cause of his unfortunate decease. His heart was found literally torn in twain! The tremendous propulsion of the blood, consequent upon such a violent nervous shock, forced the powerful muscular tissues asunder, and life was at an end. The heart was *broken*."

The second is that of the Rev. J. N. MAFFIT, the celebrated Methodist preacher, whom many of our readers well remember. During his sojourn in the South some years since, and under great mental distress, while pacing the floor of his chamber, he exclaimed that his heart would break within him. He had no sooner ended the exclamatory sentence, than he fell prostrate on the floor and expired. A post-mortem examination proved the correctness of his feelings. *His heart had literally burst open!*

The following cases, which illustrate the influence of mental cheerfulness on disease, and which should ever prompt us in the sick chamber to induce this state of mind, are given to show the controlling influence of mental impressions in a lesser degree. The first affords an instance of the power exerted by imagination in eradicating physical disease:

"A cure by the imagination has lately occurred in Germany. An old woman of the workhouse of Yeovil, who had long been a cripple, and made use of crutches, was strongly inclined to drink of the celebrated mineral waters of Baden, which she was assured would cure her lameness. The master of the workhouse procured her several bottles of water, which had such an effect, that she soon laid aside one crutch, and not long after the other. This was extolled as a most miraculous cure; but the man protested to his friends that he had imposed upon her, and that he had got the water from an ordinary spring. As soon as the patient found out the deceit, she was very angry; but nevertheless her cure was permanent."

Another case of a similar character, was that of a lady in Bond street, who, having been ill for some time, had not slept for several nights.

In order to allay irritation and induce sleep, it was considered advisable by her physician to prescribe morphine in the shape of pills: inserted in a teaspoonful of fruit jelly, they were placed at her mouth, accompanied with a tranquillizing assurance that their administration would produce sleep. The patient, after taking her dose, laid down and slept soundly, when it was found out, by accident, that she had *not taken* the pills, that they had escaped from the jelly in which they had been placed, but that her *faith* in their curative effects had produced the wished-for sleep.

A similar case occurred also under our observation. While in the office of a dentist, a young man presented himself and requested to have a tooth extracted, desiring first to be placed under the influence of chloroform. A small quantity of the fluid was given, when the patient soon lost all power over muscular motion or sensibility. In this quiescent and torpid state, the tooth was extracted.

After recovering from the suspension of his vital functions and muscular powers, he arose from his seat and said that he felt it difficult to inhale chloroform that day, but would call the next day and have the tooth extracted. We need scarcely add, that when informed his tooth was out, he was very agreeably surprised.

The influence of the mind over the body, and *vice versa*, has ever been acknowledged by the medical world, from the time of Hippocrates to the present hour. The request, "*let him be kept perfectly quiet*," by the intelligent physician, to the attendant or attendants of his sick patient, is an illustration of this fact, and a tacit admission of the principle. The fact has not been doubted, but the *modus operandi* by which the connection was established has eluded inquiry, until electricity untied the Gordian knot of ages, and explained the philosophy of this seemingly mysterious operation of nature.

Not only does the imagination exert a curative influence in disease, but it may be made, in great measure, to form the natural disposition either for good or evil. The following case, communicated to us by the late estimable divine, the Rev. Dr. Rudd, of Utica, powerfully illustrates this position.

A gentleman of some fortune residing at Auburn, New-York, whose first child had been remarkably fretful in its youth, determined to try the effect of *music* on his second born, a little girl. A small organ of surpassing sweetness of tone was purchased, and the nurses (there were always two in attendance) were ordered never to suffer the child to fall asleep or to awake except under the influence of the tunes played by the organ. The injunction was strictly obeyed: the child, during the first years of its life, was never known to cry or be fretful; it awoke with a beam of pleasure irradiating its countenance, and sunk to sleep under the soothing influence of the organ's tones, with a calm and unruffled brow. Its general sweetness of disposition was equally remarkable with the cause and the energy which had produced it.

We shall conclude this chapter by offering some arguments to prove that those spots frequently visible on the surface of the skin during infancy and maturer life, sometimes representing animals, at other times plants, &c., are produced by that electro-nervous fluid which is conveyed by the mother to her offspring during its fœtal existence.

It is much less difficult to decry than to refute a philosophical theory; and while we are not without anticipations that the skeptic may laugh at what he pleasingly terms our credulity, and console himself with the idea that the phrenological bump of marvellousness is smaller on his head than our own, we apprehend no philosophical or physiological refutation of the arguments we shall adduce, to prove that the imagination of the mother, excited by external impressions, produces the mark or marks to which we have adverted on the body of her unseen embryo.

The might of power, the excellence and perfection of form, the force and rapidity of action, have a preëxistence in the brain, and can be communicated by the electro-nervous fluid or force from the nervous system of the mother to that of the fœtus, with as much ease as the magnetic telegraph can impress the same signs and forms of letters at the distance of hundreds of miles: the ideal forms and lineaments of beauty exist within the sensorium, as do the horrific shadows which too often obscure the former. The natural formations of the infant, its organic developments, are but the manifestations of the ideal forms to which we have alluded as having their seats in the brain; they are the grosser materials fashioned and moulded by the superior spiritual existences of which they are the patterns. We might advance numberless cases to support this theory in the beauties and deformities of the rising generation, in their habits, their intellects, their natural disposition, in similarity of feature, produced by long contemplation on some loved and cherished object, and in the deformities produced by beholding some mutilated object of terror, of which the imagination cannot divest itself. The object of this work has however been accomplished in establishing the connection between mind and matter, generally.

CHAPTER XX.

Mineral and Vegetable Poisons, and their Antidotes.

Mineral Poisons most Distressing—Emetics—Sulphate of Zinc most Rapid in its Operation—Infusions of Slippery Elm—Sal Volatile—Vinegar—Tartar Emetic Wine—Mucilaginous Drinks—Nut Galls and Oak Bark—Arsenic—Case of Mrs. Wood—Verdigris—Sugar of Lead—Sulphuric Acid its Antidote—Carbonate of Soda—Oxalic Acid—The Vegetable Poisons—Opium—Morphia, or Morphine—Stramonium, or Stink Weed—Two Cases of its Poisonous Effects on Children.

Cases of poisoning, from accident or design, have become so alarmingly prevalent amongst us, that a few remarks on the mineral and vegetable poisons, with their antidotes, seemed essential to the completion of a work, the object of which is the promotion of health and its restoration, from whatever cause the functions which constitute it may be deranged, when impaired.

Of the two kinds of poison, those from the mineral kingdom are infinitely the most painful in their operation, producing the most distressing symptoms, and frequently, by their caustic power, eating into the coats of the stomach.

The stomach pump, and in its absence, when specific antidotes are not previously indicated, emetics should be immediately resorted to when the fact is ascertained that poisons, either mineral or vegetable, have been taken by design or accident. In the case of *mineral* poisons, the albumen or whites of three or four eggs should be immediately administered. We have known lie saved in several instances by this mild remedy: the mineral poison has united with the albumen, while the latter has preserved the coats of the stomach from the corroding influence of the poison until emetics could be procured and administered. The ejection of the poison from the stomach can alone yield a hope of safety. The sulphate of zinc (white vitriol, as it is called) is the most rapid in its operation: fifteen or twenty grains may be given *immediately* in a little cold water, and repeated in a few minutes, if copious vomiting is not induced. The wine of ipecacuanha, or that of antimony, is sometimes used. In the absence of the sulphate of zinc they should of course be tried; but they are less favorable in their results than that rapid and powerful emetic. In cases where young children have taken poison, any emetic is preferable to antimony in the form of tartar emetic; it prostrates nervous power so rapidly and completely, that great caution should be always observed in its administration among children.

When vomiting has commenced, it should be aided by every means that can be tried: warm water should be taken in abundance, and repeated as frequently as ejected from the stomach, until we are assured that no particle of the fatal drug is left to devastate the coats of the stomach.

Infusions of slippery elm, gum arabic mucilage, flax-seed tea, or any thing of a diluent or mucilaginous nature, should be freely taken.

Sal volatile, or water of ammonia, when taken in an undiluted state, as it sometimes is, by accident, acts as violent caustic poison on the stomach.

Vinegar, which neutralizes the effects of the alkali, is its most effectual antidote, and should be administered in water without any loss of time. Emetics are unnecessary.

Tartar emetic wine, known by the name of *antimonial* wine, when taken in an over-dose as an emetic, acts as a poison on the stomach, and produces the most distressing vomiting, attended by a prostration of nervous power that frequently threatens, sometimes destroys, life.

Mucilaginous drinks, as above directed, should be resorted to, and the stomach be kept partially, if not wholly, filled so long as the vomiting continues: this latter caution is necessary to be observed, that the spasmodic efforts may be principally exerted on the contents of the stomach rather than the organ; the violence of the efforts being such as, in some cases, to rupture the stomach, or to cause the rupture of some large blood-vessel in that organ or in the brain. To lessen the spasmodic contractions of the organ by acting on the nerves which supply it, twenty or thirty drops of laudanum should be administered, *to an adult*, every twenty minutes, until some visible effect is produced on the brain and nervous system generally.

Nut-galls and oak bark, in infusion, are the antidotes; but their use will seldom be required if the means above directed are steadily pursued.

Arsenic, the most distressing and fatal of all the mineral poisons, producing rapid inflammation, intense thirst, and a state of suffering which cannot be expressed, is one of the most general poisons taken by the ignorant and reckless. The powerful corroding properties of this mineral poison, and the alarming rapidity with which it executes its deadly purposes, demand that not a moment should be lost subsequent on its entrance into the stomach before the most powerful counteracting remedies are resorted to. Whites of eggs mixed with the *hydrated peroxide of iron* should be immediately administered, followed by powerful and long-continued emetics. The stomach pump, when it can be procured, should instantly be passed into the stomach, and the latter emptied of its contents. After all, the hope of salvation is a forlorn one: the mineral has usually inserted itself, by corrosion, *beneath* the mucous coat of the stomach before any remedy can be effectually employed.

In thecase of a post-mortem examination which we attended in the upper part of the city, about two years since, performed on a Mrs. Wood, who had been poisoned by the admixture of arsenic with the cakes which had been prepared for her breakfast by her husband, for which he subsequently suffered the extreme penalty of the law, the mineral had found its way from the *stomach* into the *liver*, although but a few hours had elapsed between the commission of the act and the post-mortem examination. We can account for this curious fact in no other way than by supposing that the arsenic had passed into the duodenum or lower stomach, and had there, during the act of vomiting, been forced through the gall duct into the liver.

Verdigris, or acetate of copper, is sometimes taken in solution in soup, through carelessness in not cleaning the copper utensil in which the latter has been made. When taken in large doses it is quickly fatal; producing, like arsenic, inflammation and corrosion of the coats of the stomach, attended with excessive pain and continued thirst.

Carbonate of soda, its most powerful antidote, should be immediately given on ascertaining the character of the poison, followed by emetics and mucilaginous drinks.

Of the various preparations of *lead*, its *acetate* (sugar of lead) is most apt to be taken, frequently unintentionally, as a poison: it produces the most distressing colicky pains in the stomach and abdomen.

Its most powerful antidote is sulphuric acid (oil of vitriol) diluted with water. Nearly all the *sulphates* will answer the same purpose, if the acid cannot readily be procured, as the sulphate of magnesia, (Epsom salts,) or the sulphate of soda, (Glauber salts,) mixed with water. Emetics and mucilaginous drinks should also be administered.

Corrosive sublimate, or oxymuriate of mercury, is a poison equally, if not more, distressing than arsenic, as rapid in its operation, and as sure in its fatal results.

On ascertaining that this mineral poison has been taken, ten or twelve of the whites of eggs, beaten up in a pint of water, should be taken by tumblers full as rapidly as possible, to induce vomiting: in the absence of eggs, soap and water mixed with flour may be given as a substitute. The object, the only one to be attained, is that of protecting the coats of the stomach from the corroding influences of the deadly mineral. The stomach pump should be introduced so soon as it can be obtained, and powerful emetics *avoided.*

Nitrate of potash, or saltpetre, taken in an excessive dose, will produce all the symptoms attendant on the exhibition of more powerful poisons.

Powerful emetics *should not*, in a case of poisoning by this drug, be administered; the nervous irritation of the stomach is too great to bear further powerful excitement. Diluents and mucilaginous drinks may be taken in large quantities until vomiting is produced.

If an over-dose of sulphate of zinc (white vitriol) has by accident or otherwise been taken, it will act as a poison on the stomach.

Carbonate or supercarbonate of soda is the antidote to this poison, and should immediately be administered, followed by emetics. The contents of the stomach should also be evacuated by the stomach pump, if it can be procured.

The mineral acids are, as we have known, sometimes swallowed by accident: among them the *nitric* (aqua fortis) is the most powerful and rapid in its effect, eating directly into the coats of the stomach. Sulphuric acid (oil of vitriol) and muriatic acid (spirits of salts) are also sometimes taken by mistake.

The most powerful antidote to the above is *calcined magnesia*, which, if taken in sufficient quantity and immediately, will sometimes neutralize the effect of the acids in the stomach. When this drug is not at hand, carbonate of potash, (sal æratus,) or chalk mixed with water, should be given. The mucilaginous drinks will perhaps be the best vehicle in which to administer the above. Emetics *should not* be given.

Oxalic acid, from its *strong* resemblance to Epsom salts, is not unfrequently accidentally and *fatally* taken into the stomach. A slight degree of caution might prevent such accidents. The taste of *Epsom salts* is exceedingly *bitter*, that of oxalic acid sour.

The antidotes to this poison are carbonate of potash, (sal æratus,) chalk or lime, dissolved in mucilaginous drinks. The stomach pump should, without loss of time, be used after taking this poison.

The *ley* formed by placing wood ashes in hot water is sometimes taken by children, and produces poisonous effects on the stomach.

Vinegar and *oil* are the most sure antidotes. The oil unites with the ley and makes soap, which is less injurious than the former. Large draughts of flax-seed tea or slippery elm infusion should be administered.

The *vegetable* poisons, if less rapid in their effects than some of those in the mineral kingdom, are usually not less sure in their fatal consequences: they are taken up by the absorbents of the stomach, pass into the circulation, and act immediately on the brain and nervous system, generally producing intense drowsiness, loss of sight, insensibility to external impressions, coma and death.

Opium, from its general use, can be more easily obtained without exciting suspicion than any other among the vegetable poisons, and is most frequently taken by those who commit suicide by poisoning. In large doses it produces an immediate shock of the nervous system, and, though nauseating in small doses, seldom produces vomiting when taken in such quantities as to produce poisonous effects, owing to the paralysis of the nervous system which it induces.

The stomach pump should be *directly* applied after taking this drug in poisonous quantities; emetics and vegetable acids, as vinegar and lemon juice, should also freely be resorted to. The patient should be kept awake by every possible means which can be applied, such as being compelled to walk about the room led by two persons, the cold douche, and by a smart stroke from the hand or a thin, flat piece of wood, occasionally. A very strong infusion of coffee is sometimes found useful in poisoning from opium.

Morphia or morphine is opium in its most highly concentrated form, one grain of the former being equal to *six* of the latter, or to *three hundred and sixty* drops of laudanum.

The means above recommended in poisoning from opium, should be resorted to when this drug has been taken to produce a like effect. From what we have observed it would seem that opium, in all its forms, exerts a powerful influence on the nerves of the medulla oblongata, as those of *respiration:* under the effects of this poison, whether in the form of morphia or laudanum, breathing quickly becomes laborious, and in a short time suspended; in the latter case artificial respiration should be kept up so long as the pulse can be felt at the wrist.

Stramonium, thorn apple, stinkweed. This poisonous vegetable is more generally known by the last name than the two former. About two years since we were called in to a little boy in Twenty-fifth street, who, we were informed by the messenger sent, had suddenly lost his senses. Upon entering the room where the little patient was, we were struck with astonishment at the symptoms which presented themselves: the eyes were bloodshot; every vessel being tinged with blood, they had a peculiarly wild expression; the lower extremities were completely paralyzed, the speech incoherent, the child raved continually. Fearing congestion of the brain, we immediately applied six leeches to the temples, but no relief followed; injections were administered with like effect; a universal agitation of the nervous and muscular systems now supervened, and certain dissolution appeared to be near at hand. A woman in the same house now entered the room, screaming wildly and terrifically; her child, about the same age, had been similarly attacked. The simultaneousness of these attacks caused us to make more minute inquiry, when we found that both children had been out playing in the vacant lots in the neighborhood. It was autumn, and the seed just ready to leave the seed-vessel of the stramonium. We now suspected what in the end proved correct, that the children had swallowed the seeds of the stramonium. Emetics of the sulphate of zinc (white vitriol) were administered, and about a table spoonful of the seed ejected in each case. The children recovered by very slow degrees; there seemed to be a continual tendency in them to convulsions; the nervous system had been so completely deranged that it recovered its functional power with great difficulty.

Hyosciamus, (henbane,) belladonna, (deadly nightshade,) aconite, (wolfsbane,) brionia,(bryony,) digitalis, (fox-glove,) dulcamara, (bitter-sweet,) gamboge, lobelia, (Indian tobacco,) sanguinaria, (bloodroot,)oil of savin, spigelia,(Indian pink,) strychnine, nux vomica, tobacco, may be included in the list of vegetable poisons. The means recommended in cases of poisoning from opium are those best adapted to remove or neutralize all vegetable poisons.

Spigelia, or Indian pink root, is frequently administered to children in cases of worms. Its administration requires great caution: we have seen several cases in which the nervous system was paralyzed by the use of this vegetable drug.

CHAPTER XXI.

General Synopsis.

IN the preceding pages we have endeavored to build up a new and beautiful philosophy of health and disease, on the basis of Electricity: we have shown the former to be dependent on an equal distribution of electric force to every portion of the system, and the latter to arise from a general diminution of such force, or from its concentration in any particular portion of the human frame to the prejudice of the rest.

Amid the host of "pathies" and "catholicons" that have risen up in our day, each one, in the self-sufficient phraseology in which it is heralded before the public, a certain cure for all diseases which exist in the present or by any possibility can arise in the future, it is a matter of some surprise that Electricity has not more generally engaged the attention of the medical profession.

But the progress of truth is slow, more especially so when the means which she presents for the accomplishment of a special or general object are simple and easy of attainment, or are opposed to the orthodoxy, however untenable, which has governed society for ages.

When the great BACON unfolded a new philosophy built on the principles of induction, the truth of which has been proven in every succeeding age since the philosopher exclaimed at the termination of his labors and his life, "Inveniam viam, aut faciam," his views were assailed, his motives impugned, and his character traduced by the senseless bigots of his day and generation.

When HARVEY declared the arteries to be blood-vessels and not *air tubes*, as supposed before, and during his time, the new doctrine was assailed by the would-be physiologists of the day, with that fury and malevolence to which ignorance united with the false philosophy of the past, and then present, could alone give rise.

Scoffed at by the multitude, slandered by the more intelligent yet deeply interested few, the discoverer of the circulation of the blood was treated as a visionary enthusiast, whose temerity was only equalled by the folly which led him to differ from the "patres conscripti" of anatomy and physiology, and to introduce a new system on the ruins of that which had existed for ages—as venerable for its antiquity as *he* proved it to be false in its theory and facts.

It was not sufficient to satisfy the credulity, or rather obstinacy, of the rulers in the medical sanhedrim of that day, that the great PHYSIOLOGIST, taking up the pervious tissue in the leg of a frog, *ocularly* demonstrated, by showing the blood in its circulation through the arteries, that his system was correct; that he exposed the *human heart* throbbing within the chest and sending forth its blood into the supposed *air tubes,* to the gaze and the *touch* of his monarch; that, like the doubting disciple of antiquity, the royal Charles was requested to put forth his hand, touch and believe: truth was considered valueless when placed in opposition to the opinions of the medical fathers of the day, who defended the altars around which they and their progenitors had worshipped, with a pertinacity and courage worthy of a better cause.

The unfortunate GALILEO was consigned to a dungeon for setting forth the truths of astronomy; and when JENNER, a high priest in the temple of science and humanity, in a later age, discovered an antidote to a loathsome disease, the small-pox, in an ichor which exuded from the mammæ of a cow, that the young girls employed in milking in Devonshire, England, were exempt from the disease, that it could not be conveyed to them by contagion or infection, his name became a by-word and a reproach; scurrility, in every form, took occasion to assail him; ribaldry, with her low and disgusting buffoonery, jeered at his discovery; envy maligned his motives; avarice sought the destruction of his pecuniary gains; the medical profession placed him beyond the pale of her order. But the genius of humanity had thrown an impregnable shield before her meek disciple, which effectually shielded him from the darts sped by bigotry and malevolence from the concealed fortress of hatred and envy.

Where now are the scoffers of Harvey—the assailants of Jenner? Time has thrown the veil of oblivion and infamy over their memories; their names have perished from her records.

Far otherwise with the philosophers they persecuted, whom they endeavored to crush beneath the weight of malignity, injustice and oppression: the latter reflect a lustre on the land of their nativity, which increases in splendor with the lapse of ages, like the finished architecture of some gigantic Grecian temple, which becomes more beautiful as the eye recedes in the distance.

The opposition to Electricity, as a means of curing disease, has been less active than that described above; she has found among her advocates and supporters, men of high professional attainments and superior intelligence. The prejudices which still surround her path and obstruct her onward progress, are rapidly disappearing before the weight of respectable testimony which she offers in support of her claims, and must, eventually, cease to exist.

In order to display the full effects of electricity in eradicating disease, and promoting a healthy condition in the functions of organic life, we have found it necessary to present a general outline of the systems in which the organs of these functions are placed.

Throughout the work we have sought to avoid the use of technical expressions, and to explain them when used.

In our description of the *bones* in the first chapter, we have not been unmindful of the importance to be attached to the spinal column, or the wise and peculiar adaptation of it by nature to the purposes for which it is intended; nor, in a future chapter, of those abuses, the offspring of ignorance or error, by which its functions are so frequently rendered useless, sometimes entirely destroyed.

In describing the anatomy of the muscles, their origin and uses, in the *second* chapter, we have anglicized their Latin names, for the benefit of the general reader; we have shown them to be the lever power by which the bones are lifted or propelled in any direction; their force being graduated by peculiar physical and mechanical conditions to which we have alluded. It will be seen that, independently of their uses as the great agents of locomotion, they exert a controlling influence over the vocal powers of the singer and the elocutionist, and that they are divided into two great classes, voluntary and involuntary; the former being under the influence of the will, the latter acting independently of it.

In instituting a comparison between muscular power and celerity in man and some of the inferior animals, as the horse, carrier pigeon, &c., we have shown that a much greater perfection has been, instinctively, attained by the latter than has been bestowed upon the former; and while we have endeavored, by well authenticated instances of prodigious muscular power in man, to show what *has* been accomplished, we have not neglected to place before all our readers the means by which such feats may be equalled—probably excelled.

In describing that peculiar power of contractility which resides in the muscles for some short time after death, the reader will find cited some interesting cases of the effect produced on the nervo-muscular systems of criminals, after execution had taken place, by the application of the galvanic current to the nerves which controlled the muscles called into action. They terminate the third chapter.

The fourth chapter, on the HYGIENE or healthful condition of the muscles, contains some interesting facts in relation to the training or physical education of the muscular system, in the Belgian giant and the Chinese and Turkish carriers. We have demonstrated that exercise increases muscular power; that the latter also increases with the demands made upon it, within certain limits; that activity and strength are the healthful elements of muscularity, and those upon which in its most perfect condition it is chiefly dependent.

The reader will find in this chapter some very interesting remarks on the treatment of insanity, and the condition of its victims in the present day when contrasted with the past.

The necessity of graduating the amount of exercise to produce corresponding muscular strength in youth and maturity, has not in this chapter been overlooked. It has been shown that the amount of exercise necessary to produce a powerful muscularity at maturity, would injure if not destroy the muscular powers in youth; that muscular energy has, in all individuals, a maximum which, if exceeded, produces exhaustion and loss of vital power.

In our remarks on healthful muscularity in the rising generation, with which we conclude the fourth chapter, we have been constrained, from an imperious sense of public duty, to advert to some of the causes which impede its progress in our public and private schools, particularly in relation to the confinement of a *fixed* muscular attitude for any great length of time, and the want of mechanical support to the spine in the construction of the seats.

We would again seriously impress on the minds of the trustees who govern and direct our public and ward schools, the necessity of enforcing an alteration in the mechanism of school benches generally, and of allowing more frequent change of muscular position, especially to the more juvenile scholars, than is now permitted by the rules of the schools; but we have said enough already in these pages on this important point, and would respectfully solicit the public guardians of our youth in the public institutions to which allusion has been made, to peruse our observations with attention.

We are aware, and the effort is an honor to its projectors, that some of our Ward schools have partially remedied the evil of which we complain; we expected nothing less from the philanthropic and benevolent spirit which prompted these valuable additions to our system of public instruction, and we feel assured that they will still further advance in satisfying the requisitions which the progressive spirit of the age demands.

In insisting on a full supply of PURE AIR as an essential to the vigorous growth and power of the muscles, in the fifth chapter, we have endeavored to draw the general attention of our citizens, particularly the "Fathers" of the city, to the damp subterranean abodes where the beams of the sun cannot enter, where the elements of death reek on the dripping walls, where a vitiated atmosphere is breathed and re-breathed, where impurities of every kind, some of them most loathsome, meet together, and encircle their victim beyond the possibility of escape; where disease and death shake hands and reciprocate their mutual benefits, the interchange of which is the eternal silence of the tomb.

We cannot separate the moral from the political duties of mankind. If the politician requires the vote of his constituent to place him in a position which will advance his pecuniary interest, and *may* place him in one where he will be enabled to watch the physical condition of those by whom he has been advanced to power, morality, humanity would *teach* and should *enforce* the necessity of applying at least a portion of that power to the best interests of those by whom it has been conferred.

Wholesome food is not more essential to animal existence than pure air: the former is the sustenance of the stomach, the latter the purifier of the juices expressed from such sustenance, as they pass, commingle with and become a portion of tho blood, in its passage through the lungs.

We should hail with pleasure a municipal law which would compel a house owner to have an *uninhabited* cellar *at least six feet deep*, under any room or rooms destined for a subterranean dwelling, and which also made it imperative that every dwelling of this kind should be *freely* ventilated.

There is a class in our cities, male and female, which is compelled to labor wherever employment can be found; necessity will not permit its members to choose their own workshops; the hard struggle for mere existence compels them to sacrifice it, that the means for its support may be obtained during the shortened period of its probation. It is these useful but unfortunate members of the community, who are literally crammed into the subterranean caverns of which we have spoken so freely, compelled to labor from ten to twelve hours per day, surrounded by walls smoking with human effluvia, the deleterious damps from the earth condensed on the floors beneath their feet in the form of water, the air above and around them deprived of its oxygen or purer constituent, their lungs gasping for breath amid the heated constituents by which they are surrounded, and their frames daily sinking under the pressure of the various morbid combinations to which they are exposed.

We are convinced that our bills of mortality would be considerably reduced in amount if our municipal authorities would deign to divide their attention, equally, between the *sanitory* and *political* conditions of the city: but in the incessant struggle for preferment, place or power, the claims of humanity are forgotten; her voice is stifled amid the shouts which rend the air for the success of some political aspirant, and her neglected and bleeding form lies prostrate amid the more exciting elements of political strife.

We would press on our clerical readers especially an attentive perusal of our remarks on their physical and theological education: they are the result of direct, personal observation, not of a day or a month, but of years.

So long as our divines persist in neglecting physical education, by exercise and other means which we have pointed out, will their physical frames be weak, their voices inefficient for its purposes, their general health precarious. We have spoken boldly but truly; an imperious duty towards them has been performed; the practical results arising from it, we leave to them.

In the *sixth chapter* the nervous system is divided into two principal centres: the one consisting of the brain proper, oblong marrow, and cerebellum or little brain; the other, that of the spinal cord, extending from the base of the skull to within a short distance of the termination of the spinal column.

We have described the origin and course of the nerves of intellect, showing them to have their origin in the superior and anterior portion of the brain proper; those more intimately connected with the process of respiration, physically and mechanically, as arising from the medulla oblongata or oblong marrow, placed between the posterior base of the brain proper and the cerebellum or little brain, as the capital to the spinal column; and those which regulate animal motion, and are more immediately connected with the grosser functions of animal life, as proceeding from the cerebellum or little brain, situated behind the medulla oblongata, at the lower and most posterior part of the skull.

The nerves which supply sensation to the muscular system, or in other words those of feeling, are shown, in the seventh chapter, to have their origin in the *posterior* portion of the spinal marrow; while those which call into action muscular motion are pointed out as arising from the *anterior* portion of the spinal cord: a distinction highly necessary for all to understand, more particularly in cases where it is necessary to apply the galvanic current in palsy, rheumatism, tic doloreux or neuralgia.

Various experiments on living animals are detailed to prove the correctness of the above division in the nervous system, to which we refer the reader who is desirous to inquire into the peculiarities of his own organization with reference to those sentient agents of intellect, feeling and emotion which pervade, in their sympathetic union, every ramification of the system, and unite in every possible condition the various functions of organic life: he will find the anterior lobe of the brain proper demonstrated to be the seat of intellect, or rather of those nerves through which proceed the manifestations of mind.

If the anatomist and physiologist have not been able to subject the mysterious principle which we call mind, the proud prerogative of humanity, to the influence of the dissecting knife, they have at least succeeded in destroying its visible operations by removing specific portions of the nerves of the brain.

They have proved by actual experiment, that when the anterior portion of the brain is removed, Mind, as we know it by its operations, no longer exists.

The reader will find, in this chapter, the cerebellum or little brain described as the regulator and director of voluntary muscular movement. The evidence which establishes this fact is incontrovertible: on its removal the animal, though living, has no command over its movements.

In our inquiries into the functions of the cerebellum, we have been compelled to attack one of the strongholds of phrenology: it is this, *that the larger the cerebellum in proportion to the rest of the body, the more powerful will be the animal propensities of the grosser kind.*

That the above is not a physiological fact, has been satisfactorily proved.

The medulla oblongata, or oblong marrow, independently of its legitimate function, that of imparting sensation and action to the respiratory organs, is shown to be the grand connector between the nerves of intellect, emotion, and animal sensation, maintaining an electro-nervous correspondence with the nerves of intellect above it, and those of animal propensities below it, standing between the two, as the great highway from mind to animal instinct; being itself the centre where all the elements of feeling mingle together, and through which all external impressions made on the superficial subcutaneous nerves are carried to the seat of intellect.

The philosophy of the passions and emotions, as connected with nervous physiology, at the conclusion of this chapter, is well worthy of deep attention, showing, as it does, some of the more immediate connecting links between mind and matter, of which so little is known.

The mimic who copies and re-displays the lighter expressions of countenance, as the celebrated Dr. Valentine, and the finished actor who gives the physical with the intellectual expression of the tragic muse, in the fulness of its grandeur and sublimity, may learn from these pages the agents by which the one is enabled, physically, to express the fooleries of nature, and the other the lofty bearing of characters who have made empires tremble, and whose names still sound along the highways of nations as mirrors reflecting the past to the present generations of men.

The eighth chapter, on the Pathology and Physiology of the Brain, is one of exciting interest to the philosopher, the physiologist, the naturalist, the moralist and the general reader.

The gradual additions to the nervous systems of animal existence, from the zoophyte scarcely to be distinguished from a vegetable, deprived of the organs of locomotion, chained to the rock which is at once its cradle and its grave, to man with his majestic intellect and perfect cerebral organization, is a subject which cannot be contemplated without giving rise to admiration at the progressive advancement in the chain of animated nature, and gratitude for the superiority of those gifts which stand as the crown of eternity on the capital of the living column, decorating the brow of the master spirit who directs and controls the whole.

An additional evidence is presented in this chapter to prove what we have previously advanced, that the upper and anterior part of the brain is the seat of the intellectual faculties. We have shown that here are found the greatest number of twists or convolutions of the brain, those deep indentations which exist on the outward surface of the cerebral mass at the division of its substance.

In the lower scale of creation these convolutions of the brain are *not* found, but their number increases as we ascend in it to the higher grades of intellect.

But comparative anatomy furnishes us with additional evidence drawn from different periods of human existence.

In *infancy* these cerebral prominences are less numerous and the fissures between them less deep: the intellect corresponds with these physiological results; it is feeble. As youth advances they increase in number and depth; and intelligence advances, until in maturity we find the brain, in reference to these convex twistings, perfectly developed, and the intellectual powers at their zenith.

We have shown that if by any means an accident should occur in early childhood, by which the growth of these convolutions is arrested, the intellect will either remain stationary or sink into idiocy.

As if the high and important offices assigned to the anterior lobe of the brain and its convolutions were exemptions from physical suffering, it will be seen that the convolutions may be removed by the dissecting knife, without occasioning any visible signs of pain.

They are the registers and reflectors of sensation and action, yet seemingly aloof from the physical evils that appertain to the latter.

The observations on the precocity of intellect in childhood, are not unworthy the attention of those parents, guardians and instructors of youth, who desire to see that "mens sana in corpore sano" in the rising generation, so important to the *full* development of intellectual vigor; who wish to see them endued with sufficient physical vigor to support the nervous intellectual excitement which is continually calling for physical aid; without which, though it may for a short time emit those brilliant mental coruscations, as ephemeral as they are bright, it will inevitably sink, ere maturity approaches, below the level over which it towered in the proud superiority of youth.

There is nothing more destructive to the energies of the brain, mentally or physically, than the premature intellectual manifestation which we have pointed out, cherished and fostered by parental ignorance and pride.

Inflammation of the brain may be produced by a continuation of such cerebral excitement, followed by that fatal disease *hydrocephalus*, or water in the head.

In this chapter the cause of simultaneous attacks of the same disease in different portions of the system, as the lungs, stomach and brain, will be found to exist in the sympathy established between these great vital centres by means of the pneumogastric nerve.

In chapter ninth, we have shown the similarity between the production of nervous force and voltaic electricity; that in either case two distinct substances are brought into contact with each other by an intervening conductor, giving rise in the former to *nervous* polarity, in the latter to *electric* polarity.

Pursuing this subject of inquiry, we have established an analogy, if not an identity, between the immediate development of nervous force under the sudden excitement of its parent nerve, and the instantaneous evolution of the galvanic current produced in the galvanic battery.

We have shown that the animo-chemical conditions in the former, and the chemical conditions in the latter, are identical; that in the absence of the former, no nervous force will be sent forth; and in the absence of the latter, no galvanic evolution of force can possibly take place.

We shall not anticipate the conclusions which may be drawn from our premises: all we ask for them is a careful and candid perusal.

We have proved beyond the possibility of refutation, that electricity is the great agent in exciting nervous action; that even after the vital spark has fled, it will excite the nervous system so to cause the muscles to imitate nature as to be undistinguishable from her actual presence, save in the absence of respiration and speech; while some of the finny tribe, as the gymnotus electricus, are *actual*, *living*, *electrical machines*.

The similarity in division which exists between the spinal cord and the medulla oblongata, is explained in the tenth chapter; where the former, like the medulla, is shown to have three columns from which issue three different sets of nerves, fulfilling opposite purposes: the anterior column giving rise to the nerves of muscular motion; the posterior column to those of sensation; the middle column to the nerves of respiration.

It will be seen that one of the peculiarities of the nerves, we may add of their beautiful adaptation to the purposes of organic life, is that of uniting various and distinct fibres into plexuses or webs at those particular portions of the system where great nervo-muscular power is required: thus the brachial or arm plexus, or web, supplies nervo-muscular power to the arms, shoulders and chest; a second, the cervical or neck plexus, gives force to the muscles which lift the shoulder-blade bone, and those surrounding the posterior portion of the neck; indeed, in every portion of the system abounding with muscles, these nervous plexuses are found to exist.

We have dwelt at some length on the anatomical position and physiological functions of the great sympathetic nerve, the last noticed but most important nerve that traverses the spinal column, down which it passes on either side, from the head to its lowest vertebral division.

This great nerve is united by filaments to every other in the system, sending off from knots or ganglions which it forms, at the joints of the bones which form the spinal column, branches which unite with the special nerves of the spine, the medulla oblongata, the cerebellum, etc., forming a complete chain of nervous communication between every part of the system.

A beautifully executed plate, showing the varied ramifications of the sympathetic, will be found accompanying our observations on its structure and functions.

In the eleventh chapter, on the HYGIENE or health of the nervous system, deeply sensible of the great importance of the subject to the individual and to society, we have endeavored to impress on the minds of all who may read these pages, the necessity of paying more attention to that peculiar susceptibility to the impression of specific disease, which is entailed on posterity by hereditary descent. Scrofula and insanity are indebted, not unfrequently, for their origin, to this cause; a calamity entailed on posterity by imprudent marriages.

We have shown that marriages within certain degrees of consanguinity are also not without their evil results to individuals and society, more particularly among the wealthy and indolent aristocracies of Europe, and at times among those of our own country.

In alluding in this chapter to the influence of the brain on the animal functions, and *vice versa*, we have again adverted to the pre-stated physiological fact, that all organic life requires repose, and that when the electro-nervous force is concentrated on *one* organic function, the rest should not be forced into action. Thus during the period in which digestion is separating the purer from the grosser elements of nutrition, the electro-nervous power is concentrated on the stomach; the brain, as a natural consequence, is deprived of this essential agent of support to activity of function: during the process of digestion the mind should never be intensely exerted.

The morning of day, as stated in the hygiene of the nervous system, is the period for great mental application: the equilibrium of nervous power, disturbed by the events of the preceding day, has been restored during the hours of sleep; the electro-nervous power has, consequently, accumulated, and requires some object on which to expend itself: the brain also in the morning suffers no interference from any action of the stomach;

no extra amount of nervous force, in health, is required by any other organ; it may be concentrated through the brain on the object immediately within its grasp.

We have proved, from the nervous expenditures of the system at different periods of life, that the assertion, "*infancy and youth require more sleep than age,*" is far from hypothetical; that the custom of forcing children to rise very early in the morning, is not in accordance with the laws of their organization, or the enjoyment and perpetuity of health. We invite the attention of parents and friends of youth to these remarks.

The necessity of a classification in our public and private schools, based upon the development of the muscular and nervous systems, is strongly advocated. We have shown the injustice in the exercise of that power, which frequently plies the cane or the rod to the seemingly indolent pupil: we say seemingly, for his physical frame and nervous energies are frequently inadequate to perform the duties imposed upon him even under the actual infliction of unnecessary, harsh and injudicious punishment.

Nature cannot be *flogged* into functional exertion which her physical and mental organization refuses to support. Every blow inflicted under such circumstances, is from the hand of the *oppressor.* The apology which ignorance may offer for injustice, is a meagre palliation for wrongs inflicted by the latter.

We have advised an equal distribution of attention, during the early years of youth, between intellectual, physical and moral education.

This subject is of such paramount importance, so deeply connected with individual happiness and national prosperity, that we shall offer no apology for again adverting to it.

If the intellectual education is cultivated to the neglect of the physical, the latter will, ultimately, be inefficient to sustain the former, and premature decay will be the certain result: *the mind will consume the body.*

If the physical and intellectual educations are strictly enforced, while the moral education is allowed to take care of itself, we may expect, in maturer life, to see the passions unrestrained, the duties of life neglected, in the progress of age the most licentious habits, and ultimately, complete moral degradation.

There are other and nobler emotions to gratify and foster than those which give rise to the cupidity for wealth, or the ambitious aspirations for intellectual fame.

Society claims from her subjects good fellowship, integrity, candor, honesty, and all those finer moral attributes without which the arm of the assassin would be unrestrained, and the midnight plunderer might indulge his propensities unchecked by any power save that of municipal law.

The twelfth chapter opens with a general consideration of the Doctrine of Life, and the simple principle of vitality which governs all animated and vegetative existence. We have shown that this simple principle, to which the term *vital force* has been applied, is seen to govern the germination of the seeds of plants, the eggs of fowls, and the ova of mammalia; that its absence implies decomposition and death; that life consists in a constant strife for supremacy between vital force and that of decay; that if the former exceeds that of the latter in the system, its various tissues will become perfect in proportion to its preponderating influence; that if the latter force, that of decay, is most powerful, the consequences will be emaciation of the system.

It has been shown that the primary condition essential to the integrity of vital actions in animated existence, is a proper and adequate supply of fresh material to supply the place of that which is continually passing into decomposition; that the second condition necessary to insure the perfection of vital force, is a constant supply of pure and invigorating air; that proper *warmth* is its third essential.

Some interesting and highly valuable remarks on these conditions, by the celebrated LIEBIG of the University of Munich, one of the most eminent physiologists and chemists on the continent of Europe, will be found illustrating our principles and supporting our doctrines, in this chapter.*

The sources of animal heat are shown to be produced by the combustion of the food and tissues

* This celebrated chemist has lately been appointed Professor of Animal Chemistry in the University of Munich, by the King of Bavaria.

of the body, acted upon by the oxygen derived from the arterial blood.

Baron Liebig estimates the amount of oxygen inhaled each day, at about thirty-two and a half ounces, and the weight of carbon *expired* from the lungs at eight ounces.

We must refer our readers to this chapter for a beautiful scientific and comparative view of animal electricity, its effects, currents and conductors, by Professor Müller, of Berlin, and Dr. Emil du Bois Reymond.

It will be found to contain, within a small compass, all that is known in reference to the laws which regulate the actions of vital force.

It may perhaps be unnecessary to add that Professor Liebig has long held the first rank among the chemists and philosophers of Europe; and, without any discredit to the great Professor, we may place Professor Müller and Dr. Du Bois Reymond in the same category.

In the thirteenth chapter, we have discussed the philosophy of life, and explained the intimacy of its connection with the healthy condition of those functions which enter largely into the principle of vitality.

It will be seen that life is not homogeneous but heterogeneous, possessing various elements, among which the most active and important is that of electricity.

That this fluid or ether pervades the whole material world; that its effects are visible in inorganic equally with organic matter; that it is the controlling power which impels vitality on its onward course, uproots the mountains, levels cities, is seen in the tornado and the whirlwind, one of the elements of air, water and heat, indeed inseparable from any object which is seen upon the earth; that it stands at the head of the elements which enter human organization, of the functions of which that organization is the seat, we have demonstrated in this chapter.

We have stated what we hold to be true, that the medical art, so called, from the time of the Messiah to the present period, has not rested on the basis of science: if, in some cases, the medical profession have agreed in reference to the diagnosis and prognosis of disease, their therapeutics have been opposed to each other.

What fixed medical laws have existed to regulate the cure of disease? We know not of any. Anatomy and surgery have long since been placed under the renovating influence of science; but medicine has been compelled to grope her way through a host of experimentalists, each one satisfied that he has discovered a catholicon in the alleviation of human suffering, and all differing from each other.

The fourteenth chapter shows the connection of electricity with living bodies, and its influence and action upon them. We call the attention of the reader particularly to the remarks contained in this chapter; after perusing them he will doubtless agree with us in the truth of the physiological fact, that all diseases to which the human machine is subject, arise from the exhaustion or accumulation of the electro-nervous fluid, or from some concentration of it on a particular portion of the system, to the prejudice of the remaining tissues.

It will be seen in this chapter that the French, ever hand-in-hand with science, and willing to take advantage of the benefits she confers, so far as they are convertible to the interests of animal or vegetable existence, have applied electricity to the purpose of vegetation; that whole vineyards in France are filled with electric conductors for the purpose of invigorating the grape-vines and producing more excellent fruit; a hint worthy of the attention of our scientific horticultural associations.

In perusing this chapter, the reader will see that when electricity is equally diffused over the face of nature, when it pervades in the same degree the air, the earth and the deeps, all is calm and quiet; and that the convulsions which rend the mountains and cleave asunder the oaks of the forest, that swallow up cities and excavate tombs for thousands, are owing to the destruction of its equilibrium.

Nor are its effects confined to the elements on these occasions: the nervous system languishes and droops, the spirits are depressed, a general and unaccountable lassitude ensues, from which no recovery takes place until the elemental electric equilibrium is restored.

Such is the condition of the system during the siroccos of the south of Europe, the kamsins of

Asia, and on all occasions when the atmosphere is suddenly deprived of its electricity.

The visible connection of electricity with that dreadful scourge *cholera*, proved on the testimony of eminent physicians in Great Britain and on the continent of Europe, as detailed at the conclusion of this chapter, we press on the attention of our medical men: a new and successful practice may yet be devised, based on the simple application of electricity in some peculiar form, which shall neutralize the effects of this fell destroyer, and render its attacks comparatively harmless.

Mr. Atkinson, an eminent surgeon in the British metropolis, says, heat and electricity were evolved together, from the bodies of those laboring under cholera, in a state of collapse.

The reports in their general character from St. Petersburg in Russia, and London in Great Britain, in connection with the atmospheric condition observed on the appearance and during the progress of the cholera in England and on the continent of Europe, coincide with the observations made by the most eminent physicians in our own land, viz., the statement that during the outbreak and continuance of cholera, *an almost total absence of electricity from the atmosphere was observed and felt, and a total deprivation of electric power in those bodies ordinarily possessed of it in a condensed degree.*

Who will say, with these facts on record, that electricity may not yet become the most powerful and only truly successful agent, in the cure of cholera?

Chapter fifteenth will be found to contain a detailed account of the effects of electricity on various forms of disease, numerous cases of which, well attested, are adduced, with the opinion of the most eminent medical professors, private and public, in London, in relation to its curative powers, and the absolute necessity of more frequently resorting to its aid. Among them will be found the names of JOHN ABERNETHY, GOLDING, BIRD, Dr. RADFORD, Dr. TUSON, &c. &c.

The scientific knowledge necessary to the electrician is detailed in this chapter, without which success will rarely, if ever, attend the applications of this health-renewing agent.

Under the guidance of the man of science, electricity will accomplish all that we have claimed for it; in the hands of the empiric, scarcely any thing.

The perfect electrician must be an anatomist and a physiologist, thoroughly acquainted with the nervous system in all its ramifications, with the muscular system in its healthy and diseased conditions, and correct in his diagnosis and prognosis.

We are supported in these remarks by the testimony of Dr. Wisgrill of Vienna, who in speaking of electricity says, "*A revolution has now taken place in favor of electricity, which had fallen into disuse, not from the insufficiency of the means, but from the mode in which they were employed.*"

If the voice which when living gave laws to medical science, appreciated and acknowledged by all her more intelligent disciples, has left its impress on the present and future generations, the remarks of the late distinguished Professor JOHN ABERNETHY, of Bartholomew's Hospital, London, in favor of electricity, demand a more than ordinary share of respect and attention. "Electricity," says this distinguished surgeon, "is a part of surgical practice that may be considered *unique;* all other means operate on the surface, but electricity will pervade the very centre of the body."

At the close of this chapter will be found a very instructive letter on the successful application of electricity to some of the little sufferers in the late dreadful calamity in the Ward school in Greenwich Avenue, (New-York) by Dr. Edward Vanderpool, one of the most respectable physicians in the city.

In the sixteenth chapter we have presented our readers with a graduated scale of the *time* consumed in digesting the various kinds of animal and vegetable food. The remarks on the adaptation of the different forms of nutriment, in reference to its *quality* and *quantity*, to the variety of *temperaments* or peculiar constitutions of the animal frame, seemed necessary to the perfection of a work intended to condense within its pages all that was necessary to be known in relation to the physiology and pathology of the human constitution: their attentive perusal will more than compensate the reader for the trouble bestowed.

We commend our remarks on pastry, puddings, rich cakes, &c., to the consideration of those kind, indulgent, but mistaken *mothers* who, to pamper the vitiated appetites of their offspring, too often injure their health and lay the foundation of lasting disease.

The remark of Dr. Caldwell, of Kentucky, "that indigestion as often commences in the *brain* as in the stomach," may on a first perusal perhaps excite a smile, but reflection will admit and appreciate its truth and value.

We conclude this chapter with a table which presents the amount of *nutrition* contained in the various articles which are enumerated in it.

The reader will find in the seventeenth chapter, some interesting observations on the influences of ALCOHOL on the human system.

The means by which the alcoholic stimulus is conveyed into the circulation, from the absorbents in the stomach, through the thoracic duct, and finally through the veins which open into the right side of the heart, are fully detailed.

We have shown that all the organs of animal life secrete some portion of the deleterious draught, as the heart, liver, kidneys, &c.; that another portion is exhaled through the lungs in the form of carbon, and through the skin in perspirable matter; that it acts as a stimulant upon all of them; that post-mortem examinations of the bodies of drunkards display diseased stomachs and livers; that in most of them the latter organ is found surrounded by a fatty tissue, which also pervades its internal structure, materially interfering with its function, (the secretion of bile,) by which means the bile is not properly separated from the blood, but passing through the whole venous system with the vital fluid, produces on the subcutaneous veins, and on the skin generally, that yellow tinge which is always an attendant on *jaundice.*

But it will be seen that it is not in the liver, kidneys, skin, &c., that alcohol produces the most injurious consequences, so far as their secretions are concerned, but upon the structure and functions of the *brain* and *spinal marrow;* producing congestion of the organ and imbecility of function in the brain, amounting in its final consequences to *idiocy;* the appalling wreck of human intellect, the self-immolation of Mind!

The blood of the drunkard cannot be rendered purely vital; it becomes so loaded with *carbon* that it cannot be properly subjected to the influence of oxygen in passing through the lungs; the nervous system, particularly that part of it within the skull, is consequently nourished by blood inadequate to the support of its energies; the cerebral function becomes depressed, and imbecility or fatuity is the result.

We commend the detail of premonitory symptoms leading to this final and appalling result, to the special attention of the general reader, and particularly to those who stand on the bank of this immoral *Rubicon*, but have not yet plunged amid its more boisterous waves.

It is shown in this chapter, that the blood of the inebriate becomes, at times, so completely surcharged with *carbon* as to give rise to spontaneous combustion.

The purest carbon which can be produced, contains about five per cent. of hydrogen gas or inflammable air: the theory of animal combustion, then, depends on the oxygen acting on and giving support to the hydrogen contained in the carbon of the blood, as it passes through the lungs.

To whatever causes, however, this *actual burning up of the animal frame, this spontaneous blazing human demolition*, is owing, the facts on record are too numerous and well authenticated to admit of doubt. That spontaneous animal combustion does consume at times the drunkard, is an established physiological fact, resting on ocular demonstrative evidence that cannot be refuted. The case recorded by Dr. Schofield, of Canada, should be perused by all.

The chapter closes with an ideal picture of the drunkard, unfortunately too often realized, accompanied by reflections on the moral consequences of drunkenness to the individual who is its subject, his family and society generally; with some remarks on our municipal regulations, and the revenues derived from licensing retail groggeries.

In the eighteenth chapter, we have discussed the influences of TOBACCO on the human system, showing its pernicious effects on the organic nerves of the stomach, and through them on the nervous system generally.

We have shown that loss of muscular power is the inevitable result of the long-continued use of this narcotic weed, either in chewing or smoking. A case is recorded which strongly supports this conclusion, as is also the evidence of Dr. Chapman of Philadelphia, who states that he has seen several cases strongly resembling "delirium tremens" occur from the excessive use of tobacco.

We know that it interferes with digestion; that it leads to a desire for drinking, being one of the first approaches, at times, to drunkenness; that it produces loss of muscular power, and that loss of energy in the nervous system, particularly that of the brain, which incapacitates its victim for pursuing the best purposes of his moral or intellectual existence. These alone should be sufficient incitements, particularly on the young and rising generation, to abstain from or abandon its use.

In the nineteenth chapter, we have discussed the question of the connection between Mind and Matter, not as metaphysicians but as physiologists.

In pursuing the investigation, we have considered the arterial blood as charged with positive electricity; the venous blood as in a negative state. We have shown that *iron* exists as one of the component elements of the vital fluid, that it is at the same time a powerful conductor of the electric fluid; that the blood in passing through the lungs extracts oxygen from the atmosphere, and electricity, by the aid of its metallic element; that it is thus imbued with the principle of vitality, and changes its color from a black or dark violet to a bright scarlet by the vitalizing influence of electricity; that the nerves are in close contact with the arteries, (more particularly the larger arteries,) through which latter the positive electrically charged blood passes; and that the electric fluid is discharged through the coats of the latter to the nerves which entwine around them; that the heart has a receiving and a communicating chamber, but within itself has but little propulsive circulating force.

In controverting the time-honored opinion of the heart's action, we have not been unmindful that assertion was not proof: we have consequently shown that the force of circulation and respiration, so far as the heart and lungs are concerned, *but no farther*, arises at the base of the brain; that it is the involuntary nerves arising from this division of a great centre, that cause the heart to pulsate and the lungs to expand and contract; that it is the electricity received into the latter organs through the blood at each inspiration, which excites the nervous force of the brain; that if the spinal nerves be cut asunder below the region of the heart and lungs, a paralysis immediately takes place in the lower extremities, but that the circulating fluid still meanders through its silent canals, furnishing positive evidence that the *general circulation* is not derived from any influence received from the base of the brain: were this hypothesis correct, when the nervous chain was destroyed at the *base of the brain* the blood *below* that point would cease to circulate. As an additional support to our theory that electricity controls the circulation, we have shown that if the spinal marrow be divided *above* the region of the heart and lungs, the latter will become immediately paralyzed; but that respiration, or rather the electricity received from it, will force the column of blood through the lungs and the *left* chambers of the heart to the uttermost windings of the arterial system, and through the returning *veins* to the right side of the heart, *after the paralysis is complete.*

The above physiological fact furnishes us with irrefragable evidence, that the muscular action of the heart and lungs is obedient to the nervous action proceeding from the base of the brain, as the former ceases when the latter is destroyed; but that the blood is dependent for its *circulation* on the *electricity* imbibed from the atmosphere as it passes through the lungs, and that this electricity, after having been discharged from the arterial blood, is carried along the nervous system to the upper and anterior lobes of the brain, where it excites the intellectual functions.

If our theory that electricity stimulates the centres and the utmost ramifications of the nervous system be correct; that the latter acts upon the circulatory, respiratory and muscular systems, the functions of the latter, in the integrity of their healthy performance, will be in no inconsiderable degree proportioned to the electricity of the system and its regular distribution: in the latter case, health will be the result; when deranged in its justly apportioned balance, disease.

Oxygen and electricity are the only purifiers of the blood: the panaceas which cupidity daily imposes on credulity as purifiers of the vital stream, may possibly fill the pockets of the empirics who manufacture them, but will confer no beneficial results on individuals or society. The blood in itself cannot be rendered impure, except by some actual obstruction to its circulation. Yet quackery finds its advocates, and disease and death friends.

Several melancholy but interesting cases are presented in this chapter, to show the connection between electricity and insanity in all conditions of the latter, and with various conditions of physical disease.

In its close we have shown how pain is produced and graduated by the positive and negative states of electricity, and by a union of both.

As an illustration of the connection between mind and matter, mingled with the awful consequences of ebriety, we refer our readers to the case recorded of Mr. V., of New-Brunswick, in New-Jersey, as true as it was fatal and melancholy.

We turn from the record of the influence of mind over matter in this chapter, in the production of disease, to its effects for good or evil on disposition and character.

A case strongly illustrative of this point is recorded, detailed to the author by the late Rev. Dr. Rudd, of Utica.

Pursuing the subject of mind over matter, we have ventured on showing its power over the symmetry and beauty of human organization. On this part of the subject we have touched lightly: it was not directly connected with the subject embraced in these pages, but still too highly interesting to be entirely omitted.

The concluding chapter, previous to this synopsis, is occupied by a description of the various mineral and vegetable poisons, and their antidotes.

An instructive case is recorded which came under the personal observation of the author, in which two children became deprived of reason and affected with symptoms of paralysis and insanity combined, from the effect of swallowing the seeds of the stramonium, commonly known by the name of *stinkweed* or *thorn apple.*

We had previously no idea that this vegetable poison was so powerful a nervous excitant. From inquiries made a few days since, (the poison was taken two years since,) we find that one of the children is still laboring under a partial paralysis of the lower extremities.

We conclude this chapter by some remarks intended as cautions, on the use of the spigelia or Indian pink root, in cases of worms in children.

We have seen the most depressing influences produced on the nervous system, by the incautious administration of this vegetable drug; there are other and far better vermifuges, as spirits of turpentine combined with castor oil, which will leave no evil effects on the delicate nervous systems of children to whom they are administered. We would reject the spigelia entirely, as a vermifuge.

The final chapter, which we are now about to conclude, recapitulates some of the leading arguments we have advanced, supports others, produces additional testimony in favor of the electro-nervous doctrine of disease and health, of which we hope there will be found few skeptics in the advancing steps of scientific investigation. We claim no further credit in our advocacy of this simple and rational system, than that due to the workmen employed in laying its foundation: its superstructure we resign into other and abler hands. Our object will be accomplished, so far as this volume is concerned, if in the arguments we have advanced and the evidence we have produced to establish their validity, in the alleviation of the pains of suffering humanity, by those simple means which Nature, ever bountiful and benevolent, has placed within our reach, we have been as successful as we desire.

We take leave of our subject with a firm conviction that Electro-magnetism will eventually form a new and scientific system in the treatment of disease, beyond the cavils of the skeptic or the frowns of interested opponents.

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