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PHYSIOLOGY AND PATHOLOGY.

BY

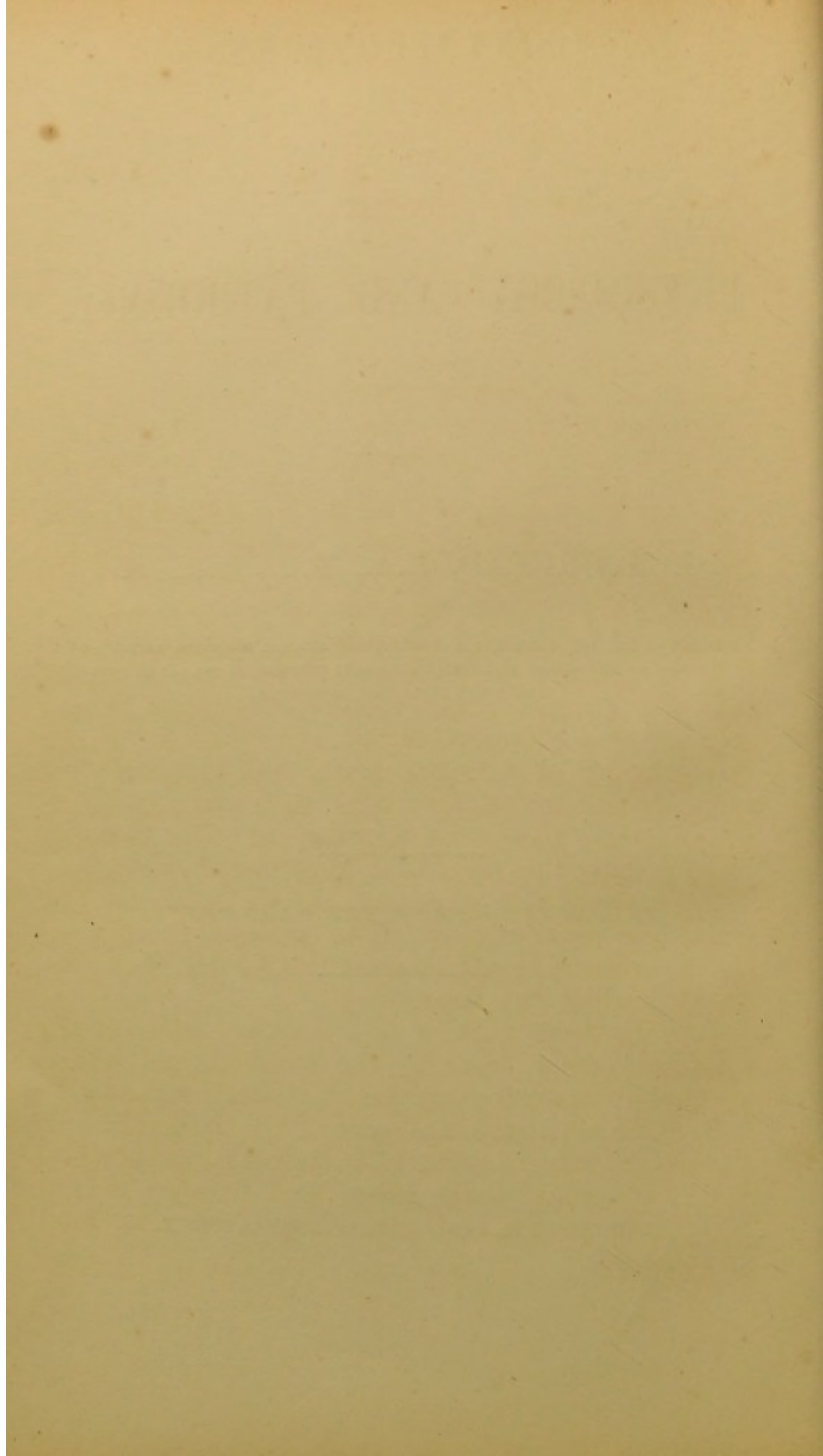
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MDCCCLXV.



ON THE
PHYSIOLOGY OF HEARING.

As the Physiology of Hearing is a subject of great and increasing interest, more especially in these days when aural surgery is progressing with such rapid strides, a few remarks on some points connected with it may not be deemed altogether unimportant.

It is not my desire, however, to enter at length into the *questio vexata* recently discussed in the columns of a contemporary in relation to the modes of treatment of perforate membrana tympani; but rather to call attention to some facts and arguments touching the *theories* in question, and then to notice other points of peculiar interest to the physiologist.

The uses of the tympanum and its membrane first claim our consideration. The *principal* functions of the membrana tympani, according to Mr. Toynbee, are (to use his own words):—

1. “To form part of the resonant walls of the tympanic cavity, whereby the sonorous undulations are thrown upon the membrana fenestræ rotundæ.”

2. “To act as the analogue of the iris in the eye, and defend the ear against too violent sonorous vibrations; and also, on the other hand, to place it in a position to receive and appreciate those most faint and delicate.”

With regard to the first proposition, it may be observed that, though the *membrana tympani* does form part of the resonant tympanic walls, and thereby, no doubt, serves the purpose above-indicated; yet this should hardly be regarded as one of its *leading* functions. That this office does not deserve the importance which Mr. Toynbee attaches to it in the economy of the ear is demonstrated by appealing to the facts supplied by the comparative anatomy of the organ. All who are acquainted with the structure of the ear in the class *Reptilia*, in which a *membrana tympani* first presents itself, must be aware that a *fenestra rotunda* does *not* exist in any of these creatures, with the exception of *Crocodilidæ*, in consequence of the non-development of the cochlea. Hence it is obvious that this alleged function of the tympanic membrane is not a principal nor an essential one.

The second proposition obtains in mammals, though it will not apply to reptiles and birds. In the former, the tympanum is provided with a chain of bones which, being acted upon by special muscles, can regulate the tension of the membrane, and thus defend the ear; but in the latter, a single bone, termed *columella*, supplies the place of the ossicles in mammals, which, being unfurnished with muscular appendages, cannot possibly affect the condition of the drumhead.

Proceeding, then, on the principle of elimination, we discard the two foregoing uses, considering them only subordinate, and arrive at the conclusion that the *membrana tympani* must subserve some other more important end, invariably accomplished by it throughout the animal kingdom.

What, it may be asked, is this great object of the *membrana tympani*? Comparative anatomy affords an answer. The structure is first developed in *Reptilia*, which is the lowest class of animals called

upon to exercise the sense of hearing in atmospheric air. Sonorous undulations in this subtle medium being comparatively faint and delicate, necessitate a more elaborate development of the ear in all air-breathing animals than in those destined, like fishes and other aquatic tribes, to appreciate sound excited in water. This higher evolution of the instrument, which is merely a beneficent adaptation of means to ends, consists in its simplest state of a tympanum traversed by a columella which has no muscular relations, and terminated by a thin but strong membrane—the *membrana tympani*. The latter, as is well known, is on a level with the surface of the head, and may be easily seen in lizards, tortoises, and other reptiles. It is formed by the general integument becoming attenuated so as to produce a delicate and susceptible membrane capable of freely vibrating in unison with the faintest sonorous undulations of air. Vibrations, being thus excited in the *membrana tympani*, are directly transmitted to the columella (for the latter is closely adherent to the membrane), and thence to the *membrana fenestræ ovalis*, to be conducted onwards by the perilymph to the expansion of the auditory nerves. That this is the course normally pursued by the vibrations is rendered most obvious by the arrangement which obtains in serpents. In this order, owing to the special provision to enable the creatures to enlarge the mouth to its greatest extent, the space otherwise occupied by the tympanum is completely filled by the large muscles attached to the jaws; and the only remnant of this cavity is the columella, which lies in the midst of muscular masses, and extends from the *membrana tympani* to the *fenestra ovalis*. This, which is the most elementary condition of a tympanic apparatus, must obviously fulfil its essential function,—namely, the reception and concentration of the delicate sonorous impulses of air.

It may be observed that the facts just mentioned are widely opposed, if not directly antagonistic, to the views propounded by Mr. Toynbee. This gentleman states, "that the sonorous undulations instead of passing through the chain of ossicles to the labyrinth are conducted from the membrana tympani to the air in the closed tympanum, and thereby impinge upon the membrana fenestræ rotundæ."

If the argument from analogy have any weight, it must be apparent to every unbiassed mind that this theory cannot be regarded as correct. If the vibrations be conducted to the air in the tympanum and not to the ossicles, it is then impossible to account for the transmission of the undulations across the tympanum of serpents, since in them this chamber is entirely destitute of air. This statement cannot be rebutted on the ground, that in serpents the sense of hearing is imperfect, since observation and experience concur in testifying that their powers of hearing are not only acute, but render them even susceptible of the charms of music. Moreover, the cochlea in these creatures, so far from ministering to the reception of vibrations that are conveyed, as Mr. Toynbee believes, by the tympanic air, does not present even a rudiment of development.

It is manifest, therefore, that though vibrations of the membrana tympani in the higher animals are undoubtedly conveyed by the air in the tympanum to the membrana fenestræ rotundæ, and thus to the cochlea, yet this is not their only route; nay, it is entirely subordinate to the other more eligible course, I mean that which is invariably present in the higher air-breathing vertebrata, consisting of the membrana tympani, osseous conductor, (columella, or chain of ossicles,) and membrana fenestræ ovalis. This channel primarily and chiefly conducts the vibrations to the vestibule and semi-circular canals, while the other transmits them to the cochlea; and thus all parts of

the labyrinth are affected by the sounds of the external world. Conducive to this end, too, is the free inter-communication of the perilymph, which serves to diffuse the vibrations more extensively over the acoustic surface, and thus to render their perception more acute.

But this novel doctrine of Mr. Toynbee receives its refutation, not only from the facts of comparative anatomy, but also from the results of experimental inquiry. It is needless to do more than mention the experiment by Müller, recorded in Todd and Bowman's "Physiology," part iii., page 96. That experiment is complete as regards all its mechanical details, and the result must be looked upon as conclusive. While the apparatus accurately represented the ear of the higher animals, the difference in intensity of the sound heard, when the end of the rod was transferred from the membrane corresponding to the fenestra ovalis to that representing the fenestra rotunda, was unmistakable.

It has thus been shown that comparative anatomy and experiment concur in maintaining the usual doctrine, which regards the *ossicula auditus* as the chief conductors of sound from the *membrana tympani* to the labyrinth; and until stronger evidence is adduced in opposition than that given by Mr. Toynbee, we are not warranted in rejecting it.

This leads me to notice briefly the acoustic principles involved in the use of the various agents that have been successfully employed in the treatment of perforate *membrana tympani*.

It may be here premised, that although I do not advocate the necessity of a *closed* tympanum in order to perfect hearing, yet I believe that the aperture in the perforate condition of the membrane must be closed before the proper use of the organ can be re-established. While, however, I agree so far with Mr. Toynbee, I must at the same time be allowed to

dissent from his theory of the action of his vulcanized membrane. He believes that the latter prevents the escape of the sonorous vibrations from the tympanic cavity,—which is a mere whispering gallery in his estimation,—and thus ministers to the restoration of the sense. Without resorting to this questionable theory, I think the *modus operandi* of the artificial membrane may be explained on more rational and philosophic principles.

The membrana tympani is normally thrown into vibration in a twofold manner: 1st, by sonorous undulations which are reflected upon it by the walls of the meatus; 2ndly, by vibrations directly propagated to it from the external ear and meatus. Now, these vibrations may be impeded by many causes occasioned by an aperture in the membrane. Amongst these causes may be enumerated the following: 1. Impaired elasticity of the membrane, and diminished excursion of its vibrations. 2. Subdual of sound consequent upon interference of its waves. 3. Resistance of currents of air passing to and from the cavitas tympani during the oscillation of its membrane. These causes will only come into operation when the aperture is of considerable size, and hence the immunity from deafness, as admitted by all authors, which is enjoyed by persons in whom the orifice is small, so long as the other parts of the ear remain intact. The three causes above specified are given in the order of their respective potency, the resistance of the air, it is believed, being the most powerful. The *modus operandi* of the artificial membrana tympani will now be obvious. By closing the aperture, the prejudicial influences referred to are arrested, and the efficiency of the natural membrane is restored. The ingress and egress of air to and from the tympanum during the vibration of the membrane, cease; interference of sound no longer occurs; and, support being given by the artificial membrane, the original

extent of the excursions is regained. Any medium, however delicate, which can effect the closure of the aperture will thus succeed in removing the resulting deafness, whether that medium be the product of accident or design. Of the former, an example is afforded in the air-bubble which is occasionally formed in the mucous or purulent secretion of the tympanum, which, while it remains in the orifice, restores the power of hearing. Of the latter, the most valuable are Yearsley's moistened cotton-wool, and Toynbee's vulcanized membrane. The latter gentleman, while he justly insists upon *complete* closure of the perforation, has put forth in support of his practice a theory which I have shown to be unsound; while Mr. Yearsley, whose views of the physiology of hearing appear to be more in accordance with the facts of comparative anatomy, falls, I believe, into the opposite error, though doubtless undesignedly, of incorrectly explaining his own facts. While he asserts that the aperture must be only *partially* closed by the moistened wool, he unfortunately appeals to no higher evidence in support of his views than the testimony of his patients in whom his treatment was successful! His directions for applying the wool are ample, indeed; but that they could not be carried out by the unassisted efforts of the patients themselves, few minds can have any reasonable doubt. My own experience, too, has shown me that in cases where very marked benefit was derived from the use of the cotton-wool, the latter slightly projected through the opening in the membrana tympani, as proved by the small prominence it exhibited on its withdrawal.

It will thus be perceived that I have advanced facts and arguments in favour of the closure of the perforation in membrana tympani, while I have also endeavoured to show that whatever benefit arises from the various agents employed as artificial membranæ can accrue only from the accomplishment of

this object. Should the other structures of the ear, however, be uninvolved in disease, it is possible the desired end may be partially attained, even though a portion of the aperture, provided it be very small, remain uncovered; but in all cases, success will only be perfect on its complete closure.

Satisfied with the elucidation of general principles, I shall not enter into the important question of the relative merits of the various substances recommended as artificial membranæ tympani, but proceed to the next division of the subject—namely, *the provisions made by Nature to counteract the drawbacks upon the efficiency of the ear consequent upon its own action.*

To all familiar with the anatomy of the human ear, it is well known that the tension of the tympanic membranes is regulated by muscular agency acting through the chain of ossicles. It is needless to state that the object of the change in the condition of the membranes is to render them equally susceptible of high and low notes, and, also, to prevent the nerves being painfully impressed by loud noises. This object is effected by means of two muscles—viz., *tensor tympani* and *stapedius*. Now, each of these muscles presents some points of peculiar interest as regards its structure and relations. Thus, the stapedius muscle, contrary to the usual arrangement is fleshy in the centre, and fibrous or tendinous towards its circumference, and, moreover, is lodged in the interior of the pyramid. What can be the object of this singular deviation in the stapedius from the ordinary structure of muscles, as well as of its enclosure, within a hollow process of bone? A few moments' consideration will enable us to answer this question.

Since it is universally admitted that muscular action is invariably accompanied by a definite "bruit," there is every reason to believe that the contraction of the stapedius does not form an exception to this law, but

is also attended by a similar sound. Now it is obvious that if this noise were transmitted inwards to the nerves of the labyrinth, it would only lead to confusion, and thus impair the efficiency of the ear as an acoustic instrument.

It is interesting to notice the means employed to obviate this untoward event, and especially to observe their analogy to those expedients constantly used by mechanists for effecting the same purpose in the construction of our elaborate musical instruments. The noise produced by the stroke of the hammer against the vibrating strings of a piano, if not deadened by the silk or baize commonly used, would completely mar the harmony of the music. These facts afford a key to the solution of the problem as regards the structure and relations of the stapedius. Sound, when passing from one medium to another of greater density, undergoes a sensible diminution consequent upon reflection, and hence I believe that whatever noise is produced by the action of the fleshy portion of the stapedius is deadened in its passage outwards—1st, by the tendinous periphery of the muscle; 2ndly, by the periosteum lining the pyramid; and 3rdly, by the bony walls of the pyramid itself. The latter, no doubt, also serves to increase the mechanical power of the stapedius by its apex acting as a pulley for the tendon of the muscle; but this office is not incompatible with that just mentioned.

Again, the “bruit musculaire” of the *tensor tympani* is also counteracted by a similar arrangement. This muscle, it will be remembered, is situate within a curved process of bone, commonly termed, from its close relation to the cochlea, the *processus cochleariformis*. Its tympanic portion is also surrounded by a structure composed of white fibrous tissue, generally known as the *tensor tympani ligament*. The means employed for deadening the sound excited by the action of the muscle, it will thus be perceived, are

three in number: 1st, the cochleariform process; 2nd., the periosteum lining this process, aided by the fibrous sheath of the muscle; and 3rd., the tensor tympani ligament.

But the above is not the only provision for securing the object in question; there is another, which is perhaps equally effective. The science of acoustics teaches us, that when two waves of sound of equal dimensions meet in opposite phases, the effect is, the neutralization of both, and the production of complete silence. This phenomenon, technically called "interference," is experimentally illustrated in the following manner, as shown by Bird, Lardner, and other physicists:—When a tuning-fork thrown into vibration is held over the mouth of an upright glass cylinder, the sound is sensibly augmented by the undulations excited in the walls of the vessel. If, however, another glass cylinder of equal size be held in a direction at right angles to the first, while the vibrating tuning-fork is placed in an intermediate position, no sound whatever is heard. This can only arise from the sonorous waves excited in the two cylinders coming into conflict while in opposite phases, and thereby neutralizing one another.

Applying these facts to the internal arrangements of the ear, is it unreasonable to suppose that the hollow conical *pyramid* and the curved cochleariform process are, in position, related similarly to the cylinders in the experiment? May not the sonorous undulations excited by the action of their enclosed muscles, if any escape the deadening influences described, possibly be in opposite phases, and thus come under the influence of the laws of interference?

But the muscles of the ear are not restricted to those above noticed, modern research having undoubtedly added another to the list. That gelatinous-looking structure forming the external part of the spiral lamina of the cochlea has had its claims to

muscular character unequivocally established by the investigations of Todd and Bowman. These distinguished physiologists have appropriately designated it, the *cochlearis muscle*. As this structure serves to protect the cochlear nerve from undue impressions of sound in the same manner as the tympanic muscles do those of the membranous labyrinth, so its action is also attended by drawbacks, which, if not counteracted, would seriously impair the perfection of the sense. Various are the means employed to effect this purpose. In the first place, the cochlearis muscle chiefly occupies the scala vestibuli,—doubtless, to be as remote as possible from the nerves which are distributed upon the surface of the lamina spiralis that is bathed by the liquid in the scala tympani. Again, since contraction, while it diminishes the length of the muscle, at the same time increases its other dimensions, it is clear that this change, being sudden, would create an agitation in the surrounding liquid, which, if not guarded against, would much interfere with the use of the instrument. This, however, is obviated by the upper or vestibular surface of the muscle being hollowed out into lacunæ, which give it a very irregular appearance, not unaptly compared to that of the cardiac carneæ columnæ. These hollow spaces, while they act like those in the heart, and prevent rupture of this structure by diminishing the resistance of the fluid, no doubt serve also, by allowing the easy insinuation of the perilymph during the contraction of its fibres, to deaden the agitation in question. Nor is confusion arising from the “bruit” occasioned by the action of the inferior part of the muscle less sedulously guarded against, for we find a spur-like process of bone projecting from the outer wall of the canal, which doubtless serves to impede, if not entirely to prevent, the transmission of the sound to the liquid in the tympanic scala.

Dismissing, however, these marks of design as dis-

played in the muscular arrangements of the ear, I venture to throw out a conjecture regarding the function of that beautiful structure, the *denticulate lamina*, so called by Todd and Bowman. My readers will recollect that it is situate upon the upper surface of the osseous zone of the spiral lamina, and is consequently bathed by the perilymph in the scala vestibuli. Now, the sonorous vibrations which ordinarily agitate this liquid, whether propagated from the perilymph of the vestibule, or that in the scala tympani, must be comparatively faint, and could not, therefore, strongly impress the nerves distributed upon the opposite surface of the spiral lamina. May not the teeth of the denticulate process, acting like so many vibrating tongues, multiply these undulations, and then transmit them by conduction to the nerves near their base? If so, this process may justly be regarded as the analogue of the otolith, having a relation to the cochlear nerves similar to that borne by the latter to those of the vestibule.

In conclusion, I may point out a few facts corroborative of the view now generally entertained regarding the function of the cochlea—namely, that it is that part of the labyrinth which more especially takes cognizance of sounds conveyed by the bones of the head.

In connexion with this hypothesis, it is interesting to notice the first appearance of the cochlea in birds, which are the lowest class of animals gifted with capacity of utterance or powers of song. Fishes and reptiles are almost universally dumb, and hence the absence of this structure in their organs of hearing. But the voices of animals reach their own ears chiefly through the cranial bones, and this at once accounts for the appearance of the cochlea in all those that are thus endowed.

In keeping with the above view, also, is the comparatively rudimentary development of this structure

in Cetaceæ, called upon, as they usually are, to appreciate the powerful vibrations of sound excited in, and conveyed by, the watery element.

Moreover, this theory appears to give a clue to the discovery of the use of that peculiar leaf-like appendage attached to the nose of many species of the bat tribe (Cheiroptera). These creatures are endowed with the highest auditory sensibility, and every contrivance which could conduce to that end is brought into requisition. Not only are the external ears enormously expanded, and provided at their base with vibrating tongues of marked susceptibility, but even the nose is disfigured, so to speak, by the fantastic membranes alluded to, in order that every possible means may be employed for heightening the sensitiveness of their organs. The external ear receives sounds, and conveys them inwards through the ossicles to the vestibule and semicircular canals; while the membrane in question, being easily thrown into vibration, propagates its oscillations to the bones of the face and head, and thence to the cochlea, so that all parts of the labyrinth are equally and simultaneously affected.

March, 1859.

In connexion with this subject, the subjoined letter appeared in the "Lancet" of July 2nd, 1859, pointing out the abandonment by Mr. Toynbee of the peculiar views previously entertained by him, and the adoption of those advocated in this paper:—

To the Editor of the "Lancet."

SIR,—Permit me to draw your attention to a paper recently read by Mr. Toynbee, before the Royal Society, "On the Mode in which Sonorous Undulations are Conducted from the Membrana Tympani to the Labyrinth in the Human Ear," of which an abstract appears in THE LANCET of June 18th, p. 612. I am glad to perceive that Mr. Toynbee has at length been led to adopt the opinion usually entertained by physiologists,—namely that sonorous undulations

pass from the membrana tympani to the vestibule *through the chain of ossicles*. This, it will be observed, is one of the leading conclusions of his paper. It is not a little remarkable, however, that Mr. Toynbee, no later than 1857, held opinions widely different from those just alluded to; for we find him stating in the number of the *Medical Gazette* for Nov. 21st of that year, "that the sonorous undulations, instead of passing through the chain of ossicles to the labyrinth, are conducted *to the air* in the closed tympanum, and thereby impinge upon the membrana fenestræ rotundæ."

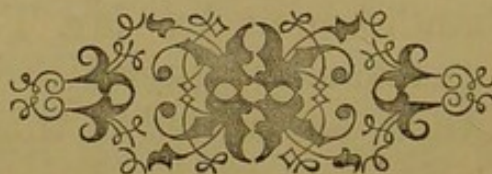
This change of opinion is the more gratifying to me, as, having had strong convictions on the subject, I took occasion some months since to write a paper in vindication of the generally accepted views, as opposed to those lately held by Mr. Toynbee. That paper is published in the last volume of *THE LANCET*, p. 236 *et seq.* Though no allusion whatever is made to it in Mr. Toynbee's communication, I cannot help thinking that to my remarks is mainly to be attributed this striking change in his views of the physiology of hearing. It is, indeed, satisfactory to find that his able experiments have amply confirmed the usual doctrine, to which comparative anatomy, as I have elsewhere shown, affords the strongest support.

Trusting, as Mr. Toynbee has not done me the justice to acknowledge the correctness of my observations, that you will give these lines a place in your valuable columns.

I am, Sir, your obedient servant,

J. MOORHEAD, M.D.

Weymouth, June, 1859.



ON A CASE OF ANGINA PECTORIS.

WITH REMARKS.

ON the 24th of January, 1859, I was requested to visit Mr.—, aged sixty-three, who, I was informed, suffered from some painful affection of the chest. On my entering his bedroom, he suddenly burst into tears, which, however, lasted only for a few minutes. Such manifestations of feeling, he said, were quite beyond his control, and had been easily induced ever since he had had two or three slight paralytic seizures several years ago. When the emotional excitement was allayed, he stated that when walking, and especially soon after meals, he was suddenly seized with a painful sensation in the præcordial region, which soon became aggravated to an intense degree. This feeling of anguish was accompanied by an aching pain shooting down both arms, and extending even to the tips of the fingers. It came on more particularly when he walked up a hill or against the wind. On the pain becoming so severe as to be no longer bearable, he stood still, and it almost immediately vanished. A similar pang recurred after a little further exercise, and was removed by a like proceeding. During the paroxysm, his breathing, he said, was unaffected.

From these attacks he had suffered for nearly fifteen years; but his disease had latterly become so aggravated that the slightest physical exertion or transient emotion sufficed to induce a paroxysm. The bowels acted only under the influence of aperient pills. He was subject occasionally to flatulency and acidity of stomach, which invariably aggravated the angina, and sometimes, he thought, brought on a paroxysm.

His previous treatment chiefly consisted in the use of remedies ordinarily prescribed for dyspepsia, many of the medical men whom he had consulted considering this his chief disorder, and the neuralgic

pain of chest the effect. Having almost exhausted the catalogue of such remedies, he had been using for more than two months past Boudault's pepsine, from which, however, he had derived no benefit.

On examination of the chest, the percussion-note was found resonant over both lungs, but there was a greater extent of præcordial dullness than usual. The respiratory murmur was natural. There were no cardiac bruits whatever, the only apparent deviation from health being faintness of the heart's normal sounds, with feebleness of its impulse; its beats were rhythmical, and the pulse at the wrist was 92, weak. There was no dyspnœa; no pain or tenderness in the epigastric or hypochondriac regions; no nausea or vomiting; tongue moist, and nearly clean.

During my visit he suffered severely from a paroxysm, which, however, was much alleviated by a dose of opium. Ordered an anodyne liniment, consisting of tincture of opium and chloroform, with compound camphor liniment, to be rubbed into the chest when the pain supervened; also an antacid mixture, containing dilute hydrocyanic acid in two-minim doses, to be taken three times a day.

Jan. 26th.—Feels better, and has not had paroxysms of angina so frequently. When they came on, he states he received much relief from the application of the liniment, and the use of morphia in small and repeated doses; sits daily in the drawing-room; has a slight cough, contracted since last visit. Stethoscope still reveals but negative signs of any cardiac derangement. Repeat mixture.

28th.—About eleven o'clock last night, the patient was suddenly seized with angina, together with dyspnœa, which gradually increased till the breathing became very short and laboured. When I arrived (about one A.M.), the patient presented a haggard, anxious expression, with rolling eyes, indicative of his acute sufferings and intense dyspnœa. Stethoscopic examination showed a constricted condition of the bronchial tubes, rhonchus and other sonorous râles being everywhere throughout the lungs distinctly audible. The suddenness of the attack, together with the absence of corresponding excitement in the vascular system (the pulse being weak and the extremities cold), led me to regard the dyspnœa as *nervous*, and accordingly I administered the following draught:—Compound tincture of valerian, one drachm; aromatic spirit of ammonia, half

a drachm; compound spirit of sulphuric ether, half a drachm; solution of muriate of morphia, fifteen minims; spring-water, to an ounce and a half. In the course of a few minutes, great relief was experienced; the rhonchus and other abnormal respiratory sounds could scarcely be detected, while the breathing became comparatively easy. Warm bottles were then applied to the feet, and the hands bathed in warm water. As the angina, however, persisted, the anodyne liniment was rubbed into the præcordia, and solution of muriate of morphia, in twenty-minim doses, twice repeated. These induced sleep for a few hours. During this attack, the pain in the arms was entirely absent.—Twelve o'clock noon: Is free from acute pain, but complains of one of a dull, aching character in præcordia; has no dyspnœa, but occasionally expectorates a little mucus; bowels confined. Ordered an ounce of castor oil; repeat mixture, substituting for the hydrocyanic acid "Hoffman's anodyne," in half-drachm doses, three times a day.

30th.—Looks better and feels cheerful; has had no return of paroxysm, nor even of dull pain of chest; bowels freely opened by the draught; no dyspnœa, but a slight cough. Repeat last mixture.

Feb. 1st.—In drawing-room, and continues cheerful; still free from angina and dyspnœa; felt himself so much improved that yesterday he took a ride in a wheel-chair, which he much enjoyed; this he had not been able to do for three weeks previously; bowels open without the assistance of an aperient; appetite good; pulse feeble. Repeat mixture.

2nd.—Half-past six A.M.: Yesterday evening, dyspnœa came on, and continued during the night, but, as reported, not of so great urgency as in the former attack. Three small doses of an expectorant mixture were given at intervals, together with warm coffee; but these proving unavailing, a messenger was despatched for me. Unhappily, however, before my arrival, death took place. This event occurred so quietly, that I was assured the attendants were not aware of it till some minutes afterwards. Coupling this circumstance with the fact that the patient was able ten minutes before his dissolution to get up to the night-chair, it may I think, be safely concluded that death took place by syncope.

Autopsy, thirty hours after death. (Assisted by Dr. Smith.)—

Cadaveric rigidity strongly marked; body corpulent, the subcutaneous layer of fat being about half an inch in thickness; sternal cartilages partially ossified; large amount of fat in mediastinum; about two ounces of straw-coloured fluid in pericardium; about two pints of serum in cavities of pleuræ; no pleuritic adhesions; lungs healthy, but congested. Heart large (weighing seventeen ounces) and very fatty, its surface, especially on the right side, being so covered that its muscular tissue, which was thin and pale, was almost concealed from view; right cavities of heart contained a considerable quantity of liquid blood, the left much less; all the valves healthy and efficient; aorta normal in calibre and structure, with the exception of a very little calcareous deposit in the wall bounding one of the sinuses of Morgagni; the coronary arteries for an inch and a half from their origin were converted into rigid tubes, and presented beyond this, at short intervals along their course, as far as could be traced, specks of calcareous deposit. Stomach contained only a small quantity of liquid; its mucous membrane somewhat congested; otherwise healthy. Liver large and congested; gall bladder contained about an ounce of bile; spleen engorged with blood; kidneys healthy, but deeply congested; omenta loaded with fat. Head not examined.

While the foregoing case presents all the usual features of genuine angina pectoris, it has also some peculiar points which, I think, render it worthy of record. The duration of the disease is somewhat remarkable, extending, as before observed, over a period of nearly fifteen years. The most interesting point, however, is the urgent dyspnœa which occurred only on two occasions during that lengthened period. The first attack which I witnessed, on the 28th January, was so decidedly spasmodic that it may justly be assigned to the same cause as asthma,—namely, undue contraction of the muscular fibres of the bronchi. This is also shown by the almost immediate relief which ensued upon the administration of the antispasmodic draught. The spasmodic contraction of the bronchi, there is little doubt, was due to irritation conveyed

along the motor fibres of the par vagum. What the source of that irritation was it is difficult positively to state, but the presumption is that it was the morbid condition of the heart. The implication of the motor filaments of the par vagum would seem to lend support to the theory that supposes *that* nerve, and not the sympathetic, to be the seat of angina pectoris. The absence of pain in the arms and the mild character of the angina during the attack of dyspnœa, show that the irritation of that nerve (par vagum) was then almost confined to its motor fibres.

Without, however, entering further into pathology, it may be stated that the morbid appearances exhibited in the above case were those most frequently found in connexion with this affection. The muscular tissue of the heart was thin and pale, and loaded with fat; while the coronary arteries were distinctly ossified. That these organic lesions excited the irritation of the par vagum which produced the angina can, I think, scarcely be doubted.

The other abnormal conditions may be explained by reference to the phenomena preceding death. The dyspnœa, which continued for several hours, brought on congestion of the lungs, which led to accumulation of blood in the right chambers of the heart and in the entire venous system. Hence the congestion of all the abdominal viscera. The large quantity of serum in the pleural cavities can only be regarded as a post-mortem product, effusion being no doubt much augmented by the pulmonary congestion.

Although, as I have before stated, death took place by syncope, yet it is highly probable, from the great amendment in the symptoms, that that event would not have then occurred but for the dyspnœa. While syncope, then, was the immediate or proximate cause of death, dyspnœa, I believe, was its primary or remote cause.

July, 1859.

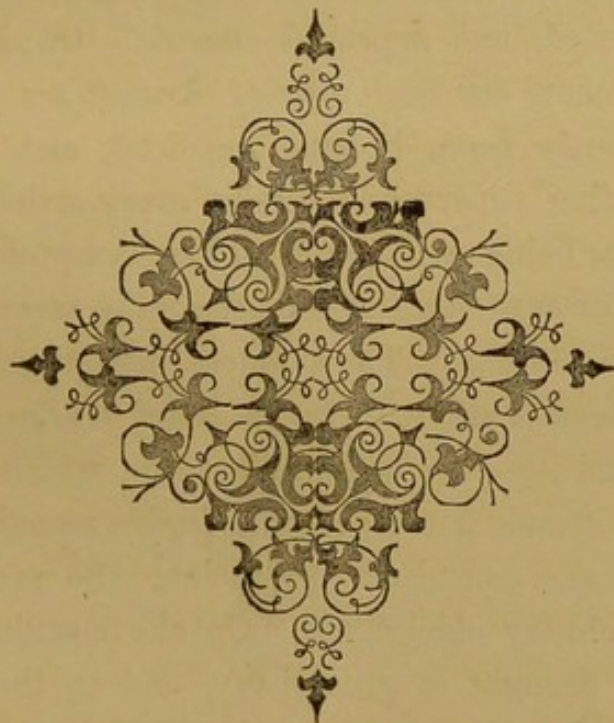
ON
EARLY OPERATION FOR STRANGULATED HERNIA.

As the attention of the Profession has been much directed to the advantages of operating *early* for strangulated hernia, the following case which strongly illustrates the utility of this practice, may not be deemed unworthy of record.

On the 28th February, 1861, E. G——, aged thirty-nine, was admitted into the Weymouth Royal Infirmary, suffering from strangulation of a right inguinal hernia. He stated that since birth he had been the subject of rupture, for which he wore a truss, and that he had always easily reduced the tumour when it accidentally descended until the 27th February at three p.m., when his efforts to do so were ineffectual. Vomiting soon supervened, and was repeated several times. On the afternoon of the following day he was seen by a surgeon, who, having tried the taxis without success, sent him to the Infirmary, where he was admitted at eight p.m. The taxis was then again tried by my colleagues, Drs. Smith and Lithgow, as well as by myself; but notwithstanding the previous use of a warm bath and the adoption of the inverted attitude, so strongly recommended by several eminent surgeons, our efforts at reduction failed. As the stethoscope indicated cardiac disease, chloroform was not given. It was then evident that operative proceedings afforded the only chance of cure; but, as the symptoms were not urgent, it was agreed to defer operating till next morning.

Accordingly on March 1st, at nine A.M., we performed the usual operation. There was stricture at both rings, but chiefly the internal, and it was found necessary to open the sac. From the hernia being of long standing, many of the superficial vessels jetted very freely, and three of them were ligatured. The wound having been dressed in the usual way, a morphia was given, and the most perfect rest enjoined. Not to enter into further details, suffice it to say that without any medicine, save a few doses of morphia, and subsequently of castor oil, no peritonitis supervened. The wound healed satisfactorily in twelve days, and the patient recovered without an untoward symptom. There cannot, I think, be a doubt that the happy termination of this case arose from the early performance of the operation, only forty-two hours having elapsed from the time at which the strangulation occurred.

March, 1861.



ON
A CASE OF HYDATIDIFORM OVUM.

As the opinion of the Profession at large with regard to the nature and pathology of so-called uterine hydatids is still unsettled, the following contribution may be deemed worthy of publication. It will serve to illustrate the symptomatology of this morbid development, as well as to corroborate novel views recently put forth on this interesting subject.

On the 24th September, 1862, I was requested to visit Mrs. G—, a respectable married female, aged fifty, who was suffering from great irritability of stomach. Though naturally of a stout habit, she was somewhat emaciated, and appeared anæmic. On inquiry, it was ascertained that about the beginning of August her appetite, which had been previously good, became impaired, and in a short time nausea and vomiting supervened, almost every article of food being rejected soon after being swallowed. These symptoms, accompanied by a great sense of oppression at the præcordia, were present almost throughout the entire day. The sickness persisting, she states that on the 12th September she took for its relief a wineglassful of the infusion of ground-ivy (*Glechoma hederacea*), which she had heard from some of her female friends was a valuable remedy in such cases. On the same day she consulted a physician, who prescribed a mixture containing chiefly chlorodyne. On the morning of the 13th she took another draught of ground-ivy, and in the course of the day two doses of the mixture, each of which, however, was almost instantly rejected. Towards evening she received a shock by a sudden knock at her door, and shortly after a sanguineous vaginal discharge took place, followed by a small clot. During the interval

that elapsed until she consulted me on the 24th, she states that the bloody discharge occasionally recurred, accompanied by some watery fluid, which came away in gushes with sneezing, coughing, or retching. The gastric symptoms also persisted with much severity, and she began to suffer in her general health. She informed me that she had had four children at full term and three miscarriages, and that she had not been pregnant for the last twenty years, during which period, however, she had regularly menstruated every four weeks until the 25th July, after which date nothing appeared until the time of the hæmorrhage above referred to.

When I first saw the patient, her tongue was thinly coated with a moist white fur; there was pain of stomach, though not considerable, attended with a sense of oppression, also slight tenderness of epigastrium on deep pressure; vomiting occurred almost after every meal. As the gushes of water which occasionally took place were supposed by the patient to come from the bladder, and the irregularities of the catamenia might be attributed to her advanced age, I then regarded the case as one of dyspepsia, and accordingly prescribed alkalies with sedatives, consisting of dilute hydrocyanic acid, chloric ether, chlorodyne, oxalate of cerium, *et hoc genus omne*. Though each of these remedies afforded temporary relief, the sickness soon returned with its pristine severity, and consequently, on October 1st, a full examination of the abdomen was instituted. There was still slight pain on pressure over epigastrium; but the most notable feature was a hard globular tumour, about the size of a child's head, occupying the hypogastrium, and extending as high as the umbilicus. This tumour, from its situation and relations, was evidently uterine, and to my mind at once accounted for the constant sickness, which was clearly sympathetic. As there had been slight hæmorrhage during the few days previous, the idea of polypus or fibrous tumour of uterus suggested itself, pregnancy having being left out of consideration, as the patient had not borne any children for twenty years. An internal examination was proposed, but she would not then submit to it, and begged me to try the effect of medicine a little longer. Accordingly, sinapisms were applied to the epigastrium, and sedative drugs again resorted to for some days; but as the vomiting still continued, and debility increased,

she at length consented to an examination per vaginam, which was made on the 8th October.

The cervix uteri was found to project into the vagina; the os was patulous, so as easily to admit the finger; and when this was pushed into the uterine cavity, the latter was found filled with a substance which was soft and placenta-like to the feel. As the finger, on being withdrawn, was covered with blood, the patient was directed to use the tepid-water douche and keep in the recumbent posture. A few hours afterwards, however, strong uterine pains set in, which soon expelled, with slight hæmorrhage, a vesicular mass nearly half filling a wash-hand basin. I was immediately sent for, but on my arrival found the mass in question so broken up by the attendants while removing it to the basin, that to recognise its constituent parts was almost impossible. I discovered, however, on careful examination, some portions enveloped by the decidua, which was covered in two places with a thin lamina of coagulum; but the distinction of chorion and amnion could not be recognised, their places being occupied by a stringy vesicular substance nearly three inches in thickness. What appeared to have been a small cavity was discovered, but there was not a trace of embryo. The vesicular bodies were generally about the size of currants, though a few were larger. It is almost needless to state that the sickness and all other distressing symptoms at once disappeared, and the patient made a rapid recovery.

Remarks.—The foregoing case, while it bears a striking resemblance to one recently reported by Dr. Graily Hewit in *The "Lancet,"* affords corroborative testimony to the correctness of the views advanced by that distinguished obstetrice in the first volume of the "Obstetrical Transactions." Several of the so called hydatids, when examined under the microscope, exhibited numerous nucleated cells similar to those presented by the chorion villi, thereby inducing the inference that the cyst-like bodies were merely hypertrophied and œdematous portions of natural structures.

With respect to the mode of origin of this vesicular degeneration of chorion there is considerable diversity

of opinion. Some think the transformation the result of perverted developmental force, and that it ultimately leads to the death of the embryo; whilst others, and especially Dr. Graily Hewitt, believe the latter event to be the first link in the chain of pathological sequence. Without entering at length into the controversy, I may observe that the circumstances of this case favor the opinion of Dr. Hewitt, and, when regarded in the light of his published observations on the subject, admit of easy explanation. As menstruation ceased on July 25th, and nausea began early in August, it may be assumed that conception took place shortly after the former date, and that foetal development went on normally until September 13th, when contraction of the uterus—induced either by the ground-ivy or the sudden shock—partially separated the ovum from its walls and gave rise to the hæmorrhage. This separation, though it destroyed the life of the embryo, was not, however, sufficient to produce abortion, and consequently the chorionic processes still embedded in the decidua continued to grow whilst they degenerated into the cyst-like bodies afterwards expelled. As the embryo at its death could have been only about seven weeks old, and therefore probably about the size of a small bee, it is not surprising that no traces of its existence were discovered more than three weeks subsequently.

The rapid enlargement of the uterus characteristic of so-called hydatid growth was well displayed in this case, as the organ had attained to the dimensions usual at the sixth month of gestation, though its contents could not have begun their development earlier than ten or eleven weeks previously. The entire absence of suspicion of pregnancy on the part of the patient, coupled with her advanced age, at first rendered the case obscure, but its termination satisfactorily removed all the difficulties previously surrounding it.

ON A
CASE OF SPURIOUS ENCEPHALITIS.

WITH REMARKS.

OF all the diseases in the wide domain of pathology there are none more interesting or important than those of the nervous system. But though they have been made the subject of clinical research and experimental investigation, it will be admitted that as regards their intrinsic nature they are still involved in much obscurity. The treatment of these affections, it will also be conceded, is often empirical and unsatisfactory. I am, therefore, induced to submit to the notice of the Profession the following case, which, by its favourable termination, shows the importance of correct diagnosis in all cerebral affections attended with delirium and coma, while it also exhibits in a striking light the great value of the stimulating plan of treatment.

On the 26th of June, 1863, at half-past seven A.M., I was requested to see Mr. S—, a gentleman sixty-two years old, who, it was stated, had suddenly manifested symptoms of mental derangement, and required immediate attention. On my arrival I found him in bed, in a state of delirium, talking incoherently in a confused jargon of Latin, French, and English, the meaning of which was quite unintelligible. He had a wild, excited expression of counte-

nance, with frequent knitting of the brow, and when interrogated, replied sharply that he did not understand the question. There was much confusion of thought, and he often applied the hand to his forehead and complained of an uneasy feeling in that region.

With regard to the history of the case, I may state that the patient, who holds an appointment in the Civil Service, and is of strictly temperate habits, always enjoyed good health until about two months previously, when he consulted me for an attack of bilious dyspepsia, which, however, soon yielded to treatment. In the course of a few weeks he again saw me, when he complained of difficulty of breathing, which came on in paroxysms, but without cough. He also said his spirits were depressed; that he took little interest in passing events, and that his memory began to fail him. He looked anæmic, and appeared to have lost flesh. His conjunctivæ, which during the previous illness were of a yellowish tinge, had again acquired their natural hue. The urine, on analysis, was found healthy: its specific gravity was 1023. Having carefully examined the chest and abdomen without discovering any traces of organic lesion, I regarded the case as one of anæmia, and, accordingly, while I advised cessation from duty for a short time, prescribed iron and quinine. Leave of absence was shortly obtained, but I subsequently learned that so devoted was my patient to his duties that he did not allow the time allotted to him to expire before he returned to his office, in which he was engaged many hours daily, while he also omitted taking regularly the medicine prescribed. Though the paroxysms of dyspnœa became more frequent, and the languor increased, he still continued in the pursuit of his daily avocation till the 25th of June, on the night of which he retired to rest with his mental faculties sound, though obtuse.

When he awoke on the 26th, at six A.M., it was stated that he complained of pain in the head and limbs, and exclaimed that he was "going out of his mind." He soon jumped out of bed, and walked wildly about the room for some minutes, until he was prevailed upon by his wife to return to bed, where he remained until I saw him. When the agitation consequent on my entering the room had subsided, I noted, in addition to the delirium, the following

particulars:—Pulse 92, small and compressible; tongue clean and moist; breath foul; bowels confined; no nausea or vomiting; skin cool; pupils *somewhat dilated*, but contractile; hearing *considerably impaired*; carotids visibly pulsating; sighing respiration about every five minutes; countenance slightly livid. Considering the symptoms indicative of nervous exhaustion, I administered a draught containing compound tincture of valerian and sulphuric ether.—Twelve o'clock, noon: There is less disposition to talk incoherently, but still confusion of ideas combined with inability to recognise any of his family. Dr. Smith, who now saw the patient in consultation with me, stethoscopically examined his chest, and pronounced both lungs and heart healthy. As he concurred with me in opinion with regard to the etiology of the symptoms, the following medicaments were ordered:—A draught, consisting of sesquicarbonate of ammonia, compound tincture of valerian, and Hoffman's anodyne, to be taken every fourth hour; a blister to be applied to the nape of the neck, and a purgative pill, containing podophyllin, to be taken at bedtime. A liberal supply of beef tea and eggs throughout the day was also recommended.

27th.—Eleven A.M.: Dr. Smith again saw the patient, who was in the following condition:—Bowels relieved; pulse 96, very feeble and fluttering; spasmodic breathing more frequent; expression of countenance ghastly, presenting general pallor, relieved by lividity of the cheeks and lips. During the paroxysm of dyspnœa the pulse was scarcely perceptible. He occasionally talked incoherently, but looked dull and drowsy. The mixture to be repeated, and a glass of port wine to be taken every fourth hour; the beef tea and eggs to be continued.—Nine P.M.: The patient has not spoken since noon, but lies in a state of stupor, with occasional yawning and panting for breath. When the dyspnœa is very urgent, he suddenly raises himself up in bed, and sits there for a few moments. Ordered sinapisms to be applied to the calves of the legs.

28th.—Ten A.M.: Pulse 92, quite thready; stupor more profound, and dyspnœa more frequent and distressing; pupils, though sluggish, yet contractile; tongue clean. The mixture to be repeated, and a wineglass of brandy, in a cup of beef tea, to be taken every second hour.—Nine P.M.: Fæces and urine twice passed unconsciously in

bed during the day. The patient perfectly comatose, with occasional hiccough. Sinapisms were applied to the soles of the feet, and ordered to be kept on for two hours.

29th.—Half-past seven A.M.: I was sent for, as the patient was supposed by his family to be dying. The power of deglutition, though not lost, was much impaired; pulse 92, very feeble; respiration so quiet that the thoracic movements could scarcely be observed, unless, during dyspnœa. I administered a glass of brandy, and ordered stimulants, with nutrients, to be continued as before.—Nine P.M.: Excretions involuntarily evacuated once since the morning; pulse, however, slightly improved; coma not so profound.

30th.—Ten A.M.: Pulse 80, stronger. The patient still less comatose. To have an ounce of brandy, with beef tea or egg, every fourth hour; and the medicine to be continued.—Nine P.M.: Appeared to sleep quietly all the day, unless when disturbed for food, when he opened his eyes and looked round the room. He now recognises the members of his family for the first time since the 26th. Has voluntarily voided urine of a high colour, of specific gravity 1025, containing a trace of albumen, but without tube-casts.

July 1st.—Much improved, being quite conscious and rational; can sit up in bed without dyspnœa. The medicine to be continued thrice daily, and one ounce of brandy to be taken every sixth hour.

3rd.—Continues rational, but labours under an impediment of speech, being unable to find suitable words to convey his meaning. He still has a feeling of uneasiness in his head, with irritability of temper.

8th.—Bowels moved once daily since last report, and urine naturally voided; pulse 76; tongue clean; little dyspnœa; feels stronger, but is still anæmic and lethargic. Ordered a draught, containing tincture of sesquichloride of iron and chlorate of potass, to be taken four times a day. The previous mixture to be discontinued.

13th.—Still continues to progress. All the organic functions are now normally performed, and the mind is gradually acquiring its original power. From this date the improvement was steady and progressive until the beginning of August, when, the patient being sufficiently recovered to take out-door exercise daily in a Bath chair, I discontinued my attendance.

Remarks.—This case appears to me to possess considerable interest in connexion both with physiology and pathology, as it exemplifies some important laws now generally recognised in those cognate sciences. Though it has long been observed that delirium and coma may be produced either by congestion or anæmia of the brain, yet it is only in modern times that the attention of the profession has been particularly directed to this important fact. It has been noticed by several authors, but most recently by the late Dr. Todd in the Lumleian Lectures for 1850. That distinguished physiologist there ably pointed out that delirium and coma, though they are in some cases symptomatic of inflammation of the nervous centres, are yet in the majority of instances non-inflammatory in their character, and are produced by deranged nutrition of the grey matter of the cerebral hemispheres. While the lecturer dwells upon the importance of correct views as to the pathology of these phenomena, he strenuously advocates the adoption of the stimulating plan of treatment. That the case under consideration was not one of encephalitis, though it presented some of its features, was manifest from the absence of certain symptoms characteristic of that morbid state. There was no nausea or vomiting, nor severe pain in the head; the pulse was not slow and sluggish; the delirium was not muttering; the pupil was not contracted; and the hearing was not acute. Whilst, then, the patient was not labouring under hyperæmia of the brain, there was also evidence to shew that he was not the subject of uræmic poisoning. Examination of the urine revealed no albumen or tube-casts, and the specific gravity (1023) showed there was a normal amount of urea excreted. The trace of albumen subsequently discovered arose from slight congestion of the kidneys, the result of feeble ca-

pillary circulation. Again, though the sudden invasion of the symptoms might point to their epileptic origin, yet the sighing respiration and general appearance of the patient, combined with the previous history of the case, left little room to doubt that the delirium and coma arose partly from anæmia of the brain. I say *partly*, because the patient had not suffered from any hæmorrhage which might have suddenly disturbed the balance of the cerebral circulation, but had gradually glided, through imperfect sanguification, into that anæmic state. But how often do we see cases of extreme anæmia thus *gradually* induced in which the cerebral functions are comparatively unaffected. It is thus manifest there was some other cause in operation, and this I believe to have been the undue waste of brain accompanying long-continued mental exertion. Here was a man who for years had concentrated his faculties upon one subject, and allowed his thoughts to become so engrossed with it that he could find no pleasure save in its contemplation. As it is admitted by physiologists that every act of the intellect involves the disintegration of brain-tissue, it is easily intelligible how such absorbing attention operated in breaking-down the nerve-vesicles to a greater degree than was compensated by repair, and so deranged the nutrition of that portion of the cerebrum which is the centre of intellectual actions.

The treatment of this case deserves a brief notice. It was eminently stimulating and supporting. For a few days, when the coma was profound, an ounce and a half of brandy was administered in beef tea every two hours, while ten grains of sesquicarbonate of ammonia were given every four hours. The grand object was to stimulate the capillary circulation, which I believe was accomplished by the remedies employed, both brandy and ammonia quickening

the heart's action, while the latter, by holding the fibrin of the blood in perfect solution, indirectly contributed to the same result. The blister and sinapisms were resorted to for a similar purpose. Subsequently, when coma had passed away, iron and chlorate of potash were exhibited; the former being intended to promote the growth of the red corpuscles of the blood, and the latter to supply oxygen to the nervous centres. Whatever be the *modus operandi*, however, of the measures employed, it is satisfactory to reflect on the favourable termination of the case, and to contrast it with the result of the antiphlogistic treatment as displayed in the melancholy instance of the late Count Cavour. Had the stimulating plan, instead of bloodletting, been adopted in his case, it is more than probable that Medicine would have achieved a triumph, and that Liberty would still rejoice in the possession of one of her ablest champions.

Weymouth, 1864.

