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## L E C T U R E S

ON

## AMPUTATION,

AND ON THE

*Nature, Progress, and Terminations of the Injuries for which it is required.*

(Delivered at Sydenham Coll. Med. School.)

By RUTHERFORD ALCOCK, K.C.T., &c.

### LECTURE XV.

*Observations on the bilio-remittent type of fever supervening on capital operations: its nature, causes, and relation to Phlebitis, Secondary affections of viscera, purulent depôts, &c.*

I ENDEAVOURED to prove to you in the last lecture, that a febrile action, of irritative type or character, often resulted from the severe shock to the system, occasioned by the crushing of a limb and its subsequent amputation; and while, on the one hand, it occasionally proved fatal, by destroying or vitiating the functions of the chief organs necessary to life, commencing with the nervous centres, it would in others produce lesions of structure, inflammations and suppurations of viscera of the thorax and abdomen; or purulent depôts, without apparent inflammation in distant parts, &c.

A step further, and I endeavoured to show that this irritative form of supervening fever could not be considered the *effect* of any local action of the stump, or structural alteration of any of the various organs, since we found it frequently in existence with healthy stumps, and destroying life without any perceptible organic change. Neither could it be considered, for a similar reason, an effect of phlebitis; for although sometimes found coexistent, they were also frequently observed independent of each other.

Many of these observations will be found applicable to the type of fever, to which I have now to direct your attention; viz., the *bilio remittent*, which has many synonyms, although this seems the best to agree, with its most prominent and most constantly prevailing characters. *Bilious-remittent yellow*

*fever*, defines more than is invariably present: so of the Portuguese name "*vomito prieto*," or black vomit, and the *fevrè gastro adynamic* of the French.

On the nature and proximate causes of this fever, whether arising spontaneously, or after the shock of an injury or operation, there is much to be said, and many considerations of interest and importance press upon our attention.

Writers on this subject are much divided in opinion, but you will find many of great repute in medicine assign to this fever a cause not militating against the conclusion to which the facts and arguments I have to lay before you will naturally lead.

Dr. Arnold, who has recently published a work on bilio-remittent fever, in giving the opinions of various authors, says, "Writers of great authority in medicine assign to endemic fevers (of which the bilio-remittent is held to be one), a cause by which the vital power is directly injured." The opinion of the celebrated Stholl is hardly different, when he says that "the proximate cause of those fevers belongs to the nervous system, affected in a manner which we hitherto cannot explain."

While many authors are inclined to attribute this type of fever exclusively to certain states of the atmosphere and to marsh miasmata, you will find upon investigation that nearly all, directly or indirectly, allow that the cause of this fever, whatever it may be, is in its nature "*sedative and debilitating*."

Cullen was disposed to regard marsh miasmata as essential to the development of this fever. Henderson, in like manner, but still more sweepingly, says, "that the cause of the remittent fever in all its varieties is marsh effluvia; nor can any other cause produce it." In thus reducing it to the mere limits of a marsh fever, there can be no doubt a great error is committed. Many other causes, as I shall proceed to show, are certainly equal to its production.

Fordyce was fully borne out in his opinion, when he said that few of the causes to which this fever has been exclusively ascribed, will bear the test of strict inquiry: yet, wherever a series of effects are perfectly similar, and observed in a great number of cases, you may receive it as a general principle, that

some *one cause*, among others, must exist common to all such cases, however varied the conditions or circumstances of each individual case may appear.

Whether the bilio-remittent fever arise spontaneously, or subsequent to a severe injury or a capital operation, that one cause must still be present; and I think it will not be difficult to prove to you, that under each of these circumstances this fever is identical in its nature, cause, and form.

We have seen that while by many it is attributed exclusively to marsh miasmata, yet nearly all allow that it acts through its influence upon the nervous system, and that this influence is sedative and debilitating. Pringle observes, in like manner, that among the more prominent predisposing causes are the depressing passions. Those who consider it endemic, entirely depending on emanations from marshes, announce the fact (as highly confirmatory of their views), that it seldom occurs even in the warmest countries on elevated places considerably above the level of the sea: yet I have nowhere seen its ravages greater than in the Hospital of San Telmo, under my charge, in 1837; a fine and airy building, built on the castle rock of San Sebastian, at least one hundred feet above the level of the sea; and where this fever appeared, almost exclusively, in a series of capital operations carrying off by far the greater proportion: had the chief cause been marsh miasma, it must have fallen upon the wounded generally, and not exclusively on one class; it is evident, therefore, we must look for another cause existing in all cases, and not applicable only to some.

In reference to the symptoms, few of those held to be distinctive are invariable, it is a fever of typhoid character, and marked by the same total prostration of nervous energy and vital power, as also by the offensive and depraved secretions. The deep yellow tinge of skin and the vomiting are neither of them invariable. Dr. Arnold states, in describing the remittent fever of the West Indies, that it is very rare to see the black vomit in the fevers of the spring, and the yellow tinge of skin is also seldom seen at that season of the year.

Let us turn from the symptoms to the evidence resulting from dissection, explanatory of the cause and nature of this fever. In dissecting many subjects, Dr. Arnold says, "I have frequently been led to the perplexing conclusion, that neither the brain, lungs, heart, liver, stomach, nor intestines, exhibited any marks of morbid action which could have deprived the patient so suddenly of life." Physical causes of death have not been apparent in any altered structure of important organs, but in many instances the blood appears to have been completely decomposed. Any decomposition or alteration in the component parts of the blood—any loss of vitality in that fluid, and consequent ap-

proach to putrescency, would not only give rise to a total want or prostration of nervous energy, remarkable in this and all typhoid or putrid fevers, but shortly destroy all vital power in the system, and, consequently, life, without necessarily producing any alteration or lesion of structure.

How could such an effect be produced on the blood? I need not point out to you how important and how direct is the influence of the nervous centres upon the living blood, and how immediately any vitiation or alteration in the quality of the fluid reacts upon the brain and the whole nervous system. What is the effect of a shock, mental or physical, on the nervous system? It depresses, impairs, or annihilates its powers—its effect is sedative, even though it should at first excite; and, doubtless, more or less of a poisonous or deleterious character. Whatever may be the symptoms and results of either physical or moral shocks upon the nervous system, this character may be traced in all. That the blood, under these circumstances, undergoes material changes, is not only to be inferred, but may be proved in some extreme cases; although many changes, doubtless, take place not appreciable to us, yet fully capable of exercising important influence on the functions of the nervous system and secretory organs.

As by the introduction of an animal poison into the circulation, the nervous centres may be deprived of their powers, and life be extinguished; so may a poison, acting first upon the nervous system, deteriorate or destroy the vital character of the circulating fluid, and thus induce loss of function and death. It has been ascertained beyond a doubt, that the miasma of marshes has a sedative effect upon all constitutions—all violent shocks to the nervous system are sedative, and thus we arrive at that common cause which links the bilio-remittent fever supervening on severe injuries, or after capital operations, with those attacking persons subjected to the influence of the poisonous exhalations of marshes and stagnant waters. The same cause, by very different means, is brought into action, and, as was to be expected, is followed by a similar series of effects: it has been the difference of the means that has led to a belief in a difference of cause and nature, and prevented medical men from acknowledging, or indeed perceiving, that such uniform parity of effects could only be the result of a cause common to both classes of cases.

A strong sedative effect upon the healthy nervous system, whether induced by poisonous exhalations, an emotion of the mind, or the shock of an operation, may either simply *arrest* or *impair* that nervous influence, which is as necessary to the health and vitality of the blood as to any part of the human system; but although it must always impair, it may, in addition, alter

and deprave the nervous functions, even to the obvious and marked decomposition of the component parts of the blood: hence we have the explanation of the various effects at which I have glanced, all depending on the sedative action upon the nervous system as a first cause.

These facts are the more important, that it has been argued by Mr. Arnott, in a paper published in the "Medico-Chirurgical Transactions," that the whole series of effects, bilio-remittent fever, secondary abscesses, affections of the viscera, of the joints, &c., whether occurring after injuries of the extremities, amputations, after injuries of the head, or subsequent to parturition, all arise from one cause, and that phlebitis. As I am not aware that any one has attempted to refute this doctrine, and the able manner in which the author has handled the materials of his paper, has given an appearance of logical deduction to his opinions, which, without careful analysis, would seem to prove all he attempts, I shall draw your attention to a few facts which, in my opinion, incontestably controvert Mr. Arnott's views.

After enumerating several cases of phlebitis, inducing fever of a bilio-remittent type, either killing the patient without organic disease, or producing some one or more of the peculiar effects termed "metastatic abscesses," affections, inflammatory and suppurative, of the viscera, joints, or cellular substance, the author details cases where secondary abscesses, inflammations, &c., occurred after injuries of the extremities and amputation;—after injuries of the head and parturition, where phlebitis was observed; and from these data argues, that whenever such effects are found, phlebitis is the cause.

But what is the conclusion, if these affections are found to exist without any trace of inflamed veins? What, if they occur in *one*, becomes of the doctrine that they are only the *effects* of *phlebitis*? If they can occur in *one*, they may take place in five hundred, without any affection of the veins—a single exception here, so far from proving the rule, is fatal to its existence.

Phlebitis, under such circumstances, neither can be set down as the constant cause, nor these changes and lesions as the invariable effects. Phlebitis may exist with pus in the veins, and yet be unaccompanied by the bilio-remittent form of fever, or by any other of the effects detailed, as so many results of phlebitis; while, on the other hand, all these effects may be present, and no perceptible degree of phlebitis. Here is a short abstract of a case, going far to prove the first of these positions, the only symptom of a bilio-remittent fever being a disposition to vomit, which the patient described as habitual to him when lying on his back.

CASE XII.—*Fatal case of phlebitis, with pus in femoral vein, and some degree of arteritis, destroying patient on the sixth day after operation, without leaving any trace of organic disease; type of fever irritative.*

Andrew Murray, ætat. 32; shot on picquet, July 16, 1836, through the tibia; amputated above the knee by circular incision within nine hours; bilious temperament; of muscular form and full habit, previously enjoying good health; treated under favourable circumstances.

Countenance flushed; pulse soft, and accelerated, having lost a considerable quantity of blood before his admission; flesh-wound of thigh also; wound over tibia freely enlarged to remove spicula.

Operation next morning borne well, with little loss of blood; but after the removal of the limb was *seized with vomiting*; before evening, however, he slept, was free from pain, and the pulse moderate.

First day after. Sensation of sickness, though no vomiting; bowels moved; pulse 100; tongue rather dry; no pain in the stump; great thirst.

Second. Sickness continued, with vomiting of greenish fluid during the night, but says he has always been sick when lying on his back, even in health; quite free from pain; tongue dry; pulse 100, regular.

Third. Stump dressed; looked tolerably; upper part inclined to heal; lower discharging imperfectly-formed pus; sickness continues.

Fourth. Sickness disappeared; bowels opened; tongue moist; pulse rather quick.

Fifth. Stump entirely opened out; tongue dryish; countenance tranquil; surface tolerably healthy; bone well buried; pulse small, 120; slight inflammatory appearance under the skin, extending to the groin; tolerable night's rest.

Sixth. Unhealthy sloughing action in the stump; great sensorial disturbance; violence and delirium; tongue moist, and pale; great restlessness; pulse small and frequent; died.

*Post-mortem.*—Retraction of muscles from bone; two dark sloughy spots near the mouth of the femoral artery; vena saphena major whiter and thicker than natural, containing pus to its junction with the femoral vein; which latter contained pus also, about three inches up; the artery, a red vermilion colour; abscess in the course of both artery and vein up to Poupart's ligament; liver pale; head not examined.

In another case, the abstract of which is before me, there is phlebitis clearly defined, though not to the same extent; no secondary affections, or peculiar type of fever, mark the case; while in a third there is pus as far as the vena cava: no organic disease after death, or bilio-remittent fever during life.

**CASE XIII.**—*Fatal case of phlebitis unattended by secondary affections of viscera, or any peculiar type of fever; purulent depôt formed in knee.*

Thomas Flinn, ætat. 32, hand comminuted by grapeshot, June 19, 1836; amputation by flap at forearm three hours after receipt of injury; died 7th day. Seemed faint and exhausted just before the operation, but bore it well; walked away in strength and spirits; hand reduced to a mangled jelly; next day but little pain, and had slept. *2nd day after operation.* Pain of stump had deprived him of sleep; dressing allowed to get dry and hard; stump looking well. *3rd.* Bowels well opened by castor-oil; swelling and tension up as far as the shoulder, painful on pressure; no discharge; tongue dry and furred; pulse quick and small. Leeches, bleeding. *4th.* Swelling increased; sutures cut out, and all sources of irritation carefully removed; light poultice applied. These measures seemed to relieve the previous active inflammation; pain and anxiety. Tongue dry and brown; stump presents a sloughing and unhealthy aspect; traces of some little hæmorrhage. *5th.* A little better; slept pretty well; discharge from stump; some thirst; pain and difficulty in making water. *6th.* Breathing difficult and laborious; severe spasmodic pains of abdomen, which is much distended; enema operated three times; countenance indicating great exhaustion; clammy perspiration; died.

*Post-mortem.*—Strong and muscular frame; abdomen distended; amputated limb much enlarged to shoulder; integuments discoloured and approaching putrefaction; cellular tissue loaded with serum to shoulder and over pectoral muscles; lower down about elbow infiltrated with pus; coats of artery and vein thickened; *clot in basilic vein as far as axilla; pus in the course of the vessels;* no particular morbid appearances elsewhere, but in thigh; an opening being made into knee-joint (left), a gush of pus immediately followed. No further disease existed.

**CASE XIV.**—*Fatal case of phlebitis after amputation of arm; no organic disease; febrile action, not bilio-remittent.*

— Keogh, gunshot wound of forearm, July 25, 1833, Oporto. 13th day. Secondary hæmorrhage from wound. 16th day. Amputated by circular incision. Died 17th day after operation. Arm during the first few days swollen and painful. 6th day. Wounds suppurating pretty well; the swelling completely subsided. 13th day after injury. Hæmorrhage during the night to a considerable extent; incision made, but bleeding point not discovered; hæmorrhage ceased. Evening of next day. Bleeding again; humeral artery above secured. 15th. Restless during the night; arm painful; thin discharge, mixed with blood from wounds. Evening. Hæmorrhage again; ceased when wound opened;

arm removed by circular incision; in a state of syncope during part of the operation; next day easy; some adhesion of edges took place, but not of parts beneath. 12th day. A disturbed night; flushes of heat; pulse small and quick; tongue brown and dry; skin hot; stump looking well; edges approaching and filled with granulations; slight healthy discharge; bowels open. 13th and 14th. Intermission. 15th. Febrile symptoms returned. 16th. Passed a restless night, with frequent fits of delirium; skin cool; tongue brown; pulse quick and sharp; sleepy, but answers rationally. Evening. Pulse more full and quick; tongue brown and dry; subsultus tendinum. Died early on the 17th.

*Post-mortem.*—*Veins* from axilla to vena cava filled with pus; one ounce of healthy-looking matter in shoulder-joint; articulating cartilages perfectly smooth; sawn extremity of bone for three-quarters of an inch denuded of periosteum; lungs and pleura healthy; pericardium contained abnormal quantity of fluid; right ventricle and auricle and superior vena cava and pulmonary artery filled with coagulable lymph.

These cases, taken with the series to which I called your attention in the last lecture, demonstrate the following facts in reference to phlebitis; the irritative form of fever, and those febrile actions of mixed and doubtful type difficult of classification.

First. In five cases, viz., Keogh, Flinn, Murray, Simpkins, and Burrard, consisting of four primary and one secondary amputations, there was phlebitis in some, in its very worst form, pus floating in the large veins, and in no one of these cases were there any of the distinctive characters of a bilio-remittent type of fever. In four of these there was no trace of organic disease. In Case X. there was not only phlebitis, but all the secondary or metastatic affections: the fever was irritative and not bilio-remittent.

Second. In Case IX., as in two other cases present to my memory which I will not detain you by relating, the febrile action was irritative or hectic in form; and in all these, diseases of viscera (as also metastatic abscess in a joint in one), which are described as the effects of phlebitis, were present—but no phlebitis. In one of these cases this train of symptoms was accompanied with slight tetanus, referring it more distinctly to the commotion and shock to the nervous system, inasmuch at least as it proves that a deleterious influence upon it was at the same time in action.

Having, then, proved that phlebitis does not, in its worst forms, necessarily develop the peculiar type of fever described as distinctive; that it does not necessarily induce the metastatic abscesses and secondary affections of viscera, joints, &c. (which has not been equally broadly asserted): having shown, moreover, that these peculiar effects are developed where no trace of phlebitis can be discovered, when the type of fever

held to be distinctive is not present, I now proceed to complete the evidence, and to show that the peculiar type of fever does exist very frequently, *without any trace of phlebitis*; and even when both this form of fever and phlebitis exist together, it not seldom happens that there are none of the secondary affections; while, at other times, the secondary affections of viscera and this form of fever are present, but not the very affection upon which they are said to depend—phlebitis. I cannot conceive any series of facts more plainly conclusive, or more entirely destructive to any theory or doctrine, than those here produced, striking at the very root of that doctrine which would ascribe the bilio-remittent fever, the secondary affections of the viscera, the metastatic abscesses, purulent depôts in joints, the cellular tissue, &c., to an inflammation of the veins—an affection independent of them, as they are unequivocally of it—though any two, or the whole, may be coexistent.

The bilio-remittent form of fever, then, is not the distinctive fever of an inflammation of the veins, although it may occasionally give rise to analogous symptoms, either by its depriving the blood of some healthy property, and thus affecting the nervous centres—of course the more readily after any shock to the mind or body, or by the formation of a peculiar morbid matter thus introduced into the circulation. Nevertheless, I am inclined to believe that the mere formation of pus is not the means by which the vitiation of the blood and the impression on the nervous system is effected, and the cases I have just related tend to bear out such a conclusion. Whenever a bilio-remittent fever accompanies a case of phlebitis, where no shock, moral or physical, has preceded, I have no doubt that the peculiar train of symptoms commence with a vitiation of the blood, communicating to it certain morbid and unhealthy qualities, and depriving the nervous system of those powers on which the blood's vitality depends. Where a sedative influence has already fallen upon the nervous system, the supervention of phlebitis can only be looked upon as a complication, tending to the same end, but by no means necessarily arising from a similar cause, although it is perfectly consistent with reason and analogy to admit the possibility of an altered quality of blood depending upon depressed or vitiated nervous influence, predisposing and inducing an inflammatory action in the coats of the veins in contact with a fluid of altered properties.

Thus, it appears, may be explained how the whole series of symptoms, purulent depôts, affections of the viscera, bilio-remittent fever, and phlebitis, may often be found co-existent after injuries and operations, although not necessarily depending upon each other, or inseparably connected, since all are prone to appear from the same cause

—viz., a sedative and deteriorating influence upon the nervous system, which may be induced by shock, mental or physical, by poisonous exhalations and effluvia, by the introduction of morbid matter or a poison into the circulation by means of a wound. Finally, in reference to phlebitis, a disease of the internal coat of the veins may deteriorate the blood, and thus induce a depressed or vitiated action of the nervous system, and a typhoid or bilio-remittent fever; and there is much reason to believe that when the deleterious influence is derived from the nervous centres in the first instance, the blood equally becoming vitiated, may excite a diseased or inflammatory action of the venous coat, further tending, by its action on the blood, to induce the bilio-remittent form of fever. In this manner it is not difficult to understand how an intelligent observer might be misled, and assume that not only this peculiar type of fever, in cases of amputation, &c., was always the result (which *occasionally*, as I have shown, it may be) of phlebitis, but distinctive of this affection—a double error, which it is of great practical importance to avoid.

In severe injuries, and in capital operations, as in amputation of one or more of the extremities, there must always be more or less of *shock* to the nervous centres, falling often more especially upon the nervous system of organic life. The usual effect of such shock being to arrest, temporarily or permanently, the nervous influence upon which all vital functions must in some degree depend, and to impair or to vitiate the action of the nervous centres, the influence of such shock is always sedative in its character.

If permanently arrested, death at once ensues; if only temporarily, life is not destroyed, and time is given for the development of all the consequences of a sedative effect upon the nervous system.

Various as are the degrees and possibly the kinds of shock which may be communicated to the brain and other nervous centres, and not less various as are the temperaments and powers of resistance in different individuals, so must the effects be infinitely modified in degrees and combinations, yet may they all be grouped under certain heads, and distinctly traced back to the same general source or cause. You will find death under such circumstances may take place,—

1. By the sudden and total abolition of all nervous power, and arrest of vital functions from the violence of the sedative action, without organic change.

2. By a powerful morbid action, chiefly developed in the true spinal system, giving rise to tetanus, which exhausts all nervous energy, without leading to any organic disease, or lesions of structure.

3. By the development of febrile action, without any organic disease, which may assume every variety of type, when it assumes that of bilio-remittent the circulating fluid

itself being materially altered in its properties, probably by the vitiated or impaired nervous influence.

In this first class, death in no degree depends upon any structural change open to our present means of investigation. Under the following are arranged those which lead to alterations of structure, sufficient to destroy, in important organs, the efficient performance of vital functions. Death then takes place—

1. By febrile action combined with affections of the viscera, frequently suppurative, with little apparent inflammation; occasionally simply inflammatory, leading to adhesions or followed by effusions; by affections of joints, or large depôts of pus in different parts of the body, and in almost any tissue, but more particularly the parenchymatous, the cellular, and the capsular; by phlebitis and the formation of pus in the veins, more rarely with arteritis.

2. By febrile affection and a disorganising action of the whole of the injured limb, exhausting the powers of life by the irremediable nature of the mischief.

Under the first head I have enumerated all the effects conjoined—they may be met with in every degree of combination—the fever being accompanied by any one, two, or by all of the more tangible results.

The liability to these fatal results in injuries, independent of the peculiar influence of temperament, will be to a certain extent, in proportion to the violence of the shock, moral or physical; and if there be more than one, in proportion to their rapidity of succession.

I will merely, in conclusion, very briefly advert to a series of facts in connection with the bilio-remittent type of fever, hitherto erroneously attributed to phlebitis as a cause, which confirm these views, and supply the remaining links required to connect under one general class the bilio-remittent, irritative, hectic, and other less defined forms of fever, with or without any of the complications already enumerated, which supervene on serious injuries or operations.

I have before me a series of ten cases where the bilio-remittent type of fever predominated. I have not selected a larger number, first, because I think these more than sufficient to establish the accuracy of my views—important as I must consider them; but more especially, because I have been anxious to exclude all where the notes left any doubt on my mind, however slight, as to the existence or non-existence of phlebitis in the case.

In three (primary amputations) with this type of fever, there was disease of the viscera, effusion, adhesion, or suppurative disease, and in one a purulent depôt in a distant articulation. The stumps being firmly and healthily united, and cicatrisation on the point of being completed: the flaps were divided by the knife, and found fleshily and

healthily united. This, I presume, will be held sufficient evidence of freedom from phlebitis.

In two (primary), well-marked cases of bilio-remittent type of fever, suppurative disease, and all the train of effects ascribed to phlebitis, were found; but in the notes it is distinctly stated in reference to one, “*no inflammation of veins discoverable;*” in the other, “*veins not diseased.*”

Here are five cases of the most conclusive character, with all the effects and train of symptoms, perfect cases for the illustration of the doctrine of phlebitis being the cause, presenting a total and well-ascertained absence of the ascribed cause, viz., inflammation of the veins.

The five next are well-marked cases of phlebitis, two of them presenting the type of fever, and all the consequences described as flowing from the former.

Three with fever of no very distinctive character, and without organic lesion in the two fatal cases, one having recovered.

External and collateral circumstances, I believe, are not without influence in determining the type of fever which supervenes upon cases of injury or operation. The vicinity of a marsh, or, possibly, even the sea—a crowded hospital—a depressed morale, seem strongly to predispose to the bilio-remittent form. The state of health at the time, no doubt, has also its influence.

This bilio-remittent fever, however, and the secondary affections of viscera, joints, &c., though more prevalent in certain localities, and under certain conditions and circumstances, may and do occur in very various circumstances and conditions, dynamic and physical. I will not dwell longer on the subject, enough, I think, has been said to prove the error of attributing this type, and the whole train of symptoms and effects already enumerated, to the supervention of phlebitis.

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#### ILLUSTRATIONS OF THE PATHOLOGY AND TREATMENT OF AMAUROSIS.

By EDWARD HOCKEN, M.D.

(Continued from page 474.)

#### PART VII.

##### *Amaurosis from Cerebral Affections.*

I SHALL not, in the present paper, discuss all that belongs to this head, but narrate two cases; one commencing after fever, the other a well-marked example of organic disease. Various imperfections or losses of vision, conditions of the pupils, of the lids, and eyeballs, occur as prominent and highly-important symptoms in the progress of many, and even diametrically opposite conditions of the brain or its membranes: in cerebral conges-