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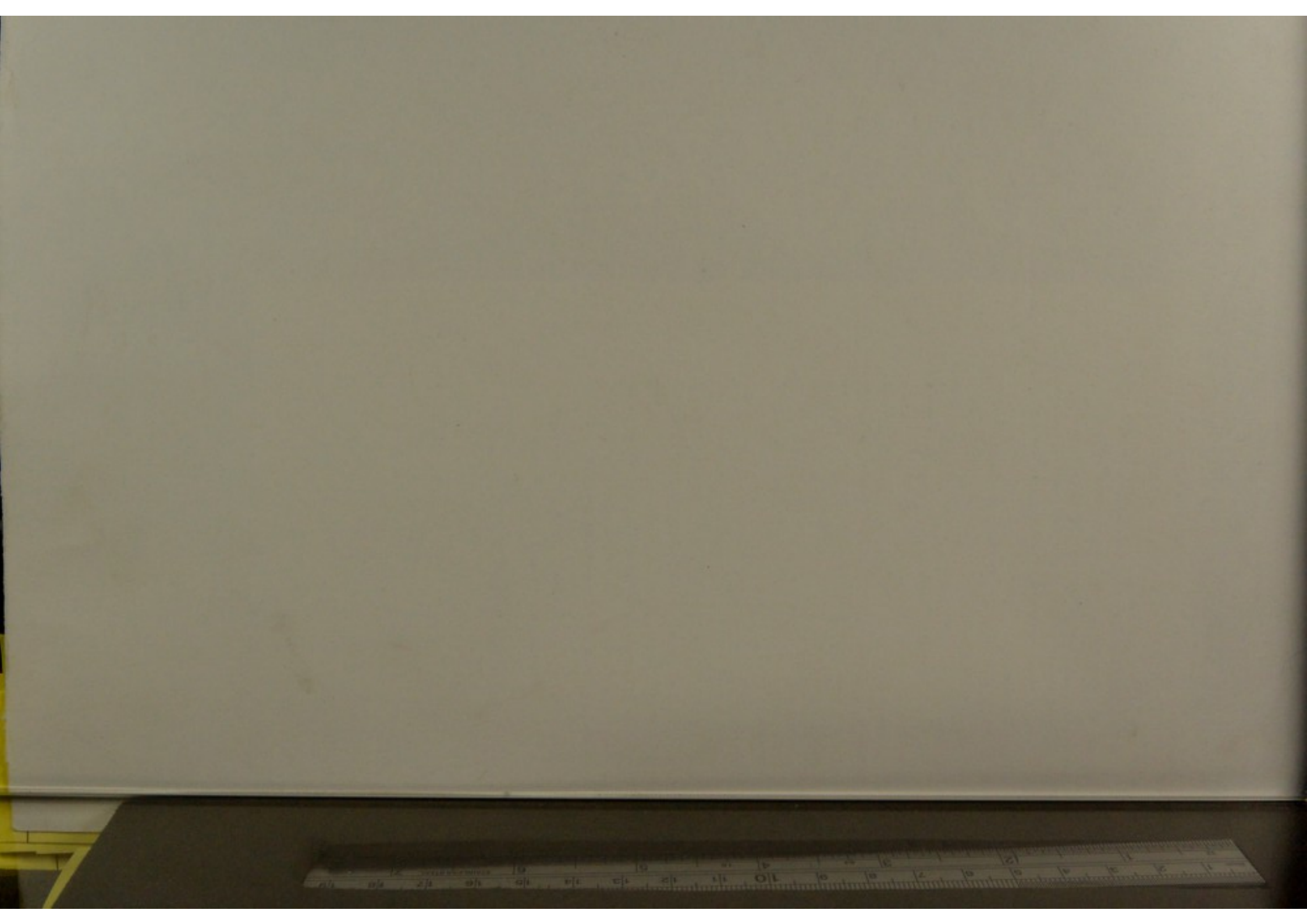

THE CEPHALIC MURMUR.

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THE clinical phenomenon which will form the subject of the present paper has hitherto attracted but little attention in Britain ; in fact it has only been twice discussed in our journals, while the text-books, without exception, pass it by without the least notice. In America and on the continent, however, the cephalic murmur has been accorded the attention which its interest seems to merit, and it is but right to bring forward in this country the work which has been done on the subject abroad.

Fisher was the first to observe the cephalic murmur, and he announced its presence in cases of chronic hydrocephalus, cerebral congestion, encephalitis, meningitis, and other brain diseases. The observations of this American physician were followed by those of Smith, in this country, but the latter did not add anything of importance to the facts described by Fisher.

Ten years after the earlier writings of Fisher were published, his countryman, Whitney, stated that he had met with the cephalic murmur in mechanical compression of the brain, scirrhus of the cerebellum, anæmia of the brain, and chlorosis.

The subject was then taken up in France, and Barth and Roger, Fournel, Vernois, and Piorry made a series of observations to test the accuracy of the American investigations, but the results obtained were entirely negative. Rilliet and Barthez, however, found the cephalic murmur

in rickety children, and stated that it was a diagnostic sign between rachitic hypertrophy of the brain and chronic hydrocephalus. Hennig, about the same time, announced that it was to be found in healthy children, below four years of age, and went so far as to state that it disappeared during illness to return on restoration to health. The seat of the murmur he believed to be in the longitudinal sinus. Wirthgen also believed the murmur to be physiological, and asserted that he had usually found it in strong and robust children.

Roger, in one of the most complete monographs on the subject, entered into a full description of the phenomenon. He stated that it was almost always intermittent, very rarely continuous, with or without reinforcements of sound, and to be found in young children in the region of the anterior fontanelle before its closure. Although occasionally observed in children apparently healthy, it was, he said, generally confined to those who, from various causes, were anæmic. Among these causes rickets was the most common. Roger never found the murmur in the cerebral affections given by Fisher and Whitney; and while these American physicians determined its presence in patients of all ages, he only detected it exceptionally after ossification of the fontanelles, and then only in cerebral apoplexy and in chloro-anæmic young women. The same opinion is supported by Barth and Roger in their systematic treatises. Henoch looked upon the murmur as being specially connected with rickets.

Jurasz believes that the cephalic murmur of children is due to a physiological stenosis of the carotid artery entering the base of the cranium. From a series of observations he concludes that up to the sixth month of infancy the carotid canal does not become wider, but that from that period it rapidly enlarges, so that by the

sixth year the adult calibre is attained. He holds that it is not caused by expansion of the bone, but brought about by an increased volume of the artery, and he therefore regards the murmur, to quote the words of Osler, as "the expression of a struggle between the artery and its bony investment, which persists until, by the pressure of the pulsations, the canal has been widened to a suitable degree."

Epstein denies the existence of the facts stated by Jurasz, and attributes the murmur to the following conditions which exist in childhood, viz., rapid blood-flow, wide capillaries, and thin arterial walls. These conditions, especially when complicated by the presence of anæmia, he thinks amply sufficient to produce the murmur.

Woillez, in his treatise, holds that the murmur belongs to childhood, and that it is of no diagnostic value.

Osler regards the murmur as having no special pathological significance, but he has found it chiefly amongst rickety children. He records the case of a child in whom the murmur has persisted for six years, and another in whom he has watched it for two years; and although he says he is not prepared to criticise the ingenious view of Jurasz, he yet thinks that such cases are fatal to the theory, as it seems scarcely credible that a physiological stenosis could persist so long as six years. Osler has found eight cases of the murmur in about sixty children.

In two exhaustive papers, Tripier lately contributed some valuable observations on the cephalic murmur in the adult. He narrated several cases, as follows;—1, case of anæmia from repeated menorrhagias; 2, case of chlorosis; 3, case of chlorosis (in which three cases cure resulted, with disappearance of the murmur); 4, case of alcoholic ulcerative endocarditis; 5, case of pernicious anæmia (in which two cases death ensued); and 6, case of a persistent murmur, apparently due to an old intracranial lesion.

He expresses his belief that Roger found the murmur only in children on account of observing children almost exclusively. He describes the murmur as always systolic; never, so far as his observations go, continuous; audible over the whole cranium, but most distinct over the temporal region; not changed by altered position; stopped by pressure over the carotid arteries; changed by the general condition of the patient, and never existing in the healthy adult. Such are the clinical facts as given in his earlier paper, and the only modification which these undergo in his later contribution is that he had meantime discovered that on auscultation of the orbit, the murmur was more distinct there than anywhere else.

Tripier believes that the murmur is due to the internal carotid artery, and that its cause is relative stenosis. He says that no such relative stenosis can occur in the hexagon of Willis, but that the internal carotid may in three situations undergo narrowing. These are—1, on entering the carotid canal; 2, on passing into the cavernous sinus; 3, on penetrating into the cranial cavity. In one or other of these situations, he thinks the stenosis must be caused.

Believing the explanations of Hennig, Jurasz, Epstein, and Tripier to be unsatisfactory, I lately proposed another hypothesis to account for the phenomenon; but before entering upon a discussion of the causation of the murmur, it will be well to narrate a few cases, so as to present the clinical features observed in such patients. I do not propose to give all the cases which have come under my notice, but to give five cases as types, so to speak, of the different conditions in which I have found the cephalic murmur.

I.—William D., aged 5, was brought to the New Town Dispensary by his mother, who stated that he was weak

and had lost his appetite. He was a pale-faced child, of what is called strumous aspect, with blanched gums and conjunctivæ. On auscultation of the veins at the root of the neck, a distinct venous hum, with systolic augmentations of sound, was heard. Over the superior vena cava there was also a very loud continuous murmur, whose sound was likewise reinforced during systole. No murmur could be detected in any of the cardiac areas, but in the pulmonary area the second sound was reduplicated.

On auscultating the orbit, a blowing murmur of systolic rhythm was present, while over the cranium, chiefly in the occipital region, there was also a systolic murmur very much fainter than in the orbital region.

II.—Elizabeth F., aged 16, complained of breathlessness and palpitation. Had suffered from amenorrhœa for some months. Extremely pale; gums, lips, and conjunctivæ quite bloodless. On auscultation there was a loud *bruit de diable* over the jugular veins, with augmentation of sound during systole, a distinct hæmic or auricular murmur, and fainter murmurs in the mitral and tricuspid areas. There was a loud blowing systolic murmur over the orbit, a less distinct systolic murmur over the occiput, and over the rest of the cranium a very faint systolic murmur.

This patient improved under treatment, and the cephalic murmur disappeared, but on discontinuing the remedies her condition became worse, and the murmur again appeared. After further treatment, however, she was cured.

III.—Margaret A., aged 36, married, suffered from palpitation, with swelling of the feet and legs towards evening, and had profuse menorrhagia and leucorrhœa. She was very anæmic, with bloodless skin and mucous membrane. There was a loud venous hum over the jugular veins, with

systolic augmentations: and this was easily converted into a musical note. In the mitral area there was a systolic murmur, and in the tricuspid area an independent systolic murmur. A systolic murmur was heard over the auricular area of Balfour. On applying the stethoscope to the closed eye, a blowing systolic murmur was made out, and the systolic murmur was also clearly heard in the occipital and mastoid regions—more distinctly in the former.

IV.—Patrick B., aged 46, complained of debility and breathlessness. Had suffered much from bleeding hæmorrhoids, and was very anæmic. Great epigastric pulsation. Over the veins of the neck there was a venous hum, whose sound was augmented during systole. In the second left intercostal space, outside of the pulmonary area, a blowing murmur occupied the place of the first sound; there were also systolic murmurs in the mitral and tricuspid areas. The patient was cured under treatment, and lost his murmurs, but relapsed, and they re-appeared. At the present date he is nearly cured. In the orbital region, there was a blowing systolic murmur, and over the rest of the cranium this was also heard, but less distinctly.

V.—John R., aged 60, suffering from an omental carcinoma. He presented an altogether ghastly aspect from the excessive pallor of his skin and mucous membrane. In the veins of the neck there was a venous hum, in the auricular area a blowing systolic murmur, and in the mitral, tricuspid, and aortic areas there were systolic murmurs as well, while the aortic second sound was imperfect. In the orbital region there was a blowing systolic murmur; over the cranium a fainter systolic murmur, more distinct over the lower and posterior portion, but not appreciably louder over the occiput than over the mastoid process. The result of his disease was death.

These five cases appear then to depend on very different causes—struma, chlorosis, menorrhagia, hæmorrhoids, and carcinoma; they agree, however, on one point, *i.e.*, all the patients were anæmic.

The orbital murmur, as I have elsewhere described it, is a low murmur of blowing character, somewhat later than the apex-beat, and slightly behind the carotid pulse. It is accompanied by the dull continuous rumble caused by the muscular contraction of the orbicularis palpebrarum in its closed state, by the irregularly intermittent noise produced by the sympathetic movement of the eyelid when the opposite lid winks, and by the respiratory murmur conducted through the cranial bones. The continuous muscular sound cannot be got rid of, but the irregular noise of winking can be stopped by placing a finger over the other eyelid; and when the breath is suspended, the conduction of its sound upwards necessarily ceases.

Over the rest of the cranium the systolic murmur is also of a blowing character, slightly following the carotid impulse. It is always more easily made out over the posterior part of the cranium, but extended observations do not bear out my earlier statement, that it is always more distinct over the occiput, than over the mastoid process. Sometimes it is so, but more commonly the murmur is of similar intensity in both positions. No alteration is perceptible on change of posture, but the intensity diminishes with pressure on the carotid arteries, and if these vessels are forcibly compressed the murmur entirely disappears.

The murmur sometimes, as in case I., exists without any coincident cardiac murmurs, but it is always associated with a venous hum in the cervical veins. All of the cases narrated above were anæmic, and I have never yet seen any instance of the murmur in any case save anæmia.

Turning to the mode of production of the murmur, I would like in this place to reproduce the arguments which I used when attempting to explain the causation of the murmur—"If the murmur originated in the terminal parts of the internal carotid system, it should be found to wane in intensity with distance from that system. It is not so, however, as above remarked, the occipital is usually more distinct than the mastoid murmur."

"The position of the greatest intensity of the murmur is of great importance. It is most clearly heard over the orbit, the mastoid eminence, and the occipital protuberance. This fact furnishes a key to the question. These three situations are closely related to the cavernous sinus, the lateral sinus, and the torcular herophili; and I am of opinion that the murmur is produced by fluid veins within these sinuses; in other words, the murmur is of venous origin. It will at once be said that the murmur ought to be continuous, like the *bruit de diable*, if it arises from vibrations of the fluid contents of these venous channels. But, as in the case narrated, the venous hum is frequently found to have systolic augmentations of intensity. These are caused by the pressure of the large arteries on the venous trunks during the distension of the arterial walls, consequent upon the cardiac systole. This pressure creates additional waves in the contents of the veins, and the acoustic expression of these waves is increased intensity of sound. The internal carotid artery is in very intimate relationship with the contents of the cavernous sinus, being practically surrounded by the venous blood. When the anæmic condition is present, therefore, with its predisposition to the generation of intra-venous ripples, the pulsations of the artery excite fluid veins in the blood contained within the sinus. In this, I think, we have a sufficient cause to account for the production of the orbital murmur; and similarly we may account for the

occipital and mastoid murmurs. The internal jugular vein, at its origin and in its upper part, is so closely connected with the internal carotid artery, that the shock of the arterial pulsation is always communicated to it. Hence, in the anæmic state, fluid waves are transmitted upwards to the blood within the cranial sinuses, and cause a murmur in situations where the vibrations come to a focus."

"It may pertinently be asked, why is the murmur louder over the occiput than in the mastoid region? And why is it more distinctly heard over the eyeball than in either of these positions? The answer is not difficult to find. The structures lying between the cavernous sinus and the closed eyelid are of somewhat similar density; or, to put the fact in different language, there is a continuity of soft tissues from the cavernous sinus, where the sound is generated, to the surface of the globe of the eye, where it is perceived. On the other hand, a murmur arising within the torcular herophili must cause vibrations in the osseous structure of the occiput in order to give acoustic manifestations. Physical laws tell us that sound is better transmitted through media of similar density than when it is propagated through media whose density differs considerably. This is the reason why the orbital or cavernous murmur is more distinct than the occipital. And in the same way the murmur arising at the bend of the lateral sinus has to pass through the temporal bone; but this is broken up by the mastoid cells containing air, so that there is a physical reason for the greater weakness of the vibrations in this position."

To all of this argument I still unreservedly adhere, but find it necessary to modify one of the facts stated above. The occipital is not always louder than the mastoid murmur. The cephalic murmur is always more distinct over the posterior part of the cranium than elsewhere—the

orbit of course excepted—but the relative intensity of the occipital and mastoid murmurs is only occasionally different.

Arguing from the limited experience afforded by a few cases, I previously concluded that the cephalic murmur in anæmia only appeared after the cardiac phenomena had been developed. This, however, is not correct, the cephalic murmur may and does appear immediately after the cervical venous hum becomes audible, as for instance in case I.

To conclude, so far as my own experience goes, the cephalic murmur is invariably associated with the anæmic state. Several of the authors referred to above report its presence in healthy children, but allow that it is more common in those suffering from rickets and similar affections. Tripier has never found it in any healthy adult, and on a careful review of the whole facts of the case, it seems to me that the cephalic murmur entirely depends upon the anæmic condition of the patient, and that like the venous hum, which may now and then be found in those apparently quite healthy, it is a sign of anæmia.

BIBLIOGRAPHY.

Fisher. Medical Magazine, 1833, and American Journal of the Medical Sciences. 1838.
Smith. Quoted by Jurasz.
Whitney. American Journal of the Medical Sciences. 1843.
Barth and Roger. Quoted by Roger.
Fournel. Quoted by Roger.
Vernois. Quoted by Roger.
Piorry. Quoted by Roger.
Rilliet and Barthez. Traité clinique des Maladies des Enfants. Vol. II.
Hennig. Anchiv für physiologische Heilkunde. 1856.
Wirthgen. Quoted by Jurasz.
Roger. Mémoires de l'Académie de Médecine. Vol. XXIV. 1860.
Henoch. Quoted by Jurasz.
Jurasz. Das systolische Hirngeräusch der Kinder. 1877.
Epstein. Beitrag zur Kenntniss des systolischen Schädelgeränsches der Kinder. 1878.
Osler. Boston Medical and Surgical Journal. 1880.
Tripier. Revue de Médecine, No. 2, 3, and 10. 1881.
Gibson. British Medical Journal. Vol. I. for 1882.
Barth and Roger. Art. Auscultation in Dictionnaire des Sciences Médicales and Traité de l'Auscultation. Edit. 1878.
Woillez. Traité théorique et clinique de percussion et d'auscultation. 1879.