congested. Frequently, a general tumefaction and ulceration involves the muscular tissue, and suppurating points dip down to the cartilages. By no unaided effort of the patients in the extreme paroxysm will the membrane be thrown off.

"In striking contrast, the croupous cast is semitransparent, delicate, and tender to handle, somewhat gelatinous, and of a pale yellowish colour, easily separable from the subjacent surface as an imperfect cast of the part on which it is formed. It is only after the death of the patient that it is seen to be opaque, and composed of more than one layer. It is generally thrown off during a violent fit of coughing, when the patient finds almost immediate relief from the more urgent symptoms. It is never found so intimately connected with the subjacent mucous membrane as to cause bleeding. It is simply a clean cast of the superficial epithelial layer, closely resembling the cast-off skin shed by some of the lower animals—the growing amphibia, for example.

"The histological differences are much more strongly marked. Diphtheritic membrane requires a good deal of teasing out to fit it for microscopic examination. A power of 350 diameters reveals an aggregation of granular matters, nucleated epithelium, fat-molecules, and minute crystals, held together by interspersed bands of connective tissue. Muco-purulent corpuscles often entangle foreign bodies; and in throat-affections, the spores of the oidium albicans are rapidly developed. The membrane is, in short, a laminated fibroid mass of the superficial and deeper seated structures, in a later stage involving the submucous tissues, muscles, glands, and cartilages. In sections made from various preparations, portions of all these structures have been well seen, and sometimes I have found considerable hypertrophy of the connective and fibrous tissues.

"A portion of a croupous cast, however, examined under the same power, consists of numerous cylindrical and pavement epithelial cells, granular matter, fat-corpuscles, and mucus, with some occasional foreign bodies, as particles of food entangled in a protoplasmic homogeneous matrix. The columnar epithelial cells retain their cilia, and are filled with clear sarcoid, and nucleated. It is, therefore, surmised that these casts are not long retained; probably they are thrown off soon after their formation. Fungus-spores are rarely found entangled in these films, which are characterised by an excessive cell-proliferation rather than a transudation or true exudation. Although some of the croup casts differ a good deal in colour and consistency, connective or fibrous tissue never enters into their composition."

These facts, which have been established by Mr. Hogg by repeated demonstrations under the microscope, and verified by Dr. Greenfield of St. Thomas's Hospital, account, in the most satisfactory manner, for the therapeutic value of emetics in croup, and their utter uselessness in diphtheria.

In a letter I have received from Mr. Jabez Hogg on this subject, dated September 15th, 1875, he adds to his previous observations: "My friend Dr. Greenfield's observations and microscopic examinations were founded upon five well-marked cases of diphtheria; and he appears to confirm me in almost every particular. He found that 'the inflammatory action extended to the larynx and trachea; and that the false membrane removed consisted of a stratified network of tissue, giving the reactions of fibrin, in the meshes of which were entangled altered layers of epithelium-cells and blood-corpuscles. The membrane throughout was partly catarrhal, with condensed epithelium and a true fibrinous exudation, with, in one case, the spores and fungus-mycelium intermixed. The inflammatory mischief extended and penetrated deeper about the pharynx than it did about the trachea, where there was, however, always a considerable amount of destruction of tissue. He was unable to say whether the fungus was an accidental or a potential agent in the inflammatory process.' There is, no doubt, something yet to be learnt in the history of the specific diphtheritic zymosis, which, unlike croup, is of a contagious poisonous nature: often an outgrowth of unsanitary conditions. With regard to croup, there is always one point in its etiology which appears to me not to have received much attention; and yet it is of some importance, as seeming to separate it very widely from diphtheria. I refer to its peculiar hereditariness. I have seen several well-marked instances of this; and I am now attending a family for an affection (strumous) of eye, in which croup has gone down to the third generation, affecting the males of the family in particular. No one ever heard of diphtheria having been transmitted from father to son, or from mother to daughter, that I am aware of."

I might have entered into this subject much more fully, but I cannot venture to trespass further on the space of the JOURNAL; and I think I have said enough to show that croup and diphtheria are distinct, not identical. Two recent cases of diphtheria in my practice confirm me in this belief, and fully corroborate Mr. Hogg's observations.

A COMMENTARY ON DR. PATRICK BLACK'S THEORY OF ASPHYXIA.

By GEORGE JOHNSON, M.D., F.R.S.,
Professor of Clinical Medicine and Physician to King's College Hospital.

DR. BLACK, in his reply to my criticism, says that I prefer Dr. Reid's theory of asphyxia to his own. The fact is, that I prefer Dr. Reid's conclusive experiments to Dr. Black's theory unsupported by a single fact.

Dr. Black questions the statement that "the *first* impediment to the circulation consequent on the exclusion of air from the lungs occurs, not in the pulmonary, but in the systemic vessels", because, as he truly says, the right cavities of the heart are found much distended after death. He apparently is not aware that the arrested pulmonary circulation which results in the great distension of the right side of the heart, with comparative emptiness of the left cavities, is a later phenomenon than the impeded but not arrested passage of blood through the terminal systemic vessels. This is clearly shown by Dr. Reid's experiments, which I again commend to Dr. Black's notice. He will find that his theory of asphyxia is quite inconsistent with Dr. Reid's unquestionable facts.

With reference to nitrous oxide gas, I would ask Dr. Black if, as he assumes, no impediment to the pulmonary circulation result from its inhalation, what explanation he gives of the great lividity of the skin and the epileptiform convulsions which suddenly occur when the inhalation is carried beyond a period of something less than a minute. Has Dr. Black examined immediately after death the heart of an animal killed by the inhalation of nitrous oxide gas? If so, will he tell us in what condition he has found its cavities? With the kind assistance of my friend and colleague Mr. Hamilton Cartwright, I have quite recently administered a fatal dose of nitrous oxide gas to two rabbits, taking care that the respiratory movements were unimpeded while the gas was inhaled. Death in both cases was preceded by epileptiform convulsions. In both animals, the chest being opened immediately after death, the right cavities of the heart were found much distended, while the left were flaccid, and contained much less blood. In short, the evidence of impeded circulation through the lungs was precisely the same as in cases of ordinary asphyxia. Dr. Black's assertion that venous blood will pass through the lungs as freely as arterial blood is as demonstrably inaccurate, as his astounding statement that the orifices of the pulmonary artery and aorta are of exactly the same diameter.

REPORT UPON THREE FATAL CASES OF CEREBRO-SPINAL FEVER.

By STAFF-SURGEON ROBERT NELSON, Royal Naval Hospital, Plymouth.

[Communicated by the Director-General of the Medical Department of the Navy.]

THE following cases may be of importance, as illustrating a disease which of late years has appeared in various countries in an epidemic form, and the etiology and treatment of which are still wrapped in much obscurity.

CASE I.—A private in the Royal Marines, aged 20, was placed on the sick list of his barracks on January 21st, complaining of epigastric pain, with incessant vomiting, tongue thickly coated with a brown fur; had been restless and out of sorts during the night; felt cold, but had no distinct rigor. Pulse, 78; temperature, 99.4 deg. An emetic was administered previously to his admission, and, after its operation, the epigastric pain and vomiting were relieved. On admission, on the third day of illness, he complained of severe headache, without any pyrexial symptoms; felt cold and "shivery", and shortly afterwards the headache became intense, the patient frequently placing his hand upon the crown of his head and shrieking with agony. At midnight, he became very restless, tossing about continually, occasionally getting out of bed, and inclined to roam about the ward in an excited and maniacal manner, resisting all examination as to the state of the tongue, pulse, temperature, etc. The skin was quite cool and the pulse not rapid. He was ordered half a drachm of hydrate of chloral, but with no appreciable effect.

Fourth day.—He was quiet this morning. He lay on his right side. He could be roused to answer questions, but showed great impatience at being disturbed. He continued to put his hand up constantly to rub or press the crown of the head, which was drawn backwards, the

muscles of the posterior cervical region being tense, and evidently very tender to the touch; and the nurse reported that there were frequent spasmodic twitchings of the limbs. Pulse, 64; skin cool; bowels constipated. He was ordered to have the head shaved, and an evaporating lotion applied; and to have an enema of soap and turpentine.

Fifth day.—The bowels had been freely moved by the enema. He had a quiet night, and slept for a few hours. This morning, he was semicomatose; pupils widely dilated; pulse, 78; skin cool; respirations, 48. He had passed no urine since yesterday afternoon. Catheterism was performed. A large blister was applied to the occiput and the nape of the neck.

Sixth day.—He was comatose; the pupils were widely dilated; breathing stertorous. He died at 3 P.M.

CASE II.—A boy belonging to one of the training ships in harbour, aged 16, was placed on the sick list of his ship on January 16th, suffering from general pyrexial symptoms, attended with great drowsiness. Pulse, 112; evening temperature, 103 deg. He slept badly during the night, tossed about, and occasionally wandered in his speech. On admission on the following morning (second day of illness), there was a dull heavy expression of countenance; pupils natural, tongue dry, baked, and browned in the centre. He had no headache; his bowels were constipated. He had a few herpetic spots round the lips, with sordes about the teeth and gums. He complained of pain in the left side of the chest, but had no cough or physical signs of inflammatory character. A gurgling sound was elicited on pressure over the left iliac region; but there was no eruption on the skin. Pulse, 120; temperature, 101 deg. He was ordered a full dose of the ordinary black draught.

Third day.—His bowels had been freely opened by the draught. Pulse, 108; temperature, 101 deg.; respirations, 40, with dilating nostrils, but no cough. He rambled in his talk, but could answer questions when spoken to in a loud tone, and his attention kept arrested. He had much headache, with stiffness and tenderness of the posterior cervical muscles, frequently putting his hand to his neck and complaining of much pain and tightness in the part. Neither pulse nor temperature was increased in the evening.

Fourth day.—He had intense vertical headache; he was noisy and delirious during the night, but did not attempt to get out of bed. He could still be roused up, so as to answer questions correctly. The pupils were dilated; tongue perfectly hard, dry, and brown.

Fifth day.—He was noisy and restless during the night, but did not appear so restless this morning. He lay on his right side, with his head drawn back, and had occasional spasmodic twitchings of the muscles of the extremities. Pulse, 116; temperature, 101 deg.

Sixth day.—The bowels were again constipated. He had less delirium during the night. The tongue was less dry, and inclined to become clean at the edges. His general aspect was somewhat improved. The black draught was repeated.

Seventh day.—He passed a fair night. The bowels were freely opened by the medicine. Other conditions were unchanged.

Eighth day.—He was again delirious and noisy; dull, heavy, and soporose. He had frequent twitchings in the muscles of the arms. The pupils were dilated, answering sluggishly to light; the tongue was again quite dry, hard, and chapped. Pulse, 120.

Ninth day.—He was quiet during the night, but did not sleep. His breathing was laborious, without stertor; he perspired copiously. The headache and cervical pain appeared relieved. He lay on his back moaning, occasionally calling out loudly, but answering a few questions correctly. He had passed no urine since yesterday afternoon. About a pint of urine was drawn off by the catheter.

Tenth day.—His tongue was perfectly dry, hard, and nearly black, as in an advanced stage of typhus. The pupils remained dilated and insensible to light. The bowels were again constipated. Pulse, 120; temperature, 101.2 deg. He had passed some urine in bed during the night. He was ordered to have an enema of castor-oil and turpentine, which was repeated in the afternoon.

Eleventh day.—He was moaning and totally insensible. His urine was very scanty; there was none in the bladder at the morning visit. The tongue was as yesterday; pupils widely dilated; breathing stertorous, with loud bronchial and tracheal rales. Pulse, 140; temperature, 104 deg. In the evening, he was deeply comatose, and died at 8.30 P.M.

CASE III.—A boy from the same ship as the previous case, aged 17, was placed on the sick list of his ship on the morning of January 23rd, suffering from much headache and pain in the cardiac region, which he stated came on the previous evening, when he had "cold and shivering", which kept him awake all night. A calomel and jalap powder was prescribed, which operated freely.

On admission (second day of illness), he was restless, tossing about

in bed, and complained of want of sleep. He had persistent vertical headache, with stiffness of the neck, which, he stated, came on yesterday. The bowels were freely opened yesterday, but were not moved to-day. He had much thirst, but other pyrexial symptoms were not severe. Pulse, 80; temperature, 100.4 deg. The pupils were somewhat dilated; there were considerable photophobia and diplopia, also nausea and occasional bilious vomiting. The patient was quite sensible and intelligent, but impatient when disturbed with questions. Six leeches were applied to the nape of the neck, and the purgative of calomel and jalap was repeated.—8 P.M. The muscles of the posterior cervical region were rigid. He lay with his head drawn back, and had great tenderness over the upper portion of the spine, and occasional twitching of the muscles of the extremities. Temperature, 101.6 deg.

Third day.—He had intense headache and vomiting of biliary matter. Pulse, 76; temperature, 100.2 deg. The tongue was coated, but moist; the bowels were freely opened by the powder.—8 P.M. Pulse, 80; temperature, 100.8 deg.; respirations, 40.

Fourth day.—The tongue was becoming dry. He slept badly, and was rambling during the night. His intellect was clear this morning. Pulse, 80, of good strength; temperature, 101.2 deg.; headache severe.—8 P.M. He lay on his back moaning, with great disinclination to be spoken to; he answered questions sensibly but peevishly; there was great sensitiveness of the muscles at the back of the neck, but no rigidity or tetanoid spasm. When left undisturbed, he rambled in his speech, and kept calling loudly for some one to come to him. There was less photophobia. The bowels were not opened to-day. He was ordered to have three grains of calomel and a quarter of a grain of tartarated antimony every three hours, and an ice-bag to be applied to the head.

Fifth day.—He was much in the same condition. He had passed no urine since the last report. Pulse, 80; temperature, 100.4 deg. The pupils continued dilated, but the photophobia was gone. One pint of urine was drawn off by the catheter; it was turbid, with copious phosphatic deposit; no albumen.—8 P.M. Pulse, 80; temperature, 101.2 deg.; tongue coated, moist. Bowels freely opened this evening.

Sixth day.—He had a bad night; no sleep; the pupils were widely dilated. He could not answer questions, but attempted to protrude his tongue when loudly called upon to do so. Pulse, 80; temperature, 101.4 deg.; respirations, 40. About half a pint of urine was drawn off, being the whole amount secreted in twenty-four hours. He refused to take any nourishment.—8 P.M. He was unable to swallow. Pulse, 100; temperature, 100.8 deg.; respirations, 35.

Seventh day.—He was totally insensible; his breathing was stertorous. Pulse, 120; temperature, 103 deg.; tongue continues moist. The pupils remained dilated and insensible to light. His urine was very scanty. He died at 11 A.M.

Morbid appearances.—As was to be expected from the symptoms, the morbid appearances exhibited by all the above cases were similar in character. The meningeal vessels of the brain and spinal cord were much engorged; the puncta vasculosa of the brain-substance were increased in size and number, and a large effusion of serum was found in the ventricles. In Case I, probably from its rapidly fatal termination, no lymph deposit was seen. In Case II, a thick layer of non-plastic lymph was found at the base of the brain, occupying the space circumscribed by the circle of Willis, and also glueing together the anterior and middle lobes so as nearly to obliterate the fissure of Sylvius. In addition, in Case III, several small and firm deposits of lymph were found upon the upper surface of the brain and beneath the arachnoid membrane. The other organs were not examined.

REMARKS.—No disease is more worthy of earnest inquiry, nor is at the present time of more importance, than that which has been variously termed cerebral typhus, cerebro-spinal meningitis, cold plague, purpuric fever, etc.; in official nomenclature designated cerebro-spinal fever, and to more recent pathologists known as "tetanoid fever". Its etiology is one of the most obscure medical problems of the day, and its treatment remains as much an *opprobrium medicinae* as yellow fever or cholera.

Without any dogmatic assertion either as to the true nature of the cases above detailed, or too strongly insisting that the occurrence of three such cases simultaneously constitutes an epidemic, I would direct attention to the facts that (1) they were in all probability cases of blood-poisoning; (2) that, on examination of the records of this hospital, no immediately consecutive cases of similar character are found to have occurred in a period of several previous years; (3) that, whilst the cases admitted into this hospital belong for the most part, in every sense of the word, to a "floating" population, these cases occurred amongst individuals stationed in Plymouth; viz., a marine from barracks and two boys from one of the training ships. Of their previous

history, it is ascertained that they were all in robust health; none were drunkards, epileptics, or had any nervous disorder. The two boys had not left their ships for three weeks previous to their seizure, and the marine was a steady well conducted young man, enjoying the usual privileges as to leave from barracks. In short, all three patients belonged to a class which is well fed and well cared for, neither cold, exhaustion, nor privation being elements of "cause"; and, although two were "sailor boys", they were, on board the training ship, far from suffering such hardships as midnight watches, wet clothes, bare feet, or scanty provisions; but, on the other hand, were at the time particularly well guarded against exposure to inclement weather, etc.

Symptoms.—Although the above cases differ somewhat in minor details, a fairly typical case of cerebro-spinal fever may be constructed from their symptoms, the more salient points in each being identical, and all relating to the generic characters of the disease. The principal symptoms common to all were:—

1. *Headache*, limited to the vertex, intense in character, ceasing before death, and at its height on the second or third day's illness.

2. *Derangement of the Digestive Functions*, which was probably the earliest symptom, and evinced by a coated tongue, foul breath, epigastric tenderness, constipated bowels, and bilious vomiting.

3. *Moderate Pyrexia*.—In Case I, during the most violent phrensy, the pulse did not rise above 70. From the nature of this case, the pulse and temperature could not be taken so regularly as in the others, where it will be seen that the febrile symptoms did not run high until a fatal termination appeared inevitable.

4. *Tetanic Contraction of the Muscles*, the decubitus in all these cases being remarkable, but most pointed in Case II. This boy, from admission, complained of stiffness of the neck; said that he "often had a stiff neck, but never anything like this". He lay for the most part on his right side, his head drawn back, the sterno-mastoid muscles being tense in front, the posterior cervical muscles rigid and very tender to the touch, so that he had the greatest horror of being in any way disturbed. In the other cases, this partial opisthotonos was less pronounced, but in all there were involuntary clonic spasms or twitchings of muscles, most marked in Cases II and III, where, on feeling the pulse, a kind of subsultus tendinum was repeatedly felt.*

5. *Dilated Pupils* were observed in all cases from the third or fourth day till death; there was no strabismus observed, but, in Case III, there was much photophobia, and on admission he at once volunteered the statement that he "saw everything double".

6. *The Sensorium* was in all affected early, rambling or delirium occurring in each case on the third night of the disease; but only in Case I was the delirium of a violent character.

7. *Retention of Urine*, and latterly suppression, occurred in all, the paralysis of the bladder commencing and continuing with the comatose condition of the patient.

No characteristic eruption was observed on the bodies. Herpes labialis was present in one case in a slight degree; and in another, after death, several purpuric-looking stains, about the size of "thumb-marks", were observable on the anterior and upper portion of both thighs; but, as these had not been observed during life, and the *post mortem* lividity was very great, no particular attention was paid to them as diagnostic marks. The cases were treated in the general wards of the hospital, and no suspicion has been aroused with regard to any emanating contagium.

Diagnosis.—Each case, in its early stage, promised to be a simple mild continued fever, and for such disease was admitted into hospital. On the second day, the general symptoms pointed to enteric fever or a low type of pneumoemia. In Case II, for instance, the "gurgling" in the left iliac fossa was most marked, and the dull pain in the chest was the more suspicious on account of a large number of pneumonic cases being at the time received from the same ship; but the absence of diarrhoea or cough, the low temperature and moderate pulse, opposed such an opinion, and, on the third day, the intense vertical headache, constipated bowels, dilated pupils, and tetanoid contraction of muscles, pointed to the real condition.

Prognosis was in each case unfavourable. From the beginning, there seemed a downward tendency, except perhaps on the sixth day's illness of Case II, when, although the pulse rose to 120, the tongue became moister, the intellect clearer, and the general expression more favourable. The temperatures show a rise *patri passu* with the approach of death.

Treatment.—It will be seen that no specific treatment was adopted. The two boys were treated, one on antiphlogistic and the other on

stimulating principles, with equally unfortunate results. Leeches and sinapisms to the nape of the neck somewhat relieved the spasmodic contractions. For the relief of this painful symptom, Dr. B. W. Richardson suggests the inhalation of five or ten minims of nitrite of amyl, frequently repeated, and, from its marked success in similar nervous affections, it seems well worthy of a trial. The obstinate constipation required the constant use of purgatives. The catheter was in each case required two days before death, and all along the most assiduous nursing was required to watch and feed the patients with beef-tea, milk, eggs, etc.

In conclusion, I regret I have but little to say regarding the cause of the above disease. It is now some years ago, after an epidemic in Northern Germany, that Niemeyer pointed out and expressed a decided opinion that it did not depend upon any atmospheric or telluric influence, and that it by no means belonged to that class of infectious diseases of which typhus is a type, but, on the other hand, that the febrile symptoms arose from a local disease induced by a specific poison.

Dr. Richardson and Dr. Baker have, no doubt, made out a strong case on behalf of the supposition that poisoned grain is the *origo mali* of tetanoid fever. Without some more definite proof, however, of such origin, I would submit that the panic likely to arise from the premature promulgation of such a theory amongst the *populus* would counterbalance any good which would otherwise result from it; but the subject is well worthy of careful consideration and study, and, without too rashly asserting the existence of ergot of wheat in the food of the above patients (a subject still under investigation), it would, no doubt, be well, with such grave suspicions, to cut off or change all bread and flour supplies in any district where such disease appears in an epidemic form.

No diseases usually considered of malarial origin were then prevailing in the men-of-war in harbour, nor, indeed, zymotic disease of any kind, and the returns of other diseases from the training ships and barracks present nothing unusual.

SOME REMARKS ON WHOOPING-COUGH AND ITS TREATMENT BY CARBOLIC ACID INHALATIONS.

By SAMUEL LEE, M.R.C.S.

BEFORE alluding to the treatment of whooping-cough by inhalation, we may with advantage consider what means we have at our disposal in retarding the spread of the malady. It is apparent that, in a considerable majority of cases, no precautions likely to lead to the desired result are adopted; and at first sight it appears somewhat surprising that isolation of patients suffering from scarlet fever, small-pox, and enteric fever, should be strongly advocated, and in many instances enforced, when the victims of pertussis, which may be looked upon as one of the most fatal diseases to which children are liable, are submitted, as a rule, to no such restraint. There is reason to believe that the isolation of patients in a special ward in some of our hospitals, both in London and the provinces, would be beneficial. In a former number of the BRITISH MEDICAL JOURNAL, we were favoured with an interesting communication from Mr. Richard Harrison, of H.M. Convict Prison, Dartmoor, on the treatment by carbolic acid inhalations; and the general conclusion arrived at was that, in the majority of cases so treated, considerable relief to the more urgent symptoms was the result. The inhalation of the acid may be conducted in two ways, either by long continued inhalations of a weak solution, or by strong inhalations three or four times a day. For this purpose, I have used the steam-draught inhaler, by means of which, owing to the free admixture of fresh air with the vapour to be respired, the inhalations can be prolonged for several hours; and, there being no effort of inspiration, one of the main difficulties in obtaining the desired result in young children is overcome. In cases complicated with obstruction of the bronchial tubes with mucous secretion, a stimulating inhalation will sometimes excite spasmodic contraction and expulsion of the offending material. I have used the carbolic acid inhalations in the mild and severe forms of the disease, and in both with considerable relief. In three cases that have come under my notice in adults, in one of which the malady had continued in spite of all treatment for eight months, attended with hæmoptysis and severe and frequent attacks of coughing, the relief obtained by inhalation of the acid was very marked. I hope on a future occasion to be able to communicate to the JOURNAL a report of cases treated by the above method.

* In a paper by Dr. Dowse, read before the Medical Society of London, he states that, in sporadic cerebro-spinal meningitis, these tetanoid symptoms do not occur. The temperature, too, in sporadic cases is much higher from the commencement of the disease, and the sensorium is not usually affected so early.