chloral, but to the combined action of both. It depended, not upon exhaustion following violent discharges of nerve-force, not upon profound coma, but upon a sudden failure in cardiac power.

The effects of chloral upon the cat are exceedingly like those of chloroform, only more protracted; and among them, therefore, is a weakening or paralysing effect upon the heart through its special vaso-motor nerves and ganglia. Then, on the other hand, among the effects of picrotoxine upon the cat, is a retarding influence on the heart and prolongation of its diastole through increased inhibitory power exerted by the vagi. If, then, the paralysing influence of chloral is exerted on the heart contemporaneously with the inhibitory influence of picrotoxine, we can readily understand why syncope and death should ensue, and why practically no antagonism exists between them, although chloral-hydrate mitigates the cerebral irritability brought on by picrotoxine, and although picrotoxine restricts the depth of the hypnotism brought on by chloral.

The danger of the conjoined action of chloral-hydrate and picrotoxine on the heart is greatest during the earlier stages of the action of the former, when some degree of excitement is present; and so trial was made of the effect of picrotoxine when given to a cat that had passed altogether through the period of chloral excitement into deep chloral sleep.

Experiment xcvi.—A cat weighing 5 lbs. 2 oz. had twenty grains of chloral-hydrate hypodermically injected at 11.45 A.M. At 1.45, it was deeply asleep, after much restlessness alternating with drowsiness; and then one-sixteenth of a grain of picrotoxine was injected at 1.50. Its sleep was disturbed; there were movements of the paws and tail, and general quiverings. At 2 P.M., however, its sleep was again calm and profound. Throughout the afternoon, it had alternate periods of sleep and wakefulness. During the latter, it got up and staggered about as if drunk, its pupils being widely dilated. During the former, it lay upon its side, its head being bent down, and its back arched in a distinctly emprosthotonic attitude. Whenever it was moved out of this position, it forthwith, without waking, resumed it. At 9 P.M., its sleep was continuous, and there were no spontaneous movements. It remained in a deep uninterrupted sleep for two days and three nights, when it began to recover itself. In a few hours more, it was quite well. Throughout its long sleep, its bowels did not act, nor did it void urine. When its tail was pinched, it did not flinch. Milk was frequently administered to it, and it was kept warm.

The description of further investigations which have been undertaken, but which are not yet complete, with the purpose of ascertaining the effects of the combined administration of picrotoxine, chloral, and atropine, picrotoxine, chloral, and digitalis, and picrotoxine, chloral, and alcohol, must be reserved for a future contribution to these pages, in which it is hoped that the effects may also be recorded of the continuous administration for long periods of small non-fatal doses of picrotoxine to animals. If, as has been repeatedly alleged, *coccus Indicus* is extensively employed by dishonest brewers to impart bitterness and inebriating qualities to the pernicious liquids which they sell as beer, it is certainly eminently desirable that we should accurately ascertain the effects upon health of such a dietetic counterfeiter; and this can only be satisfactorily done by watching the effects upon animals of minute and frequently repeated doses of the suspected adulteration. In the meantime, however, we are not without indications of the evils wrought by such deleterious additions to a popular beverage. When giving evidence before the Select Committee of the House of Commons on Habitual Drunkards in 1872, I suggested that perhaps the greater prevalence of epilepsy in England than in Scotland was to be ascribed, partly at least, to the preponderance of beer-drinking and to the adulteration of beer by *coccus Indicus* in the former country. Further observations have only tended to strengthen my belief in the theory which I then broached. Large quantities of Levant nuts are imported annually into this country, and the difficulty is to find any destination but the brewer's vat for these importations. But the action of these Levant nuts upon those who partake of them or of their active principle is to set up an unstable condition of the nervous centres, which eventuates in paroxysmal discharges analogous to, if not identical with, epileptic fits. If, then, we find that beer is adulterated with *coccus Indicus*, that *coccus Indicus* is adequate to the production of epileptic conditions, and that beer-drinking and epilepsy are generally in proportion to each other in their prevalence in the population, there are good grounds for holding that the adulteration of beer is responsible for much of the epilepsy by which this country is now so grievously afflicted.

And there are still other inquiries in relation to picrotoxine which remain to be made. Its therapeutic properties ought to receive attention. Many years ago, Sir Robert Christison pointed out that the actions of

this agent in medicinal doses were deserving of investigation; but the hint which he then gave has not yet been acted on. Now, however, we know that picrotoxine is a powerful stimulant to certain nervous centres; and we have therefore reason to hope that it will prove useful in some diseased conditions in which symptoms of diminution of function in these nervous centres are apparent.

The following general conclusions seem to be fairly established by the investigations which have been described in the foregoing paper.

1. Chloral-hydrate is physiologically antagonistic to picrotoxine in rabbits and guinea-pigs, and will, when administered in a suitable and proportionate dose, save life after a fatal dose of picrotoxine.

2. The antagonism of chloral-hydrate to picrotoxine in rabbits and guinea-pigs may be exerted so as to save life, even when it is not administered until fifteen or twenty minutes after the fatal dose of picrotoxine.

3. The antagonism of chloral-hydrate to picrotoxine is subject to two limitations: *a.* That the dose of picrotoxine may be so large as to kill before the chloral-hydrate has time to operate; *b.* That the dose of picrotoxine may be so large that nothing short of a poisonous dose of chloral-hydrate would avail to counteract it.

4. Picrotoxine is to a very limited extent antagonistic to chloral-hydrate in rabbits and guinea-pigs, by mitigating the hypnotic effects of the latter upon the brain and higher nervous centres, which it stimulates to activity.

5. The minimum fatal dose of chloral-hydrate in the rabbit is twelve grains to each pound of body-weight.

6. Practically no antagonism exists between picrotoxine and chloral-hydrate in the cat, nor between strychnia and chloral-hydrate.

7. Picrotoxine and chloral-hydrate, when administered simultaneously to the cat, cause death by stopping the action of the heart, and not by any destructive or exhausting action upon the supreme nervous centres.

8. Chloral-hydrate causes in the cat excitement and restlessness, with motor defects prior to the state of sopor, and its effects upon that animal are protracted to an extraordinary extent.

9. The energy of the action of chloral-hydrate, as measured by its minimum fatal dose, is in proportion to the development of the cerebral hemispheres.

In closing this paper, I have to express my gratitude to my colleague Dr. Lawson for much valuable assistance, in making some of the observations upon which it is founded.

ON PUERPERAL FEVER.

By EDWARD JOHN TILT, M.D.

ONE good result of discussions like that on puerperal fever, now proceeding at the Obstetrical Society of London, is, that it brings to light valuable cases, like two that were published last week in this JOURNAL by Mr. Stewart of Barnsley. He truly remarked "that they were exceedingly interesting from their tendency to throw light upon the nature and production of puerperal septicæmia, as they show that the application of decomposing lochia alone to a recent scratch or wound has been sufficient of itself to produce gangrene of the part and death of the patient in the one case, and a very severe attack of phlegmonous erysipelas in the other, although no puerperal condition existed in either of the inoculated subjects. I think we may, therefore, draw the conclusion, that the passage of decomposing lochia over any abraded surface in the vaginal passage is sufficient to produce puerperal septicæmia without the importation of any other specific poison. In this manner, we may account for the disease attacking much more frequently primiparous cases, as the vagina and perinæum are much more likely to be slightly lacerated in those than in multiparæ".

All this is no doubt true, but it has been already pointed out; and the interest of the cases lies in the fact that they show the precise channel through which a woman frequently pours into her blood the poison secreted in her womb. The lymphatics surrounding the recent scratch of one woman, and the cut thumb of the other, took up the poison, passed it on to the lymphatics of the forearm, and they into the blood. What became of the inflamed lymphatics in one case is not said, but in the other they inflamed the surrounding cellular tissue. In exactly the same way, the lymphatics in and around a rent of the circular fibres of the internal os uteri, or of the cervix, on the "fourchette", often take up the poison that comes down from the puerperal womb, and transmit the poison to the pelvic lymphatics, that pour it into the blood. The contact of the poison with these lymphatics influences them in various degrees, and sometimes acutely inflames their surrounding cellular tissue. This is called pelvic cellulitis; but, when

the same process occurs under the skin, as in one of the two cases, it goes by the name of phlegmonous lymphangitis. I said the passage of the puerperal ichor through the larger lymphatics caused various degrees of inflammation; and the error of Cruveilhier and the pathologists of his time was to suppose that puerperal fever could not be attributed to the lymphatics unless they contained pus. In my paper on lymphangitis in pelvic pathology, I have cited cases of puerperal fever in which the enlarged lymphatics were found to contain not pus, but a fetid brown fluid, similar to that found in the womb, containing a bit of putrid placenta. I have, moreover, shown that when filtered putrid lochial fluid is injected into the womb of recently delivered animals, this gives rise in all to the same typhoid symptoms; but, on opening the animals, it is found that sometimes the lymphatics contain pus, and at others a fetid sanious fluid like that found in the womb.

SPINA BIFIDA.

By E. NOBLE SMITH, L.R.C.P.Lond.

MR. BURTON's communication upon this subject induces me to again express a doubt that a case of spina bifida, in which the cord communicates with the sac (*i.e.*, adheres extensively to the back of the sac), can be cured by an operation which causes the sac to contract and shrivel up. The success attending Dr. Morton's treatment seems, in a very great measure, due to the modifications which he has introduced. This fact I fully recognise, but I trust I may be allowed to express a doubt as to the spinal cord being connected with the sac in the manner shown in the diagrams given below, or in the preparation, a drawing of which accompanies Sir Astley Cooper's cases reported in the *Medico-Chirurgical Transactions*.

In answer to a former letter of mine, Dr. Morton observes (*BRITISH MEDICAL JOURNAL*, November 21st, 1874) that, as all his cases have been successful, he had not had an opportunity of making a *post mortem* examination of an injected case. Five consecutive cases treated according to Dr. Morton's plan recovered. A sixth is now reported, which has failed.

I now venture to analyse these five successful cases.

CASE I (*BRITISH MEDICAL JOURNAL*, April 6th, 1872). *Spina bifida in a child two months old.*—"Its covering was thin, so that it was quite translucent; and at the child's birth it was about half its present size; moderate pressure upon it did not cause much inconvenience or suffering; and the child had never had convulsions, and seemed in all other respects quite healthy." It was cured by Dr. Morton's injection. In this case, there is no evidence of the cord communicating.

CASE II (*BRITISH MEDICAL JOURNAL*, June 15th, 1872). *Spina bifida in a child fourteen days old.*—"Dr. Morton's assistant reports, that 'the tumour was as large as a middle-sized orange, and cylindrical in shape. In some parts it was reddish, and at others bluish in tint. It was semi-transparent, and somewhat wrinkled on the surface. It became tense when the child cried. On looking through it, several striæ were seen passing over its internal surface.' There is no proof that these striæ were nervous, and, as the child does not seem to have suffered at all from convulsions or paralysis, I think it is highly probable that they were only inflammatory adhesions. This opinion is strengthened by the fact that the tumour 'at birth was small, but had increased in size', and that 'some time ago it showed signs of ulceration, but these healed up, leaving thickened cicatrices of different colours'. It was cured by Dr. Morton's injection.

CASE III (*BRITISH MEDICAL JOURNAL*, April 26th, 1873).—Dr. Watt reports a case in which the spina bifida was a sessile semi-transparent flesh-coloured fluctuating tumour, as large as an ordinary sized hen's egg. It was extremely sensitive, and, "when viewed by transmitted light, cords were seen passing near the surface". There is much more evidence in this case in favour of the cord communicating to some extent with the sac, for the child moaned almost constantly. "Its legs dangled, and no voluntary attempt was made to move them", and "the sphincters seemed very weak". This tumour was injected with Dr. Morton's fluid, and the tumour contracted into "a cake of firm condensed tissue", but "the legs never moved together, but, when the soles were tickled, one or other leg was drawn up a short distance". There is no absolute proof, however, that the cord communicated with the sac, nor does there seem to have been a complete cure.

CASE IV (*BRITISH MEDICAL JOURNAL*, January 31st, 1874). Reported by Dr. Watt.—The child made an excellent recovery after injection with Dr. Morton's fluid. The tumour "was very sensitive to the touch, became tense when the child cried, and palpation discovered a perfectly fluid condition", which is equivalent to stating that the cord did not communicate with the sac.

CASE V (*BRITISH MEDICAL JOURNAL*, October 24th, 1874). Re-

ported by Dr. Morton. In this case, the tumour was situated in the cervical region, and no evidence is given of the spinal cord being involved in the sac.

The accompanying cuts represent two preparations in the Museum of the College of Surgeons, of which Mr. Flower kindly allowed me to

make drawings, and I cannot understand how such cases could be cured by making the tumour contract and shrivel up.

ON JABORANDI.

By SYDNEY RINGER, M.D., Professor of Materia Medica and Therapeutics in University College, London; and W. MURRELL, L.R.C.P.

SINCE a paper published in conjunction with Mr. Gould, the present writers have made ninety-four additional observations on the effects of jaborandi. The results, whilst confirming the previous statements, add a little to our knowledge of the action of this interesting drug. We gave the medicine sixty-eight times to patients, who took it at their own homes at bedtime. In fifty-nine instances, both perspiration and salivation occurred; in five, perspiration without salivation; in four, salivation without perspiration; thirteen complained of pain over the pubes, often very severe, with a strong desire to pass urine; thirty-one experienced pain in the head, often accompanied with giddiness and dulness.

On seventeen occasions, we gave the drug at nine o'clock in the morning, in a warm room, before a large fire. Of these cases, both perspiration and salivation occurred in eleven; in two, perspiration without salivation; in one, salivation without perspiration; three experienced pain over the pubes; six felt severe pain in the head; six nausea or sickness; and, in one instance, the drug caused a good deal of drowsiness; in four cases, the sight became affected; and finally, in three cases, the jaborandi produced no effect. On nine occasions, we gave the drug to patients who immediately left the hospital and returned home, during the late severe weather. Both perspiration and salivation occurred in eight cases; in three, pain over the pubes; in six, severe pain in the head; in four, nausea; in six, much sleepiness; and, in one instance, the drug produced no effect.

In by far the greater number of observations, both perspiration and salivation were profuse; but sometimes the perspiration or the salivation or both were only slight. The observations were repeated several times on certain individuals, and we found that the effects of the drug varied considerably, not only on different people, but even in the same person. Some yield with difficulty to the drug, and require a large dose, even ninety grains of the leaves. In others, whilst exciting considerable perspiration, it affects the salivary gland but little, or not at all; on the other hand, in some it excites profuse salivation, but scarcely affects the perspiration. In respect to its influence on the brain, the sight, the urinary organs, the effects of jaborandi are even still more uncertain.

As might be anticipated, cold, exposure, and food influence the effects of the drug. Thus it acts less freely on the skin of persons dressed or exposed to cold; moreover, when administered on a full stomach, the drug is more slowly absorbed, and its effects are less marked. In experimenting, therefore, on persons dressed or exposed to the cold, we were obliged to give a larger dose to get the desired effects. The pain over the pubes was often very severe, especially on two occasions, when it was felt across the navel and passed downwards along the penis, and down the urethra. With few exceptions, the pain subsided immediately on passing water. The headache was generally referred to the forehead over the eyes, though sometimes it involved the whole head, and on one occasion was limited to the left parietal region. The character of the pain was generally dull; most persons calling it a "weight over the eyes". In one case, it was paroxysmal. When the drug was given in the daytime, the pain lasted from half an hour to several hours. Giddiness and a stupid feeling were often associated with the headache. This effect on the head, we believe, has before not been noticed. On