1. The medicine may be given in the manner directed without danger.

2. That it very often does good, producing speedily in most cases, refreshing, quieting sleep; and even when it fails to induce sleep, it generally calms undue excitement.

3. That some cases appear to be uninfluenced by the drug.

It yet remains, however, to ascertain the forms of the disease amenable to digitalis.

There can be no doubt that under this treatment some severe asthenic cases, in which, on account of the great prostration of strength, death seemed imminent, have rallied astonishingly and ultimately recovered. The evidence of this is too strong to be disputed. Under the influence of digitalis, the weak, rapid, and fluttering pulse grows strong and steady; the skin comfortably moist and warm; while, with the improvement in the circulation and state of the skin, the general condition of the patient has mended. On the other hand, it appears equally certain that the sthenic forms of the disease are also amenable to this drug. In several instances the author has seen this disease yield speedily to these huge doses of digitalis; but on two occasions the patients suddenly fell back dead, although, to the moment of death, no warning occurred of this sudden and untoward termination. Whether in these instances death was to be ascribed to the digitalis or to the disease, it is impossible to say; for it is well known that delirium tremens, however treated, ends sometimes suddenly in this fatal manner.

TOBACCO.

A poultice of tobacco leaves is said to relieve pain, and an ointment, made by boiling half an ounce of tobacco in eight ounces of lard, kept constantly applied to the breasts, is said to arrest the secretion of milk. In this respect it is probably inferior to belladonna (*vide* Belladonna).

Several deaths having occurred through the application of tobacco to the abraded skin, it must be applied externally with caution.

Tobacco dilates the pupil when introduced into the eye, or when taken by the stomach.

Tobacco produces nausea and sickness, accompanied by great weakness and faintness. It confuses the ideas, dims the sight, enfeebles the pulse, and makes the skin cold and clammy with profuse sweating. Owing to the prostration, it removes spasm; and tobacco in the form of clyster, or administered by the stomach, has been employed in colic of the intestines, and in strangulated hernia; but in spasmodic diseases it is quite superseded by chloroform. Tobacco-smoking excites an abundant secretion of saliva; hence some persons maintain that tobacco-smoking aids digestion. Smoking acts on the intestines as a slight purgative, and no doubt a pipe or cigar smoked after breakfast is often sufficient to ensure an easy and satisfactory relief of the bowels; and is a practice not without advantage for persons troubled with habitual constipation.

Smoking in excess is, no doubt, a very harmful habit; it disorders digestion, greatly lessens the appetite, produces much restlessness at night, with disagreeable dreams, and weakens both mind and body. Chronic pharyngitis, the mucous membrane looking like dirty-red velvet, with constant hawking, and also chronic dyspepsia, may in some instances be clearly traced to smoking in excess. Even amaurosis is said to be sometimes produced by excessive smoking. The habitual smoker has generally a thickly coated tongue. The symptoms produced by excessive smoking soon cease when the habit is discontinued. The evil consequences are much less marked if the tobacco is of good quality, and contains but little nicotine. In the cultivation of the tobacco plant, it is a point of importance to develope much of the aromatic principles, and but little nicotine.

At present it has not been satisfactorily determined what structures tobacco affects. Kölliker teaches that (1) nicotia

quickly paralyzes the brain, and destroys voluntary movement; (2) that it excites the medulla oblongata and the cord, producing tetanus, which continues only a short time, and is unaccompanied by increased reflex irritability; (3) that the motor nerves are paralyzed, and if the tetanic movements are severe they assist in producing this paralysis; (4) that the sensory nerves do not appear to be affected by nicotine; (5) that the heart continues to pulsate long after nicotine poisoning; (6) that the muscular irritability is unaffected by nicotine. Other observers teach that nicotia feebly paralyzes the motor nerves, and destroys muscular irritability.

Nicotia appears to tetanize the heart; for when, from a mechanical cause, this organ has ceased to contract after death, on the direct application to it of nicotia the pulsations recommence, and the heart soon becomes rigidly contracted —tetanized, in fact—and then of course, the beating again ceases. In birds and mammals killed by chloroform, when the ventricles are immobile and dilated, and respond most imperfectly to stimuli, a drop of nicotine, directly applied, immediately occasions strong contractions in the heart, and causes the organ to respond energetically to mechanical and galvanic stimuli.

The experiments of Fraser and Brown show that nicotia, like other tetanizing substances, as strychnia, brucia, thebaia, codeia, and morphia, when converted into ethyl or methyl compounds, loses its tetanizing properties; but, unlike these, the methyl and ethyl compounds of nicotine do not possess any paralyzing action on motor nerves. This difference inclines them to believe that the convulsions of nicotia are not produced in the same way as those arising from strychnia, brucia, thebaia, etc.

Nicotia has been highly praised in tetanus, and many recorded cases appear to show its usefulness in this very fatal disease. It must be administered either by the rectum or hypodermically; for when put into the mouth, it very generally excites a severe paroxysm, which, by firmly fixing the muscles of the chest till asphyxia is produced, may destroy life.

Tobacco-smoking commonly affords some relief in spasmodic asthma; but like all other asthmatic remedies, it succeeds much better in some instances than in others.

Whether the active principle of tobacco is destroyed in the system, or is eliminated with any secretion, is at present unknown.

Nicotine is supposed to be diuretic, but we are not told under what circumstances.

CONIUM AND ITS PREPARATIONS.

The statements of the physiological action of this medicine, made by various observers, coincide in the main; but they contain a few contradictions which cannot at present be reconciled.

We are chiefly indebted to Christison, Schroff, Kölliker, and Guttmann for our knowledge of the action of this medicine.

Paul Guttmann, who has lately published some excellent investigations on the action of this alkaloid, says it is one of the most active and powerful poisons, being in this respect scarcely second to prussic acid; yet some vegetable-feeders, as the goat, sheep, and horse, are said to eat hemlock with impunity.

This medicine exerts no influence on the unbroken skin, even when applied in large quantities; but strong preparations applied to wounds excite inflammation, with its usual accompaniments of heat and pain.

The preparations, or the pounded leaves, or the expressed juice smeared over a poultice, ease the pain of ulcers both simple and malignant, and at the same time improves the character of the sore. The pain-easing property of hemlock rests on the evidence of highly competent observers, and cannot be gainsayed; yet this remedy is now rarely employed

for this purpose, although formerly it was in constant use as a soothing application to broken cancers and malignant sores.

The alkaloid, whether directly applied to the eye, or swallowed, causes dilatation of the pupil, sometimes with subsequent contraction. According to Harley, the dilatation is never very great.

The smell of conium has been compared to the urine of cats and mice. It has a burning, acrid taste, provoking an increased secretion of saliva. Conia, dissolved in alcohol, introduced into a hollow, painful tooth, has been employed to remove toothache.

Hemlock has scarcely any influence on the stomach and intestines. It may produce nausea, vomiting, and diarrhœa; but such occurrences are not common. Walshe has seen it useful in relieving the pain of cancer of the stomach.

That conia enters the blood is proved by the symptoms arising when it is swallowed; but what physical or chemical changes, if any, it produces in the blood are at present unknown. Added to blood after its removal from the body, it produces in it no perceptible alteration.

The deficient coagulability and dark colour of the blood noticed by some observers after death from this drug, are according to others often absent; and when present, is probably due to the fatal asphyxia.

The effects of conium on man and animals is very similar. The best account of the symptoms occurring in a human being from a poisonous quantity of the plant, is given by Dr. H. Bennett, who has recorded the case of a man who ate hemlock in mistake for salad. Weakness of his legs, so that his gait was faltering, was first noticed; as the weakness increased he staggered, as if drunk, and at the same time his arms began to be similarly affected. Perfect loss of all voluntary movement followed, and he was unable even to swallow. Lastly, the muscles of respiration were slowly paralyzed, and he died of asphyxia. Up to his death his intelligence was apparently unaffected, but his sight was

destroyed. Slight movements in the muscles of the left leg took place.

The same, or nearly the same, sequence of events happens in animals poisoned by hemlock. With rabbits, however, early and severe convulsions occur; but in frogs these are absent. In all the experiments and observations of Guttmann, gradual paralysis of the voluntary muscles, and then of the respiratory muscles, took place. The paralysis began first in the hind extremities, affected next the anterior, soon afterwards the muscles of the trunk, and lastly those of respiration.

How this paralysis is produced will be next considered. It is to Kölliker and Paul Guttmann we are indebted for most of our exact knowledge on this subject.

The paralysis is certainly not due to the action of the hemlock on the muscles; for an animal completely paralysed by conia, to such an extent that galvanic irritation through the nerves entirely fails to excite contractions, yet energetic contractions are excited if the current is made to pass through the muscles themselves. Nay, further, the irritability of muscles through which blood poisoned with conia has been permitted to flow is as great and as enduring as that of muscles of the same animal protected from the action of the poisoned blood by a ligature of the blood-vessels.

Nor does hemlock paralyze by its effect on the spinal cord, for if a limb is protected from the influence of the poisoned blood by ligature of both its artery and vein, and the animal (frog) is then poisoned and thoroughly paralysed by conium, it can still manifest powerful movements in the ligatured limb. Moreover, irritation of any of the paralyzed parts is answered by energetic contractions in the ligatured limb.

This last experiment greatly narrows the question before us; namely,—Through what tissues does hemlock paralyse? In this experiment the only muscles which retained their power of movement were those protected from the poisoned blood by the ligature of the vessels; and it follows that conia operates on some of the tissues thus protected, that is, either on the nervesor muscles; and it follows as conclusively that

the paralysis is due in no respect to the action of the poison on the brain or cord; for these parts were freely supplied with poisoned blood, while their nervous communication with the ligatured leg was intact, and yet this limb remained quite uninfluenced. We have, therefore, to decide whether conia affects nerves or muscles; but this question has been answered already, when it was proved that the poison exerts no influence on the contractility of muscle.

The investigation may be carried a step further; for an experiment of Guttmann proves that the poison affects the periphery of the motor nerves earlier than their trunks. The leg of a frog, after the vessels leading to it had been tied, was separated from the trunk, except by the chief nerve, and the animal was then poisoned. The uninjured limb in free vascular communication with the trunk, the extremities of the nerves being exposed to the action of the poisoned blood, became quickly paralyzed, while at the same time contractions through the femoral nerve were easily produced in the limb protected from the poison by its partial separation from the body. In this experiment the main trunk of the nerve of each leg was equally subjected to the poison, but the termination of the nerve in one instance was exposed to the poison, but in the other was protected from its influence. The paralysis, as we have seen, occurred speedily in the limb whose peripheral nerves were subjected to the poison, showing that the primary action of conia is exerted on the terminations of the nerves. But, ultimately, the trunks themselves become paralyzed; for after a time the partially severed limb became paralyzed below the point of section, even when the trunk of the nerve exposed to the poison was irritated.

Are the sensory or afferent nerves in any way affected? Apparently not, as they can certainly convey to the cord or brain afferent impulses in an animal rendered quite motionless by the poison.

The following experiment shows this:—If the legs of a frog are protected by a ligature of both arteries and veins, and the animal is then completely paralyzed by conia, energetic

movements can be excited in the ligatured limbs by irritation of the paralyzed parts. Whether these movements are purely reflex, or whether they are voluntary, and are occasioned by pain, it is in this case impossible to decide; but at all events this experiment conclusively shows that in frogs the afferent nerves of completely paralyzed parts can convey impulses to either the cord or brain. When the paralyzed parts of animals higher in the scale than frogs, such as rabbits, are pinched, they exhibit signs of pain, if we may judge from their aspect and from the noise they make, till the face and larynx are themselves affected, and it is therefore probable that sensory nerves convey impressions to the brain, even when the animal is almost perfectly paralyzed in respect of voluntary movement.

The vaso-motor nerves also of some parts appear to be affected by conia; thus the arteries of the frog's foot fail to contract on irritation when the animal is poisoned by hemlock, but the motor nerves of some other involuntary muscles are uninfluenced by conia, as the peristaltic contraction of the intestines of the rabbits, killed by the alkaloid, continued active after death.

When applied directly to the nerves, hemlock destroys their conductivity. The poison produces no pain.

Its influence on the brain will next be considered. No doubt both man and animals remain conscious of pain so long as they are capable of giving any signs of it; that is, before the muscles of expression become paralyzed. Still this is possible, while at the same time the brain may in some way be affected. Schroff states that a short time after the poison is taken it is followed by a feeling of heaviness in the head, with giddiness, inability to think, great impairment of common sensibility, blunted taste, dimmed sight, dilated pupils, and a sensation as of insects crawling on the skin.

The foregoing observations show that the mind is in some degree weakened, and that many of the special senses suffer. In Dr. Bennett's case there was total blindness, but the hearing was but little, if at all, dulled. Some observers assert that the mind remains quite uninfluenced by hemlock.

At an early part of this section it was stated that convulsions resulted from poisoning by this substance. These occur in some animals, not in others. Rabbits appear to suffer from convulsions, but frogs die unconvulsed. These spasms, Kölliker has suggested, may be due to asphyxia from paralysis of the muscles of respiration. This explanation, however, appears to be insufficient, as the convulsions often occur among the earliest symptoms, before any asphyxia has resulted; nay, if a tube is introduced into the trachea, and artificial respiration is performed, they still occur. In man, convulsions are certainly sometimes absent, and in the case recorded by Bennett only slight movements in the left leg were witnessed.

In their recent investigations, Drs. Crum Brown, and Fraser for the most part confirm the conclusions of Kölliker and Guttmann. They have shown, however, that specimens of conia are not of identical composition; for while each specimen produced the same symptoms, they find that these were not always produced in the same way. In other words, some specimens affect chiefly the motor nerves, while others act on both motor nerves and cord. Their observations on hydrochlorate of conia, methyl-conia, and iodide of dimethyl-conium, in a great measure explain these differences. They conclude that conia "produces paralysis solely by influencing the motor nerves," and that hydrochlorate of methyl-conia acts "on the motor nerves and spinal cord; with large doses the former action is completed before the latter, while with small doses the latter action is completed before the former." They conclude that commercial specimens of conia consist of mixtures in variable proportions of conia and methyl-conia; sometimes methyl-conia is present in small, at other times in large quantities. This variety of composition will explain the varied physiological effects of different specimens of conia.

Their observations on iodide of dimethyl-conium "show that the paralysis produced by dimethyl-conium is dependent on an action on the motor nerves primarily restricted to the

peripheral terminations," and that the substance "is entirely free from spasmodic and paralyzing actions."

Dr. John Harley's physiological experiments lead him to the conclusion that succus conii is a depressant of the motor tract of the cord, and the motor ganglia of the brain. Dr. Fraser's observation that succus conii generally, if not always, contains methyl compounds of conia, serves to explain the discrepancy existing between Guttmann, Kölliker, and Harley.

Concerning the action of this poison on the heart, very conflicting statements have been made. Thus, some authorities state that it reduces the frequency of the pulse, especially when the heart beats too quickly from disease, as from fever, etc. Even a small dose under such conditions, they say, suffices to produce a very decided effect on the pulse, while in health the same quantity exerts no influence. Such are the conclusions of Wertheim.

Kölliker, Guttmann, and J. Harley, conclude that conium does not affect the heart. Harley says, "excepting as a transient emotional effect in nervous individuals upon the sudden accession of the symptoms after a first dose of hemlock, the heart and bloodvessels are absolutely unaffected by its operation. I have carefully determined this in persons of all ages—in the weakly infant not three months old, in the strong and debilitated, and in those who have intermittent action of the heart." He gave the medicine in sufficient quantities to produce partial paralysis.

In experiments with warm-blooded animals poisoned by hemlock, the heart, it is true, soon ceases to beat; but this can be for a long time retarded if artificial respiration is performed, and in the case of the frog the poison appears to leave the heart unaffected. Hemlock has been recommended in fevers and acute rheumatism, and in these diseases its efficacy has been supposed to be explained by its action on the heart. But, as we have just seen, it is very doubtful if conia exerts any influence on the heart.

Harley says, conium, in doses sufficient to produce physiological effects, may be taken for months without affecting

nutrition. It has been supposed to be useful in whooping and other kinds of coughs. The succus conii in one to four drachm doses, or even more, has been recommended lately by J. Harley in chorea; and these large doses certainly control the movements temporarily, and impart steadiness to the patient; but these effects wear off if the medicine is not soon repeated. Some cases, no doubt, are cured by this treatment, but in my experience, in most instances, it only palliates; for on discontinuing the drug, the symptoms returned with their former severity. In order to maintain the effects of conium on the choreic movements, the dose must be quickly increased, for patients speedily become tolerant of conium, and after a short time will bear enormous doses without any physiological effect. Thus, on one occasion, I gradually increased the dose, till the patient—a child—took seven drachms of succus conii hourly, except when asleep.

We have the high authority of Dr. Neligan in favour of hemlock in various painful affections, as cancer, rheumatism, and neuralgia. In no well-authenticated case has it yet been shown, that conium produces either sleep, coma, or delirium.

Considering the physiological action of conia, it would appear that this is not indicated in convulsive diseases dependent on the affections of the cord, as tetanus and strychnia poisoning; for the effects of this drug and the symptoms of these diseases are not antagonistic. Guttmann, from whose valuable paper on the action of conia the chief part of our remarks has been extracted, put to the test of direct experiment the power of conia to arrest or check in any degree the tetanus from strychnia. He strychnized frogs, and then gave them conia; but, even when administered in doses sufficient to completely paralyze the animals, this drug failed to check in any degree, the tetanic spasms produced by the strychnia.

Professor Christopher Johnson, of Maryland, however, reports cases of recovery from severe traumatic tetanus under the use of conia. In one case he injected hypodermically, every two hours, fifteen minims of a solution composed of two

minims of conia, one minim of dilute sulphuric acid, to one drachm of water. In the second case, he commenced with twenty minims of the same solution every three hours; then he increased the conia to one-third, then to two-thirds of a drop, and ultimately to rather more than a drop every hour, when the symptoms abated. Afterwards he used two minims of conia hourly, but owing to the weakness of the pulse he returned to one minim every two hours, but the spasms returning, he again used two minims every hour, and immediately the spasms diminished. But these cases, unfortunately, are much less satisfactory than they might have been. In the first case, the cicatrices of the wound were removed by a hot iron, and in the second, bromide of potassium and morphia were administered. But Dr. Johnson says, that the spasms were considerably reduced after each conia injection.

Dr. Crichton Browne strongly recommends conium in acute mania. He believes in common with Dr. John Harley that it represses undue activity of the motor centres.

It will be obvious how very similar the action of conia is to that of curare. One difference there is between these substances which has not been noted. Curare, when swallowed, is not poisonous, but is strongly toxic when injected under the skin; conia in either way is equally poisonous.*

Dr. Neligan draws particular attention to the fact that the only preparation of any value is the juice; and so true is this, that the various statements made concerning the success and failure of this remedy in various diseases must be accepted with caution, unless the conclusions have been deduced from observations founded on the use of this preparation.

* Claude Bernard believes that the innocuousness of curare administered by the stomach is due to its slow absorption, as contrasted with its much more rapid elimination by the kidneys, so that a very minute quantity is retained in the blood.