lives. And yet, strange as it may seem, if a brutal murderer is to lose his life, and there is the least doubt as to his premeditation, a large part of the community is often aroused into moral excitement, if not indignation, while the innocently-murdered railroad passenger excites little more than a murmur.

There is, perhaps, no subject upon which the public conscience is more tender than the treatment of the criminal.

Psychologically, the explanation is simple, for the public have been educated gradually to feel the misfortune and sufferings of the criminal; it is also easier to realize, since the thought is confined generally to one personality at a time. But if the public could all be eye-witnesses to a few of our most brutal railroad accidents, the consciousness gained might be developed into conscientiousness in the division of their sympathies. But this feeling, however paradoxical, is a sincere, though sometimes morbid expression, of unselfish humanitarianism, for the underlying impulses are of the most ethical order, and over-cultivation is a safer error than under-cultivation. The moral climax of this feeling was reached when the Founder of Christianity was placed between two thieves.

The Circulation of the Blood and Lymph in the Cranium during Sleep and Sleeplessness, with Observations on Hypnotics (Prize Essay). By John Cumming Mackenzie, M.B., Assistant Medical Officer, Northumberland County Asylum, Morpeth.

Sir Henry Holland, in his chapter on Sleep, considers its investigation should include causes which prevent as well as those which favour or produce it. In the investigation of sleeplessness we assume the converse of this as true, and advert briefly to what experimental physiologists regard as causes and accompaniments of sleep before engaging on its pathological condition, for the therapeutics of sleeplessness imply a knowledge of both. Disturbances of sleep are so constantly the heralds and associates of mental disease as to make insomnia, more than any other condition, common to all, or pathognomonic. The object of sleep, says Sir Henry Holland, is reparation, and sleep itself repose of sensibility and volition, whose cause is a change of condition of the nervous substance closely related to these functions, probably never to be ascertained by investigation, "yet," he continues, "not the less real as a change on that account."

Among other distinguished physiologists, Michael Foster looks for an explanation of the condition in molecular changes, applying the analogy of the cardiac systole and diastole to the sleeping and waking conditions of the brain. Preyer, however, believes that the presence of lactic acid—a product of protoplasmic activity—tends to produce sleep, for while the reaction of muscular activity, or work, is acid from this formation, that of quiescence or repose is alkaline. In an allied chemical process, Pflüger looks for the causation of sleep in the exhaustion of intra-molecular oxygen. For a muscle will continue to react to stimulation, and give off carbonic acid after its circulation is withdrawn, which, however, must soon be renewed to keep up the irritability; but why the stored-up oxygen should become exhausted, in the presence of its source, the blood, is not clear.

Associating changes in the cerebral circulation with the causation of sleep is historical, for that a form of sleep or stupor is induced by compressing the carotid arteries is a fact to which these vessels probably owe their name (Kussmaul and Tenner). At the threshold of investigation in this direction is the doctrine of the constancy of the cranial contents as formulated probably by Munro Secundus (Edin.). Taken as applied to the circulation, therefore, we adduce evidence bearing on the variability of (1) the absolute, and (2) the relative cranial contents, as the basis of inquiry into any cerebral circulatory change. Dr. Kellie, of Leith, published experiments made to demonstrate the doctrine of Munro. These were on sheep slaughtered in the ordinary way by the butcher, on dogs killed by ligaturing the carotid arteries, and by prussic acid. He concluded that the brain vessels are not emptied by any means of general depletion as vessels elsewhere are, although profuse hæmorrhages drain it "of a sensible portion of its red blood"—its place being taken by serum—"watery effusion within the head," he says, "being frequently a consequence of great depletion." These conclusions were apparently interpreted as pointing to the invariableness, in all circumstances, of the amount of blood within the cranium—a view regarded as opposed to the experiences of general practice.

Dr. George Burrows followed with a nearly similar set of experiments on rabbits. He found, on opening the carotid artery and jugular vein, that scarcely a blood vessel was visible after death, while, following death from strangulation, every vessel was turgid with blood. Two killed with prussic acid were suspended while the heart pulsated—one by the ears, the other by the hind legs. In the former the head was completely

anæmic, but intensely congested in the latter. Two were ligatured around the trachea—one being suspended by the ears after death and the other laid upon its side. In the former the cerebral vessels were depleted, but congested in the latter. He concluded that bleeding diminished the quantity and momentum of blood in the brain, and that, as a rule, the brain is congested after death from any form of asphyxia, or interference with the return of venous blood. Diminution of one system of vessels does not necessarily imply repletion of the other, and that circumstances vary the amount of blood within the cranium. Those, he says, who maintain the doctrine of its constancy there have not considered the extra vascular serum, but the whole contents, he concludes, "blood, brain, and serum together, must be at all times nearly a constant quantity."

By introducing suspension he was able to show that subsidence of fluids was not confined to cavities subject to atmospheric pressure, but operated in the closed cranium. The demonstration was no part of Kellie's experiment. The formula of Munro did not, and probably could not, contain a place for it, the blood being regarded as the only movable contents of the air-tight box. Donders, carrying on the investigation, closed air-tight with a piece of glass an opening trephined into a rabbit's skull, and with a microscope observed the vascular changes.

Kussmaul and Tenner repeated and elaborated the experiments of Donders, and confirmed his conclusions. These observers found, on closure of the left subclavian artery and compression of the innominate, the brain become pallid, the smaller vessels invisible, and contraction of the veins opening into the longitudinal sinus, with a doubtful contraction of the sinus itself. During closure of the nostrils or convulsions, the veins enlarged, but the brain position and pallor remained unchanged, and continued so till after death. On restoring the circulation the brain became pink, the finest vessels visible, and the veins enlarged. In the opened cranium the vascular phenomena were the same, but on closing the nostrils or on convulsions supervening, the brain swelled without turning red, although the veins on its surface enlarged. Similarly Kellie opened the cranium of a dog and bled the animal to death. The brain, he says, subsided, and contained very little blood, whereas in the unopened skull the brain filled the cranium, and contained "a considerable quantity of blood." Many of the conclusions of Kellie, therefore, and the rival ones of the eminent observers who followed him, differ in degree rather than kind; some

maintaining that instead of differing at all, Burrows and Kellie subscribe to the same doctrine. These experimental results show that, while the absolute contents of an intact cranium continue to fill the cavity, the proportion of blood may vary.

We are now in a position to consider the reputed relationship between sleep and the circulation. Dr. Marshall Hall believed sleep to be a result of congestion of the brain—a view, as a cause of natural sleep, probably without place in modern physiology, although the complexity and difficulty of the subject is expressed in the wide and varied range of its distinguished and authoritative hypotheses. Dr. Hammond, of New York, concludes that sleep is directly caused by anæmia, or diminished brain circulation. Mr. Durham, in Guy's Hospital Reports, concludes similarly, maintaining that the cerebro-spinal fluid adapts itself to variations in the amount of blood by receding to spinal cord spaces during congestion, and re-ascending, aided by atmospheric pressure on the soft parts, when the cerebral blood is diminished. Dr. Cappie, of Edinburgh, compensates the variations from the blood itself, and argues that an inactive brain is followed by a diminution of its capillary circulation, and a consequent retreat of its volume from the surface of the unyielding skull. To prevent a vacuum, the retreat is covered by turgescence of the pia-mater veins, into which blood is sucked and forced, aided by atmospheric pressure on the vessels leaving the skull, leading to "altered balance of encephalic circulation," or pressure less expansive, and more compressing, which is his formula for sleep. Kussmaul and Tenner found that during convulsions, or closure of the nostrils, the veins swelled, but the brain pallor remained unchanged. In the dead animal, pressure on the thorax or diaphragm propelled blood into the veins of the neck and skull—even when the throat is ligatured it ascends by the dorsal and vertebral veins. Further, Mr. Durham, in experiments on a dog, found that "the longer the administration of chloroform was continued the more distended did the veins on the surface of the brain become;" as its effects passed off, natural sleep supervened, the venous distension subsided, and the brain became pale.

A clinical *résumé* of the condition is illustrated in the case of E. I., æt. 23, a strong, healthy housemaid, who, to relieve pain and restless nights following a surgical operation on the foot, had a hypodermic injection of half a grain of morphia for a few nights with good results. Two months afterwards she suffered from renal colic, for which she had, with other treat-

ment, one grain of morphia hypodermically for two days in succession. On the third day the paroxysms were so continuous and severe that she had a total of two-and-a-half grains in three hours. The pain subsided for forty minutes after, and then recurred again. In the paroxysms she tossed herself frantically about the bed, shouting "Oh, if I could sleep." The pupils were pin-pointed. Something must be done. Chloroform was gently administered to bring her within grasp of the morphia. It was discontinued in twenty seconds—the respiration suddenly slowing, deepening, and finally stopping altogether. The face became cyanotic. In about three minutes the pulse began to intermit, and all efforts to rouse her failed. Artificial respiration was at once begun, and the right median basilic vein opened and allowed to bleed unchecked. She was lifted into a hot bath that happened to have been ready for another purpose, it being a portable one, her head hung over the edge, and the artificial respiration was continued. In immediate sequence, she groaned, opened her eyes, breathed unaided, and in about twelve minutes after the chloroform was administered she was marching up and down a carpeted corridor between two nurses. After a two hours' immunity the coma again supervened, but with the usual restoratives she was awake and lively four hours afterwards. For some days subsequently she was anæmic from loss of blood, but her recovery was perfect. Durham's chloroform experiment is a commentary on the case, the action of the chloroform being to give a sudden fillip to the compression already increased by the morphia, but which the sudden and decided depletion immediately relieved. Cappie, regarding the retinal veins as part of the cerebral system, appeals to the ophthalmoscope as showing the state of the circulation in the brain. Dr. Hughlings Jackson found the retinal arteries smaller and the veins larger during sleep, and, in a case of abnormal disposition to sleep, Professor Gairdner (Glasgow) found congested retinal veins, but barely visible arteries. In a case ("British Medical Journal," 5th July, 1873) of coma from charcoal fumes, the retina was in a similar condition. Cappie believes, and quotes, that "with a sufficient amount of pressure consciousness is suspended," yet, the transference of blood from the brain capillaries to the veins on its surface is not, in his theory, a cause of sleep, but an invariable consequence of slowing molecular activity. Denying circulation to the cerebro-spinal fluid, he ignores it as a compensatory mechanism, for, he says, even if the subarachnoid spaces communicate with the ventricles of the brain, the compensation would take place too

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slowly for the frequent instantaneousness of sleeping and waking. He doubts the existence of Magendie's foramen, but now histologists agree that it, and probably other two (Mierzejewsky), perforate the floor of the fourth ventricle.

As further evidence of anastomosis, the perivascular spaces of the brain, and perineural lymphatics, can be injected from the subarachnoid spaces (Landois and Stirling), the latter communicating with the spongy bone, veins of the skull, and surface of the face (Kolleman); and the nasal mucous membrane with the subdural and subarachnoid lymphatic spaces (Meynert). Further, the cavernous venous spaces, described by Cruveilhier, adjoining the longitudinal sinus, and lined like it, Ludwig Meyer regards as a compensatory mechanism, designed to replete the cranial cavity,—dilated during brain anæmia, and collapsed on the return of the full current of blood (Meynert).

Beyond and behind all these is a sensitive motor mechanism. Arteries all over the body undergo rhythmic movements of contraction and dilatation as demonstrated on the rabbit and frog by Claude Bernard, Schiff, Riegel, and others. These movements cease on division of tho sympathetic or spinal cord, pointing to their vaso-motor origin. Burckhardt, on four cases of defective skulls, obtained tracings of three phases of brain movement: (*a*) The movement common to arteries (the vascular wave of Mosso) 2-6 per minute. (*b*) Pulse wave 60-80 per minute. (*c*) Respiratory wave (Ecker) 15-20 per minute—the expiratory rise due to jugular vein stasis and increased aortic pressure, and inspiratory fall due to blood suction heartwards.

The behaviour of the cerebro-spinal fluid before this alternate protruding and depressing force, is shown by Quinke, who, from the spinal subarachnoid space, injected with cinnabar the Pacchionian glandulæ, dura mater, sheaths of cerebral nerves, and cervical lymph glands, the pulse and vascular waves travelling from base to apex, and the respiratory one from vertex to base with similar effects, except in expiration, when the venous blood opposes the lymph current. The swelling of the basal walls of the ventricles diminishes while the higher channels are tumid and constricting the ventricles from the vertex shutting off advancing basal fluid, some of which escapes through the foramen of Magendie opposing the cinnabar from the ventricles, a portion of whose fluid is pressed into the veins of the choroid plexus. On the arterial systole reaching the vertex, diastole sets in at the base, preventing the return of the escaped fluid, as well as pushing fluid past the shrunken upper parts into Pacchionian bodies and sinuses, and then into basilar

nerve sheaths and cervical glands. The dilated choroid arteries secrete fluid which prevents the return of that expelled. The cinnabar, it was observed, failed to reach the perivascular spaces, because, says Burckhardt, during systole parenchymatous fluid fills the spaces in a direction opposed to the course of the injection, and during diastole the arteries fill their own spaces and no cinnabar can enter. Subarachnoidal fluid is forced into the subdural space, and from there filtered into veins and sinuses through the Pacchionian prolongations. Burckhardt maintains that the injection experiment of Quinke proves the vascular wave a motor mechanism, designed to carry off waste products through the lymphatics by setting up currents in the brain fluids.

The relation of these movements to sleep may be explained by the theory that attributes sleep to the accumulation of waste products of tissue metabolism, and recent research has shown this to be no mere theory. For the regular uninterrupted vascular peristaltic movements peculiar to sleep lead, says Burckhardt, to increased deportation of waste products, explaining brain restitution during sleep—a view subscribed by Meynert, who claims for lessened consumption but a minor share in the refreshing influence of sleep.

Mendel found nocturnal urine richer in phosphoric acid than that passed during the day. This observation is shown by reference to the accompanying elimination tables, estimated for consecutive periods of 12 hours—"Diurnal" signifying from 6.30 a.m. to 6.30 p.m., and "Nocturnal" from 6.30 p.m. to 6.30 a.m. Wood also observed that the alkaline phosphates of the urine are slightly increased, but the earthy phosphates more decidedly diminished during mental activity.

Mendel considers, therefore, that nerve tissue increases during mental work, and that excitation involves a synthetic chemical process, and, therefore, a decrease of waste products. The nerve current of rest, increased products of chemical decomposition, and the mechanism for the removal of waste products, exist also during sleep (Meynert). On the same authority "sleep implies a universal diminution of activity, but waking by no means implies increased activity of every part of the cortex," nor, let me add, does sleeplessness. For Burckhardt observed that regularity of the vaso-motor wave was peculiar to sleep, while during waking it reflects the faintest activity, or projection from the external world, the complexity in its variations being determined by the character and form of the excitation. Burckhardt observed that during pain the wave was one of prolonged depression, while sudden

fright caused a rapid rise, followed as quickly by a fall (seen also in the median artery of the rabbit's ear). Quiet humorous reading giving a curve of very irregular variations, and elevation arising less from intellectual processes than from emotions. Further, Ditmar, from manometrical measurements of blood-pressure in the carotid artery during sensory stimulation, found increased arterial pressure keep pace with sensation, as is shown by Goltz and Schlesinger in arteries of spinal-cord centres. That is, that vaso-motor systole, or blood-pressure, increases with the painfulness or intensity and duration of the stimulus. For while reflex response to a weak stimulus applied to the skin of a decapitated frog is small and delayed, reply to a stronger stimulus is ample and sudden, demonstrating the relation between stimulus and reflex (in the sense of Meynert's repulsion), the equation, or physiological equivalent of pain, as well as showing that the reflex, or repulsion, depends on the summation of stimuli, which are transmitted in waves, and not on a single impulse (Stirling). For Schiff and others found on impairing conduction through grey matter that burning the skin only gave rise to a sensation of warmth (analgesia). Similarly, Meynert applies the well-known fact that dipping the finger in water at 50° Celsius is attended with a sensation of warmth, while dipping the whole arm or body is attended with pain, the excitation being more numerous and widely spread in grey matter, of which inhibition is a function, and, with blood pressure, is diminished on removal of the cortex, but increased on its stimulation. The impulse or activity, therefore, need not come from an afferent nerve, but may, as, *e.g.*, an emotion, originate in the cerebrum, giving rise to blushing or pallor, for "stimulation of a nerve may produce inhibitory or augmentative effects" (Foster). Red fluid, therefore, and blood produce the same effects on the retina (Meynert), but the inductions or associations called up by the latter are more intense and widespread, just as a painful emotion, or psychical pain, depends on ex- and in-tensity of inhibition, or of irradiation in the association system. Thus Burckhardt found emotion, as being more widely spread, to more intensely influence the vascular wave than thought. We observe, therefore, that the vascular systole, or inhibition (anæmia), keeps pace with painful activities. "Marked inhibition of nervous impulses from the forebrain excites," says Meynert, "like the inhibited conduction of painful sensory stimuli, or the suggestion of torture, a concept of the impossibility of counteracting this inhibition which may ultimately lead to suicide." But suicide or death,

as the reflex of the widest spread inhibition of association, most intense systole, or "extreme concept of repulsion," Meynert considers may simply be intended to ward off destruction from other portions of our individuality, for, he observes, be the actions of men what they may, "avoidance of greater pain is the determining motive."

The experiments of Ditmar, and tracings of Burckhardt, show that diminished blood-pressure, or hyperæmia, follow non-painful activities, as well as show the converse. For the latter observer found the vascular wave raised by a warm bath, but lowered by a cold one, while Goltz shows that the processes and conditions of blood-pressure are opposite, and not existing together. He elicited on gentle stroking the ordinary croak and embracing spasm in the frog, but inhibited both on applying a painful stimulus at the same time; showing that painful and non-painful, as opposed processes, give rise to opposite conditions of blood pressure, the variety and degree depending, in the psychical sphere, on the extent of association called up, and whether active with pleasurable or non-pleasurable concepts. "A new and stronger emotion," says Sir Henry Holland, "will often totally obliterate a weaker one existing before, though the causes of the latter are still actively present; exampled in the voluntary infliction of a momentary pain, as pinching or other strong sensation, to counteract the first access of pain which we know will follow a blow or injury. I recollect," he says, "cases where patients combed the hair to bleeding to obviate some distressing sensation elsewhere, for the mind cannot maintain two impressions simultaneously, and, though the succession in such case may be uniformly pleasurable or painful, still it is sequence, and not coalescence of effects." The same authority considers that the circulation may so act on the nervous system as to produce any degree of sleep, for he regards "changes of circulation in the head as doubtless concerned in all these variations." Sleep, he says, is not a "unity of state," but a series of fluctuating conditions, related, and having close kindred to some disorders of the brain.

Differentiating on the same lines, Maudsley says, "sleep is a fluctuating state, not only of the cerebro-spinal system as a whole, but of its different parts."

The pillow in its varying quantity closely demonstrates this relationship, for we have observed that (1) posture varies the circulation in the head, and (2) that the venous circulation there increases with the degree of sleep. Further, diminished elimination of urinary products, as in anuria, may lead to coma,

or deep and prolonged sleep (Christison). In the accumulation of waste products the cause and motive to sleep is ever present, probably impoverishing the brain of oxygen, exciting a dyspnœtic phase of nutrition by interfering with the respiration of nerve-cells; for as soon as the condition of painful sensations exists a dyspnœtic phase of nutrition is set up (Meynert).

To illustrate the anatomical possibility of endless degree or variation in sleep, we have only to refer to the expansion of the pia mater with its "terminal" vessels (Cohnheim) of nearly equal diameter, laid along association and projection systems (shown by injections), as favouring a functional activity of one set of the centres while others rest (Meynert). But let the centres active be where and what they may, the relations between activity and blood-pressure in the brain remain the same.

Sleeplessness, as a variety of cerebral activity, is attended by an irregular vascular wave, anæmia or hyperæmia of the brain, while sleep, or the systole and diastole of regular rhythm, comes in between the two. Sleeplessness, therefore, from what we have shown, is divisible into two great varieties as it is accompanied by increased or diminished cerebral blood pressure (anæmia or hyperæmia), each variety reflecting its own etiological process of pain or pleasure. It is clear, therefore, that degrees and varieties of insomnia, some of which may be complicated with and allied to other diseases, can have no common remedy, explaining much of the varied and apparently contradictory results obtained from hypnotics—even in the experiences of the same observer. Following, therefore, this classification of sleeplessness, hypnotics also resolve themselves into two great therapeutic groups, according as their pharmacology influences the character of the proximate etiological process, or the cerebral blood pressure, in which the variety of the insomnia is mirrored.

Be, however, the variety or degree of sleeplessness what it may, it is never a safety valve, but frequently an aura of subtle and far-reaching evils, the removal of which, even by "any means," is entreated from every department of literature and experience.

Before making clinical observations on hypnotics (Bacon's "balm of life") the following case is given *in extenso* as illustrating two conditions of insomnia, and, as shown by an appeal to therapeutics, distinct, but yet existing together. R. B., male, æt. 60. Suffering from muscular twitchings, inco-ordination, ataxic gait, exaggeration of reflexes, resistance

to passive movements, tremulous and difficult speech. Bundling and destroying his bed-clothes night and day, and scarcely ever asleep. 18th Nov., 1888, 2.14 p.m.—Given $\frac{1}{160}$ of a grain of the hydrobromate of hyoscin; at 2.35 he is drowsy, but still clutching at the bed-clothes, and the dose is repeated, twelve minutes after which he is asleep, but the muscular twitchings are observed here and there—a slight touch readily eliciting the motor inclination. Easily wakened, he goes to sleep again almost immediately. Pulse 60, full and regular, respirations 20 per minute. Wakened for tea at six, but asleep again at 7.45, when the pupils are sluggish and slightly dilated, and the reflexes seem charged with excitement. Awake at ten, but looking stupid and sleepy, moving his head first one way then another. 19th Nov.—This morning he is wandering about and restless as ever. At 12 noon he gets $\frac{1}{120}$ grain hyoscin. At 1.40 he is lying down, but his limbs actively jerking amongst the bed-clothes, which he fumbles and bundles hither and thither, when he now gets 15 grains urethane. At 2.5 p.m. he is asleep, and the bed-clothes are tucked about him without any resistance. Awake again at 2.35, but quietly looking at the wall, and manifesting no muscular impatience. The muscles are fairly flaccid, resistance easily overcome, and reflexes not so excitable to touch. Slept from three to four o'clock with no apparent muscular twitchings. Restless from six to nine o'clock, when he gets other 15 grains urethane. 20th Nov.—Restless from four a.m., but awake all night. At 11 a.m. he gets 23½ grains urethane, and is left busy with his bed-clothes. At 12.40 he is not asleep, but quietly resting. 21st Nov.—23½ grains urethane repeated last night, after which he slept all night. Urethane discontinued to-day, but hyoscin continued as a night draught, until, on the 8th Dec., the maximum dose of $\frac{1}{80}$ grain is reached. It is finally discontinued on the 15th January, 1889. For twelve of the nights he was on hyoscin he slept all night, but was restless and destructive for the remaining forty-three nights. He became emaciated to a degree, and died from exhaustion on the 14th of March, 1889. A post-mortem examination was not obtained.

Hyoscin given alone induced sleep, but a sleep in harness, for a spasm or movement was nearly as easily elicited on touch as when awake. Urethane induced muscular stillness, or rest, without obliterating the cerebral restlessness. With urethane in combination with hyoscin, however, the spinal-cord impatience subsided, and there was sleep with muscular flaccidity superadded.

Hyoscin.—Hyoscin was discovered by Ladenberg in 1880. In the "Practitioner" for Nov., 1886, Dr. J. Mitchell Bruce has observed concerning it as follows:—Case I.—Hydrophobia with spasms. Result, death. Case II.—Delirium, apparently from hyperpyrexia. Result, recovery. Case III.—Cardiac dilatation, albuminuria, dropsy, and delirium. Result, compensation practically re-established. Case IV.—Pleurisy, empyæma, and alcoholic delirium. Result, success. Case V.—Chronic Bright, hallucinations and delirium. Result, discharged unfit. Case VI.—Acute double pleuro-pneumonia with delirium. Result, recovery. Case VII.—Insomnia with restlessness. Result, failure. Case VIII.—Profound hysteria or dementia, with refusal of food. Result, sent to an asylum unfit. Case IX.—Epileptiform convulsions, with a history of head injury (in combination with bromide). Result fair, but discharged unfit. This last case is a parallel to the case of R. B., with urethane and hyoscin.

Dr. Drapes, in his experiences of hyoscin ("British Medical Journal," April 7th, 1889), concludes something as Dr. Bruce has done. These observations accord with my own experience as far as they have gone, but while the results of these observers were confined, in some of the cases, to one, two, or more applications of the drug, the following is a record of continuous and systematic use over periods of from five to ten weeks, showing the ultimate effects of the drug on habits and nutrition generally.

Throughout these observations the urea is estimated by decomposition with hypo-bromite of soda prepared at the time, and estimating the amount of nitrogen gas evolved (Russell and West).

The phosphoric acid is estimated by a S. S. of uranium acetate, with a solution of ferrocyanide of potassium as an indicator.

CASE I.—Jane A., æt. 19. An excited, sleepless, and acute maniac. 3rd December, 1888—Put on $\frac{1}{100}$ grain hydrobromate of hyoscin at bed-time. 16th—Weight 126lbs., sleeps better, but her food has to be spooned into her. 17th December—Now on $\frac{1}{100}$ grain hyoscin morning and evening. 25th—As a rule she is noisy and restless every night; hyoscin increased to $\frac{1}{50}$ grain twice daily. 1st January—Sleeps for a few hours in the early morning. 16th January—Weight 122lbs. She is destructive, idle, and very untidy in her habits; hyoscin discontinued. 12th February—Works a little in the wards. 20th—Working in wash-house. 28th March—Weight 137lbs. She is clean, tidy, and bright, and fast convalescing. 20th May—Discharged recovered.

Case II.—Annie W., æt. 41; married. Labouring under chronic mania for 14 years. Her treatment included an experience in most hypnotics, croton oil vesication, shower baths, and having her head shaved; but she remained violent, noisy, destructive, and untidy. October, 1879—She is noted as on hyoscyamine, and quieter; and for ten days usefully employed. November, 1888—She crouches naked in the corner of a shuttered room. When bearable she is up, and sits on her haunches in a corner with her dress over her head; but in a moment she may rush along the ward, tossing and knocking over everything moveable; then, as suddenly, squats as before in an opposite corner. She looks pale, wiry, and wild. November 27th—Put on $\frac{1}{100}$ grain hyoscin thrice daily. December 12th—She is calmer since last note, but is now getting wild. Dose increased to $\frac{1}{50}$ grain thrice daily. 14th—Walking beyond the grounds, what she has not done for years. Weight 121lbs. 25th—In bed excited. Her nights vary from noisy all night to slept well. 28th—Wild and dirty as ever, and in bed. January 5th—Hyoscin increased to $\frac{1}{40}$ grain thrice daily. February 1st—Weight 115lbs.; hyoscin discontinued. March—Weight 118lbs. She is on small doses of tinct. opii thrice daily, and she is up part of every day, and frequently the whole day.

Case III.—Elizabeth G., æt. 35; married. She is suspicious, delusional, very abusive, and violent, especially on the entrance of the medical officers, on whom she would make an onslaught tooth and nail if not restrained; when *in furore* she exhausts herself. She belongs to the discontentedly lean, and never takes time to fatten, although her appetite is very fair. She is restless at night, but her habits are tidy, and she sews or knits daily when at her best. 20th November, 1888—Put on $\frac{1}{100}$ grain hyoscin morning and evening; quieter after first dose. 27th November—Quietly muttering to-day. 9th December—Aggressive and violent again. 10th—Dose increased to $\frac{1}{50}$ grain twice daily. 13th December—Quietly winding wool. 18th—Weight 103lbs. 26th—Restless and discontented, but not violent. 16th January—Wild as ever, appetite variable; hyoscin discontinued; weight 97lbs. 1st March—Weight 102lbs. Result, no improvement.

Case IV.—Elizabeth B., æt. 30. Chronic maniac. January, 1888—Shouting, "Oh, the pain in my head!" Her habits are untidy. A course of chloral hydrate was followed by one of hyoscyamine; weight 102lbs. May—Weight 88lbs. September 24th—Hyoscyamine only given occasionally. She is unimproved. November 18th.—Put on $\frac{1}{100}$ grain hyoscin twice daily. November 28th—Conduct unchanged, but quieter at night. December 18th—$\frac{1}{40}$ grain hyoscin hydriodate twice daily substituted. January 5th, 1889—Covered by a canvas rug, she lies naked in the dirty coir teased from her destroyed bed. She tears everything tearable, and is disgustingly dirty. If the door of her room is unguarded, she may rush out, and

break a mirror or window. A $\frac{1}{40}$ grain hyoscin hydrobromate given twice daily; hydriodate stopped. January 9th—Sleeps better, but otherwise is unimproved. April 1st—Weight 92lbs.; hyoscin discontinued. May 3rd—Getting small doses of tinct. opii. She is now up daily, and walking beyond the grounds; weight 96lbs.

CASE V.—Henry E., æt. 50; suffering from acute mania. 13th December, 1888—Weight 146lbs.; sleepless, destructive, noisy, and undressing himself. Given $\frac{1}{100}$ grain of hyoscin as a night draught. 15th—Still noisy, and dose increased to $\frac{1}{80}$ grain. 16th—Slept for six hours last night. 19th—Restless again. 20th—Dose increased to $\frac{1}{60}$ grain morning and evening. 21st—Slept eight hours last night. 29th—He is as excited as ever, and frequently noisy all night. 9th January—Weight 131lbs. 14th January—Never at rest; pokes the fire, knocks things about, talking excitedly and gesticulating, but good natured. Weight 128lbs.; hyoscin stopped. March 1st—Weight 136lbs., but is unimproved. April, 1890—He has acquired untidy habits, but otherwise he remains unchanged.

CASE VI.—John H., æt. 36; married. He is idle, mischievous, and abandoned. 13th December, 1888—Weight 172lbs. He scarcely ever sleeps, and is to-day put on $\frac{1}{100}$ grain hyoscin thrice daily. 15th December—Sleeping better. 24th—Frequently suffers from diarrhœa, and is mentally unimproved. 26th December—Hyoscin increased to $\frac{1}{60}$ grain thrice daily; habits dirty. 29th December—Tears the strongest canvas bed-rugs in the house. 9th January—He is intractable as ever, but sleeps better. 14th January—Weight 159lbs. He refuses his food, which he throws all over the room. 31st January—Secluded for violence. 24th February—Continuously secluded. He speaks coherently, and with deliberation, but is exceedingly cunning and destructive. 20th March—Weight 121lbs. The hyoscin is discontinued to-day, and tinct. opii in small doses substituted. He is getting very feeble, and nightly disembowels his mattress, and sleeps inside it. May 17th—He died from phthisis.

CASE VII.—A. Bell, æt. 23; single. She is now in her third attack of acute mania, talking and gesticulating incessantly. 5th September, 1888—Weight 120lbs. She is noisy every night, and her habits untidy, destructive, and indecent. 10th December—Given $\frac{1}{100}$ grain hyoscin at night. 16th—She is up for a few hours daily, but as excited as ever. 17th—Weight 104lbs. 18th—Hyoscin increased to $\frac{1}{60}$ grain every evening. 26th—She goes to sleep about half-an-hour after her draught, and sleeps from three to four hours. Weight 108lbs. 1st January—Restless every night. 16th January—Weight 111lbs.; hyoscin discontinued. 1st February—Weight 126lbs. 27th—She is idle, but clean in her habits. 4th April—She works in the laundry. April, 1890—Working there still, but is now a silent dement.

CASE VIII.—Anchor. T., male, æt. 38. Suffering from chronic mapia for 14 years, with exacerbations of excitement, when he tears

the strongest canvas to shreds. He is noisy, and dirty in his habits. 15th December, 1888—He is at the height of excitement, and altogether like a wild beast. 12.40 p.m.—Given $\frac{1}{60}$ grain hyoscin; at 1.10 he is quiet, and at 1.40 asleep. 6 p.m.—Getting excited as ever, and is given another $\frac{1}{60}$ grain, ten minutes after which, while pulling a picture from the wall, he fell back in what seemed a genuine epileptic fit, with a momentary apparent loss of consciousness. He slept from 6.30 to 8 p.m. At 9.30 his temperature is F. 99°, and pulse 96—regular and full; pupils large and sluggish; skin moist, and no sign of collapse. He seems very drowsy. He went to sleep at 10, and slept for seven hours. 16th—Talking and gesticulating, but much subdued. 20th—Weight 152lbs.; hyoscin $\frac{1}{60}$ grain continued every evening. 30th—Sleeps, on the whole, fairly well. 14th January—He is up daily, and very quiet; weight 149lbs.; hyoscin discontinued. When 17 years of age he had one fit, but there is no record of any since. April, 1890—Unimproved and hopeless.

Case IX.—Elizabeth D., æt. 50, widow. Suffering from melancholia. For months she sits idle all day, wishing for death. She had been on hyoscin and paraldehyde, but without much apparent benefit. The further record of the observation is found on Table I.

According to Clouston, hyoscin is a type of a cortical motor depressant, while Leech observes that it is, in cases of sleeplessness with delirium, as is well known, that hyoscin is often used with such great advantage, especially where great mental disturbance is accompanied by considerable excitement of the circulation. Hyoscin is capable of paralyzing all brain excitement, but not, especially when used systematically, of giving that rest in which mind tissue heals.

Its best reputation is acquired when the necessity for continuing it disappears on a few applications. Systematic use is, however, difficult to avoid, as toleration is early acquired. There was an almost universal loss of weight, which, however, was most marked in acute maniacs, and probably from impaired appetite. By the time the drug was discontinued, the greater number of these cases were idle, and untidy in their habits; those who were untidy to begin with becoming more so. This degradation takes place comparatively suddenly in young cases, and particularly so when they are acute and recent. In the chronic and old it is more insidious and less apparent, but equally certain. These disadvantages were, in some instances, recovered from on withdrawing the drug. From these observations, therefore, hyoscin, it may be observed, is an allayer of mental excitement rather than of motility, which, however, becomes depressed secondarily, or as a consequence.

Table I.

Elizabeth D., æt. 50; Melancholia.

"Diurnal"—6.30 A.M. to 6.30 P.M.														"Nocturnal"—6.30 P.M. to 6.30 A.M.										In the 24 Hours.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp.		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of Urine.	Phosphates.	Urea.
	Solids.	Fluids.						9 a.m.	1 p.m.	9 a.m.	1 p.m.	9 a.m.	1 p.m.									7 p.m.	7 p.m.	7 p.m.			
1890	Grms.	C.C.	C.C.			Grms.	Grms.							1890.	Grains.	C.C.			Grms.	Grms.	Hours				C.C.	Grms.	Grms.
Apl. 18			242	Acid	1526	·50	8·							Apl. 18-19	None	426	Acid	1021	·44	7·7					668	·94	
,, 19			227	,,	1022	·35	5·3							,, 19-20	,,												
,, 20														,, 20-21	,,												
,, 21														,, 21-22	,,	511	Acid	1015	·42	8·1							
,, 22	793	750	539	Acid	1013	·35	6·1							,, 22-23	,,	454	,,	1018	·50	8·2					993	·85	14·3
,, 23	,,	,,	156	,,	1029	·31	4·6							,, 23-24	,,	383	,,	1022	·59	9·6					539	·90	14·2
,, 24	,,	875	369	,,	1020	·31	6·7							,, 24-25	,,	314	,,	1026	·61	11·					683	·92	17·7
,, 25	765	,,	262	,,	1021	·44	6·7							,, 25-26	,,	552	,,	1017	·82	10·					814	1·26	16·7
,, 26	,,	,,	430	,,	1019	·63	8·2							,, 26-27	,,	436	,,	1019	·87	9·4	7				864	1·5	17·6
,, 27	,,	,,	500	,,	1017	·65	7·9							,, 27-28	,,	320	,,	1031	·75	9·1	none				820	1·4	17·
,, 28	737	874	440	,,	1016	·48	7·1							,, 28-29	,,	350	,,	1032	·74	11·9	6				790	1 22	19·
,, 29	793	1000	578	,,	1024	·93	13·8							,, 29-30	,,	524	,,	1019	·47	8·9	7				1102	1·4	22·7
,, 30	850	750	530	,,	1015	·46	8·9	97·6	97·8	89	94	24	22	Ap. 30, My. 1	,,	360	,,	1014	·83	10·2	8	97·8	98	17	890	1·29	19·1
May 1	,,	800	294	,,	1021	·45	8·	97·4	97·6	96	98	18	20	May 1-2	,,	250	,,	1022	·60	8·8	6	98·	96	19	544	1·05	16·8
,, 2	737	900	650	,,	1017	·93	12·6	97·6	97·6	98	99	17	19	,, 2-3	,,	600	,,	1021	·96	13·9	7	97·8	98	20	1250	1·89	26·5
,, 3	680	750	498	,,	1022	·55	12·4	97·2	97 8	116	106	28	19	,, 3-4	Hyoscin $\frac{1}{120}$	460	,,	1020	·72	11·2	8	97·8	100	28	958	1·57	23·6
,, 4	,,	,,	306	,,	1025	·70	8·7	97·	96·6	99	96	19	21	,, 4-5	,, $\frac{1}{120}$	266	,,	1023	·81	10·5	4	97·2	105	24	572	1·51	19·2
,, 5	793	,,	312	,,	1025	·63	9·5	97·2	97·4	100	106	23	26	,, 5-6	,, $\frac{1}{120}$	194	,,	1026	·40	5·9	3	98·2	98	26	506	1·03	15·4
,, 6	680	,,	436	,,	1026	·95	12·9	97·8	97·8	100	108	20	21	,, 6-7	,, $\frac{1}{120}$	508	,,	1016	·76	10·6	6	97·8	98	26	944	1·71	23·5
,, 7	737	,,	224	,,	1032	·64	8·9	97·8	97·8	100	104	24	20	,, 7-8	,, $\frac{1}{120}$	460	,,	1017	·76	11·9	7	97·2	98	23	684	1·4	20·8
,, 8	765	,,	380	,,	1020	·66	9·3	97·4	96·8	100	104	23	22	,, 8-9	,, $\frac{1}{120}$	242	,,	1030	·81	9·1	5	98·4	94	24	622	1·47	18·4
,, 9	793	800	396	,,	1027	1·10	13·4	97·8	97 2	98	98	22	24	,, 9-10	,, $\frac{1}{120}$	246	,,	1032	·85	10·9	6	98·	99	21	642	1·95	24·3

TABLE I.—*(Continued.)*

"DIURNAL"—6.30 A.M. TO 6.30 P.M.														"NOCTURNAL"—6.30 P.M. TO 6.30 A.M.										IN THE 24 HOURS.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of Urine	Phosphates.	Urea.
	Solids.	Fluids.						9 a.m.	1 p.m.	9 a.m.	1 p.m.	9 a.m	1 p.m.									7 p.m.	7 p.m.	7 p.m.			
1890.	Grms.	C.C.	C.C.			Grms.	Grms.							1890.	Grains.	C.C.			Grms.	Grms.	Hours				C.C.	Grms.	Grms
May 10	793	800	364	Acid	1023	·72	10·2	97·6	97·8	98	94	22	20	May 10-11	Hyoscin $\frac{1}{100}$	572	Acid	1015	·71	10·4	7	98·	100	23	936	1 43	20 6
,, 11	822	,,	444	,,	1017	·67	9·6	98·	97·8	108	100	34	24	,, 11-12	none	416	,,	1020	·65	11 8	8	97·8	98	25	860	1·32	21·4
,, 12	850	,,	442	,,	1018	·61	9·1	97·4	97·4	103	100	18	20	,, 12-13	,,	292	,,	1032	·71	10·6	8	97·6	100	23	716	1 32	19·7
,, 13	,,	,,	574	Alk.	1020	·74	11·2	97·	97·8	96	105	27	24	,, 13-14	,,	554	,,	1015	·81	10·7	7	97·8	97	23	1128	1 55	21·9
,, 14	,,	,,	596	Acid	1016	·64	8·8	97·4	97·	96	91	23	20	,, 14-15	,,	314	,,	1025	·70	10·5	7	97·4	93	23	910	1·34	19·3
,, 15	,,	,,	658	,,	1017	·90	12·3	97·2	97·	98	94	20	20	,, 15-16	Hyoscin $\frac{1}{100}$	550	,,	1017	·85	11·	8	97·4	90	22	12·8	2	23·3
,, 16	737	,,	385	,,	1020	·66	8·7	97 2	96·8	98	92	22	20	,, 16-17	,, $\frac{1}{100}$	582	,,	1015	·82	10·	4	97·6	89	24	967	1 48	18 7
,, 17	793	900	448	,,	1018	·68	8·7	97·2	97·4	94	88	20	24	,, 17-18	,, $\frac{1}{100}$	570	,,	1014	·84	8·4	6	97·4	90	23	1018	1·52	17·1
,, 18	,,	850	570	,,	1015	·74	8·3	97·2	97·	88	75	20	18	,, 18-19	,, $\frac{1}{100}$	580	,,	1013	·84	8·3	8	97·6	98	26	1150	1·58	16 6
,, 19	,,	,,	480	,,	1017	·89	8·6	97·8	97·2	96	92	26	18	,, 19-20	none	500	Alk.		·90	9·6	7	98	92	20	980	1 79	8·2
,, 20	,,	800	452	,,	1016	·67	10·5	97·2	97·	96	98	20	21	,, 20-21	,,	384	Acid	1024	·80	12·2	6	97 8	94	24	836	1·47	22·7
,, 21	,,	,,	582	,,	1016	·69	11·2	97·2	97 8	98	92	23	21	,, 21-22	,,	456	,,	1015	·68	10·7	8	97·6	88	24	1038	1 37	22·9
,, 22	,,	,,	462	,,	1020	·81	10·5	97·4	97·8	100	98	19	23	,, 22-23	Paraldehyde 60 m	542	,,	1015	·74	10·5	5½	98·4	100	24	1004	·55	21·
,, 23	,,	,,	376	,,	1021	·78	11·1	97·4	97·	100	96	24	24	,, 23-24	,,	474	,,	1014	·76	8·9	9	97·8	94	26	850	1 54	20·
,, 24	,,	,,	372	,,	1022	·78	11·8	97·2	97·8	98	96	22	23	,, 24-25	,,	440	,,	1019	·72	11·2	5½	97 8	98	26	812	1 50	23·
,, 25	,,	,,	516	,,	1015	·60	9·7	97·2	97·	100	90	26	21	,, 25-26	,,	704	,,	1010	·76	9 7	7	98·	98	24	1220	1·36	19·4
,, 26	,,	,,	370	,,	1020	·62	9·2	97·4	97·4	90	84	26	22	,, 26-27	none	558	,,	1015	·58	7·7	8	97·4	96	20	928	1·20	16·9

NOTES TO TABLE I.

April 19th. Nocturnal urine lost; April 20th. No collection of urine made; April 21st. Diurnal urine lost; April 22nd Patient very miserable and unemployed; April 23rd. Appetite fair; May 5th. Restless at night; May 10th. No change; May 16th. Seems, if possible, more miserable; May 21st. No change; May 23rd. Almost refuses her medicine; May 25th. Takes her medicine only in presence of stomach tube.

N.B.—No medicine was given during the day from April 18th to May 26th.

It may further be observed that while the urea is diminished, the phosphates are slightly increased.

Urethane.—The therapeutic action of this drug is already clearly demonstrated in combination with hyoscin in the case of R. B., where, by contrast, the sedative or hypnotic action of the two drugs is manifestly different in kind—from a probable preference for different foci of activity.

The characteristic action of urethane finds demonstration in the experiments of Coze, who found that rabbits under its influence could stand large doses of strychnine. Jackmann used it successfully when chloral hydrate failed in the treatment of a case of traumatic tetanus, and the following cases extend its application in the same direction :—

Case I.—Catherine E., æt. 13; an epileptic imbecile. The few words of her vocabulary are used irrelevantly. Her gait is staggering. Fits followed scarlatina six years ago, and she has had no fewer than six in twenty-four hours since; and frequently a bout of twenty to forty. 30th March, 1889—Given two grains urethane thrice daily. 9th April—Dose increased to 8¼ grains thrice daily. 18th—Fits fewer and less severe. 30th—Fits ceased, and urethane discontinued. 2nd May—She has had eight severe fits this morning. 4th—Given five grains bromide of potassium thrice daily. 6th June—Fits average two in the twenty-four hours. 10th June—Fits average six in the twenty-four hours. 14th—She is in a severe bout; fit succeeds fit with an almost continuous coma. She has had two enemata of chloral hydrate and bromide, but the fits are not subdued. 15th June—Patient died.

Case II.—George R. R., married, æt. 38. Suffering from acute mania, muscular excitement, and nervousness. 3rd May, 1887—He has not slept for five nights, but a hyoscyamine draught last night was followed by six hours' sleep. This morning he is excited and restless, but looks exhausted. His tongue is dry, appetite poor, and thirst considerable. At 3 p.m. he is given 20 grains of urethane, and other 20 grains at 7 p.m., and 20 at 10.45 p.m. 5th—He slept six hours last night. His appetite is improved, and he is put on 20 grains urethane thrice daily. 6th—He slept well last night, and is quiet and taking all his food to day. 7th—Urethane increased to 25 grains thrice daily. 8th—Quieter to-day; he answers questions; the muscular excitement is almost gone, and his appetite is excellent. He says the medicine is cinchona. 10th—Urethane discontinued. 10th June—He is working in the grounds daily. 22nd—Discharged recovered, and in good bodily health.

Case III.—Annie B., æt. 38, married. She is as a rule stupid and incoherent, and an epileptic for the last ten years. During and after a bout she is either maniacal or very stupid. The number of fits recorded on Table IV., before the urethane was begun, gives a

Table II.

Annie B.; æt. 38; Epilepsy.

"Diurnal"—6.30 A.M. to 6.30 P.M.														"Nocturnal"—6.30 P.M. to 6.30 A.M.										In the 24 Hours.			
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Fits.	Temp.		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Fits.	Sleep.	Temp.	Pulse.	Resp	Quantity of Urine.	Phosphates.	Urea.	Fits.
	Solids.	Fluids.							9 a.m.	1 p.m.	9 a.m.	1 p.m.	9 a.m.	1 p.m.										7 p.m.	7 p.m.	7 p.m.				
1890	Grms.	C.C.	C.C.			Grms.	Grms.								1890	Grains.	C.C.			Grms.	Grms.		Hours				C.C.	Grms.	Grms.	
May 2	737	1060	686	cid	1018	·97	14·	1	96·8	97·4	72	80	18	16	May 2-3	None	534	Acid	1021	·78	9·1	1	8	98·	78	16	1220	1·75	23·1	2
,, 3	793	1250	232	,,	1022	·32	4·7	1	97·8	98·	74	80	20	22	,, 3-4	,,	1016	Alk.	1010	·75		2	8	97·2	80	22	1242	1·07		3
,, 4	765·4	1000	318	,,	1026	·66	6·	none	97·4	97·6	82	80	23	19	,, 4-5	,,	638	Acid	1015	·90	9·1	none	8	98·2	76	20	956	1·56	15·1	none
,, 5	850	900	388	,,	1026	1·02	11·	,,	97·	97·6	74	76	19	20	,, 5-6	,,	642	,,	1015	·75	9·2	1	9	96·8	72	21	1030	1·77	20·2	1
,, 6	793	900	400	,,	1025	·81	8·3	1	97·4	97·4	82	80	22	24	,, 6-7	,,	898	,,	1013	81	9 4	none	7	97·8	82	20	1298	1·62	17·7	1
,, 7	,,	,,	180	,,	1025	·53	5·	1	97·	97·2	68	76	21	20	,, 7-8	,,	482	,,	1018	·65	6·1	,,	8	98·2	80	15	662	1·18	11·1	1
,, 8	737	1000	356	,,	1016	·42	6·2	1	97·2	97·4	76	82	21	22	,, 8-9	Urethane 10	784	,,	1011	·78	14·8	1	7	98·	82	22	1140	1·20	21·	2
,, 9	765	,,	618	,,	1016	·83	10·1	2	97·8	98·2	80	82	21	21	,, 9-10	,, 10	668	Alk.	1012	·64	8·8	none	5	97·8	82	18	1286	1·47	18·9	2
,, 10	828	,,	422	,,	1015	·40	5·9	none	98·	98·4	78	82	22	21	,, 10-11	,, 10	900	,,	1011	·54	7·1	1	7	97·4	78	18	1322	1·11	13·	1
,, 11	850	,,	446	,,	1016	·59	9·1	1	97·6	97·8	72	80	22	22	,, 11-12	,, 10	636	,,	1012	·59	7 9	none	9	97·8	84	20	1112	1·18	17·	1
,, 12	737	,,	300	,,	1019	·29	6·7	1	98·4	98·6	80	80	23	24	,, 12-13	,, 30	1120	,,	1011	·64	10·2	,,	7	97·6	82	20	1420	·93	16·9	1
,, 13	661	900	360	,,	1017	·45	6·1	2	97·6	97·6	74	81	20	23	,, 13-14	,, 30	708	,,	1013	·56	8·4	,,	5	97·4	75	22	1068	1·01	14·5	2
,, 14	,,	,,	480	,,	1015	·44	6·5	1	97·	98·	73	80	20.	23	,, 14-15	,, 30	312	,,	1019	·43	4·1	2	5	98·	76	22	792	·87	10·6	3
,, 15	,,	,,	514	,,	1015	·60	7·2	none	97·6	99·4	78	84	21	19	,, 15-16	,, 30	500	Acid	1015	65	7·4	none	6	98·4	82	19	1014	1·25	14·6	none
,, 16	623	750	236	,,	1023	·49	6·4	,,	98·	98·6	78	80	22	21	,, 16-17	,, 30	840	Alk.	1010	·75	7 6	,,	7	97·4	77	22	1076	1·24	14·	,,
,, 17	,,	,,	466	,,	1018	·64	8·8	,,	98·2	98·4	76	80	18	21	,, 17-18	,, 30	242	Acid	1020	·59	4·6	,,	5	97·8	78	15	708	1·23	13·4	,,
,, 18	,,	900	396	,,	1019	·76	8·	,,	98·4	98·6	78	81	23	21	,, 18-19	,, 30	734	,,	1010	·68	8·3	,,	6	97·	74	20	1130	1·44	16·3	,,
,, 19	661	,,	420	,,	1018	·58	7·8	,,	98·2	99·	82	84	21	22	,, 19-20	,, 30	574	,,	1014	·63	6 5	,,	8	98·2	80	19	994	1·23	14·3	,,
,, 20	,,	,,	430	,,	1013	·35	6·3	,,	97·6	98·6	70	80	21	19	,, 20-21	,, 30	882	,,	1010	·53	7·4	,,	7	97·4	78	22	1312	·88	13·7	,,

fair account of their frequency since her admission six months ago. The urethane was only given at night, and after the third dose of 30 grains she had no nocturnal fits, while the day ones certainly lost their severity. She is now never incoherent, she knits or sews, and walks out daily, and her memory is good. She takes an interest in her surroundings and in current events. I feel sure that a similar dose during the day would diminish or entirely subdue the day fits also.

As shown by the experiments of Coze and Gordon, urethane diminishes the spinal reflexes and peripheral sensation. Urea is slightly increased by small doses, as was shown by Gordon, but diminished by large ones. The phosphoric acid is always diminished—its diminution, within certain limits, keeping pace with the dose; fits, as seen from the table, similarly affecting its elimination, while they have an increasing or opposite action on the urea. The temperature, pulse, and respiration are diminished on large, but not appreciably affected by small doses. No sickness, diarrhœa, or loss of appetite was observed from its use, but in some cases the appetite was certainly improved. Urethane, in its therapeutics, it may be observed, is closely allied to the bromides. In my experience all hypnotics in large doses depress the heart's action, and with the exception of sulphonal, reduce the temperature. Even the latter drug in continuous and large doses is no exception to the rule. The action on the heart may explain the curve of urinary excretions, an action probably diastolic, or opposed to that of the digitalis group. This latter observation probably applies to all the so-called hypnotics referred to in this paper.

The indications of urethane, it may be observed, therefore, are found in the milder forms of irritability of the nervous system, exaltation of function, fidgets, epilepsy, and the insomniæ associated with these conditions.

Opium.—The historic "Gift of God" has entered upon a new trial—not as a competitor, however, for it has probably no compeer, but to erase from its record alleged disadvantages that mar its reputation, and narrow its hopes and uses; it still tops the list as a hypnotic, and experience but widens the field of its application while other hypnotics pass away.

Case I.—John C., married, æt. 50, suffering from mitral and aortic disease, with great cardiac irregularity, sleeplessness, and dyspnœa. He sits propped up in bed night and day, with coat and vest off, and shirt unbuttoned. His limbs are œdematous, and he looks sallow, distressed, and exhausted. 17th Sept., 1888—Put on 5 ♏ doses each of tincts. opii and digitalis. After the third dose he is sitting

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up and dressed. The digitalis is discontinued. There is an apparent relief to the breathing, and the heart is steadier and less irritable, but still irregular. 18th—Given ½ grain of opium and 5 ♏ tinct. digitalis at bedtime. 19th—Slept four hours last night. This morning the breathing is much relieved, and the fluttering discomfort over the heart is very slight. 20th—He is dressed, sitting in a chair, for he cannot stand without support; his facial expression, however, is comfortable. Yesterday he said he was dying, but to-day he is hopeful and cheery; his appetite is improved, and the œdema disappearing. He gets opium thrice daily. 11th Nov.—Still on opium. He walks to the dining room unassisted, although with difficulty. 23rd—Discharged mentally recovered.

The deep-seated pressure is diffused, and the heart stimulated, partly from acting under more favourable conditions. The dropsy and sense of impending death disappear, and the nervous system becomes relieved of the constant irritation of an irregular pulse-wave.

Case II.—William D., æt. 75. A feeble and noisy chronic maniac or dement. The inner lower surface of left leg is covered by an enormous foul-smelling ulcer of 20 years' standing. June, 1886—Iodoform dressing and rest in bed lessened this surface, and the suppurating points are nearly healed, and at the end of August he left his bed. Dec.—Resting in bed again. The ulcer is not yet healed, and the œdema in its neighbourhood is considerable. Feb., 1887—Sitting up again. March—The ulcer is broken down and foul-smelling as ever. Appetite poor and general health feeble. His nights, almost invariably, are noisy. April 26th—He is put on 45 ♏ paraldehyde as a night draught. May 1st—Getting one grain of opium at night. 3rd—30 ♏ tinct. is substituted. He sleeps and rests better. June—Getting as many as 60 ♏ tinct. opii every evening. The ulcer is healed, his appetite is good, and he moves about the airing court daily; good-natured and cheery. 8th. Oct.—Opium discontinued. Dec. 1st—He is very feeble and the ulcer completely broken down. His appetite is poor, and he never leaves his bed. 6th Jan.—Still in bed, and the ulcer improved, but not healed. 27th—He is up a little occasionally. 20th Feb.—Died from pneumonia.

The paraldehyde had no apparent effect, but for the five months he was on opium the ulcer remained healed, and he was up daily. Two months after it was stopped, the ulcerated surface again broke down.

The healing of the ulcer may be partly explained by the removal of the chronic starvation that may have helped to keep it open.

Case III.—C. M., female, æt. 15, suffering from typhoid. Even-

ing temperature as high as 104°F. Stools about six per diem; intestinal pain considerable; pulse 120-140; skin dry, but extremities clammy, with severe headache and distressing sleeplessness. Given ½ grain opium, made into pill form with bread crumb, every four hours. After the third pill the skin became active, the diarrhœa restrained, the pulse soft and diminished in frequency, and a refreshing sleep was enjoyed when it was most needed.

CASE IV.—Sarah B., single, æt. 21, suffering from acute rheumatism, pericardial effusion, headache, severe tinnitus, irregular breathing, and great want of and desire for sleep. Given a pill containing one grain of opium and three of calomel every three hours until sleep was induced. The relief became apparent after the second pill; the head symptoms and joint pains becoming less severe, breathing slower and more regular, pulse soft, heart less energetic, and the patient slept quietly.

This combination seems to have a special indication in conditions of pyrexia, when headache or noise in the head is complained of, and is aggravated or caused by too energetic cardiac action. In the cases of chronic mania in which hyoscin failed, the success obtained from opium, it will be observed, is unapproached by that of any other drug used. In painful conditions it searches out the seat of unrest almost wherever it is, and frequently restores the break in the physiological unity. In the insomnia and miseries of senility, its sleep more closely approaches that of health, while the body weight frequently increases as evidence of the improvement in nutrition.

To the digestion, in such cases, it is soothing, and, it may be, stimulating, especially when that function is long established and habituated to a variety of conditions. The circulation is more equably distributed, especially in cases of atheromatous and relatively impermeable blood vessels, where the resiliency that adapts itself to the heart's beat is lost or modified.

Dr. Stephen Mackenzie, in a paper on the treatment of chronic uræmia by morphine, read before the Medical Society of London, claimed to have got good results from morphine in uræmic dyspnœa. Dr. Loonns, who among American physicians has made this practice his own, records a case of complete uræmic coma in which he administered ½ grain of morphine in a single dose with good results. "In no instance," he says, "am I aware that I have caused a fatal narcotism."

Mr. Alfred Grace reports two cases of puerperal convulsions treated by morphine; a first injection of one grain was followed by a second of nearly that dose. Both made a perfect recovery. In the discussion on Dr. Stephen Mackenzie's

TABLE III.—WILLIAM S.; æt. 50; Chronic Bright's, and Melancholia with delusions.

Date.	Medicine.	Urine passed in 24 hours.	Reaction.	Specific gravity.	Urea.	Albumen.	REMARKS.
1889.	Grains.	C.C.			Grms.	Grms.	
June 21	None	1306	Alk.	1018	23·8	23·3	Considerable debility and dyspnœa
,, 22		1448	,,	1019	24·1	20·4	
,, 23		1930	,,	1017	32·1	23·3	
,, 24		1817	,,	1012	18·2	26.1	
,, 25		1646	Acid	1016	21·6	—	
,, 26		1604	Alk.	1017	23·4	—	
,, 27		1774	Acid	1010	21·	45·8	
,, 28		1618	,,	1015	24·	—	
,, 29		2385	,,	,,	31·5	33·6	
,, 30		1831	,,	,,	21·7	22·7	
July 1		3009	,,	1011	30·	30·5	
,, 2	Opium 1½	2655	Alk.	1014	26·	61·3	
,, 3	,,	2214	Acid	1016	27·7	24·6	
,, 4	,,	1987	,,	1017	27·6	35·5	
,, 5	,,	3151	Neut.	1011	33·	35·5	
,, 6	,,	2087	Acid	1018	30·9	29·9	
,, 7	,,	2413	,,	1015	30·2	51·	
,, 8	Opium 3	709	,,	1019	13·7	3 9	Purged four times; urine for 12 hours lost during night
,, 9	,,	1490	,,	1017	21·4	10·9	
,, 10	,,	1774	,,	1016	24·3	20·5	
,, 11	,,	1490	,,	,,	22·1	9·2	
Aug. 21	None	2995	,,	1010	22·5	24·	
,, 22	,,	3166	Alk.	1009	28·1	20·	
,, 23	,,	2541	Neut.	1011	24·3	18·2	
,, 24	,,	3293	Acid	1009	30·	42·6	
,, 25	,,	3379	Alk.	1009	26·9	23·3	Legs œdematous
,, 26	,,	2626	Acid	1012	23·9	11.8	Slightly jaundiced
,, 27	,,	3123	,,	1010	24·9	7·4	Weight 12st. 7lbs.
,, 28	Morphine ¼	2555	,,	1010	22·7	24·5	Doing a little work.
,, 29	,,	2186	,,	1012	23·9	25·8	
,, 30	,,	1732	,,	1013	22·5	20·7	Perspiring freely; appetite good, and thirst not increased.
,, 31	,,	1632	,,	1012	22·7	17·2	
Sept. 1	,,	1547	,,	1012	20·4	3·5	No constipation
,, 2	,,	1036	,,	1016	18·4	13·5	Purged three times during the night
,, 3	,,	1746	Alk.	1009	19·9	8·8	Weight 12st. 11½lbs.; slightly purged
,, 4	None	1277	,,	1012	13·9	12·	Œdema increased
,, 5	,,	1717	,,	1011	21·5	18·1	
,, 6	,,	2101	,,	1010	20·1	13·9	
,, 7	,,	1717	,,	1010	17·6	18·1	
,, 8	,,	1533	,,	1014	18·5	11·	
,, 9	,,	1476	,,	1015	16·8	19·1	Not able to work
,, 10	,,	1760	,,	1014	17·6	7·9	Weight 13st. 11lbs.
,, 11	Mag. Sulph. after meals 20 thrice daily	1604	,,	1018	23·4	8·5	
,, 12	,,	1590	,,	1017	23·5	19·7	Slightly purged twice
,, 13	,,	1604	,,	1017	25·6	24·1	
,, 14	,,	2158	,,	1014	28·	18·8	
,, 15	,,	2314	,,	1014	26·9	12·	
,, 16	,,	2186	,,	1015	25·9	11·7	
,, 17	,,	2782	,,	1014	26·	39·9	Weight 13st. 3lbs.
,, 18	Mag. Sulph. 20 before meals thrice daily	2200	Acid	1014	26·1	31·6	
,, 19	,,	2058	,,	1017	29·5	31·	
,, 20	,,	1973	,,	1017	27·	38·	Mentally not so well
,, 21	,,	1916	Alk.	1016	23·6	26·4	
,, 22	,,	2371	,,	1017	30·8	20·	

TABLE III.—*(Continued.)*

Date.	Medicine.	Urine passed in 24 hours.	Reaction.	Specific gravity.	Urea.	Albumen.	REMARKS.
1889.	Grains.	C.C.			Grms.	Grms.	
Sept. 23	thrice daily	2087	Alk.	1018	27·6	11·1	
,, 24	,,	1760	Acid	1021	28·5	18·8	Weight 12st. 11lbs.
,, 25	20 after meals concentrated	1689	,,	1019	28·1	18·8	Œdema almost gone
,, 26	,,	1732	,,	1018	25·6	42·4	Commenced work
,, 27	,,	1504	,,	1018	20·6	20·5	
,, 28	,,	2101	Alk.	1016	23·9	31·6	
,, 29	,,	2371	,,	1015	26·5	20·7	
,, 30	,,	1817	Acid	1019	26·9	40·1	
Oct. 1	,,	1760	,,	1018	26·5	33·2	Weight 13st.
,, 2	20 before meals concentrated	1760	Alk.	1016	22·1	11·6	
,, 3	,,	2243	Acid	1016	27·1	32·2	
,, 4	,,	1519	Alk.	1021	25·6	19·4	
,, 5	,,	1604	,,	1019	26·4	23·	
,, 6	,,	2170	Acid	1018	32·6	35·8	
,, 7	,,	1930	Alk.	1017	28·6	24·2	
,, 8	,,	1902	,,	1020	32·1	7·7	Weight 12st 12lbs.
,, 9	40 concentrated	1817	Acid	1020	26·9	24·8	
,, 10	,,	1519	,,	1020	23·5	22·8	Purged slightly twice
,, 11	,,	1490	Alk.	1022	23·8	16·1	
,, 12	,,	1660	Acid	1022	28·2	14·5	
,, 13	,,	1703	Alk.	1021	25·2	24·4	Purged slightly twice
,, 14	,,	1774	,,	1019	24·3	22·5	
,, 15	,,	1817	,,	1020	23·2	22·2	Weight 12st. 7lbs.; slightly purged twice
,, 16	40 double previous concentration	1206	,,	1021	17·9	16·8	Œdema scarcely apparent anywhere
,, 17	,,	1831	,,	1018	28·4	27·6	
,, 18	,,	1533	,,	1018	26·2	22·4	
,, 19	,,	1689	Acid	1020	25·4	40·6	
,, 20	,,	2782	,,	1010	25·4	16·4	
,, 21	,,	2143	Alk.	1013	29·3	30·8	
,, 22	,,	2697	,,	1010	25·8	23·5	12st. 10lbs.
,, 23	None	2200	Acid	1012	20·	34·7	
,, 24	Caffeine 6	2541	,,	10.0	26·	38·6	
,, 25	,,	3180	,,	1017	23·2	14·3	
,, 26	,,	2158	,,	1010	14·7	5·1	Micturition increasing in frequency
,, 27	,,	2924	,,	1010	26·6	13·5	
,, 28	,,	2569	,,	1010	20·5	31·4	Thirst considerable
,, 29	,,	3918	,,	1008	26·8	38·6	
,, 30	Caffeine 6	3194	,,	1006	25·5	28·8	Weight 12st. 12lbs.
,, 31	None	3180	,,	1009	29·	19·7	
Nov. 1	,,	3151	,,	1007	24·4	24·4	
,, 2	,,	4117	,,	1007	28·1	29·5	
,, 3	,,	3393	Alk.	1005	26·3	30·5	Slightly purged
,, 4	,,	3208	,,	1008	14·6	22·1	Some urine lost
,, 5	,,	3265	Acid	1007	20·8	26·6	
,, 6	,,	3663	,,	1011	25·	42·8	Weight 13st. 4lbs.
,, 7	,,	3024	,,	1007	20·7		
,, 8	,,	3663	,,	1007	25·	29·9	
,, 9	,,	3492	,,	1008	26·1	34·4	
,, 10	,,	2669	,,	1010	15·2	15·4	Some urine lost
,, 11	,,	2598	,,	1010	17·7	13·5	
,, 12	,,	1902	,,	1007	9·5	15·5	
,, 23	Tr. Strophanth 7½m.	3336	Alk.	1006	18·2	18·3	No collection made here
,, 24	,,	3364	,,	1008	15·3	17·1	
,, 25	,,	3251	,,	1007	14·8	17·8	
,, 26	,,	3833	,,	1008	18·3	22·6	
,, 27	,,	2683	,,	1010	12·2	38·5	Part urine lost
,, 28	,,	2072	,,	1010	12·7	14·8	Large part of urine lost
,, 29	,,	752	,,	1007	4·2	7·7	Part urine lost

paper, Dr. C. Theodore Williams mentioned a case in which morphine had been given before the diagnosis of eclampsia was made, and apparently, he adds, with benefit, although it was kept back as contraindicated. There was no reference, however, made, in that discussion, to the action of the opiate treatment on the excretion of albumen. The following observation was made to show this action, as well as the effects of the opiate treatment on the urine, in a case of the variety referred to :—

Case V.—William S., æt. 50, suffering from chronic Bright's, with delusions, accusing his neighbours at home of operating on him with telephones, galvanic batteries, and electric machines. He is big-boned and muscular. There is evidence of an old severe compound fracture of the lower third of both bones of the left leg. After a series of experimental urinary testings, the following method was taken throughout the observation, as throwing down most albumen. To two drachms of urine were added 10♏ of strong nitric acid, and heated to boiling point. The albumen was filtered, dried, and weighed on filter paper of known weight. There was no attempt made to separate the albumen from the inorganic constituents, the observation being a relative one. The results are detailed on Table III. The patient died on 10th Dec., 1889. The kidneys weighed, right 12oz. and left 12½oz. The lungs were studded with tubercular nodules, and abundant pus cavities here and there.

Dr. Clouston, in his great experience, believes opium to cause loss of appetite and of weight, while a habit or craving is apt to be set up. Undoubtedly such disadvantages do occur; but probably it is undeniable, as was echoed by Dr. Leech at Manchester, that "in sleeplessness due to pain there can be no doubt that no other hypnotic approaches opium in value." Nasse, in the treatment of psychoses by opium, found benefit from its use in cases of mania of from four to seven or more months' standing.

Under hyoscin it is referred to in such cases.

Case VI.—Frances L., æt. 30. Puerperal mania. Her sixth child was born eight weeks ago. 4th June, 1889—Weight 119lbs.; hæmoglobin 60 per cent., red cells 3,830,000, white cells ·3 per hæmic unit. 15th June—She is restless, her appetite is poor, and she looks pale. Put on 8♏ tinct. opii morning and evening. 30th.—Mentally she is very much improved. 8th July—Working in the wards being insufficient, she is sent to the laundry. 18th.—Hæmoglobin 60 per cent., red cells 4,530,000, white about ·2. Weight 134lbs. 18th—Convalescence is noted as established. She is not very anxious to go home to her husband, who is her second, and apparently unkind to her. 26th Oct.—Weight 141lbs. She is discharged recovered.

Renault recommends opium in asthenic and anæmic cephalalgia, and in cerebral symptoms with chlorosis and anæmia, it bringing to the brain, he says, the necessary quantity of blood.

The late Sir Robert Christison, says Brunton, used to say that, "Not only coryza, but probably all inflammations could be nipped in the bud by opium if given sufficiently early and freely."

Dr. Clouston, in referring to paraldehyde, says :—"If it did no good it did not do any harm. That," he continues, "is a great thing in any drug, if true."

With this expression I conclude and heartily concur.

Sulphonal.—Introduced about two years ago, sulphonal is one of the latest, and probably most important hypnotic of the alcoholic series. First prepared by Professor E. Baumann, of Freiburg, and examined and recommended by his colleague, Professor Kast, its physical characters and chemistry have already been well described by others. Clinically its two great physical disadvantages are its insolubility and bulk. To those not familiar with the drug it may be stated that it is crystalline, and may be considered as practically devoid of taste and smell.

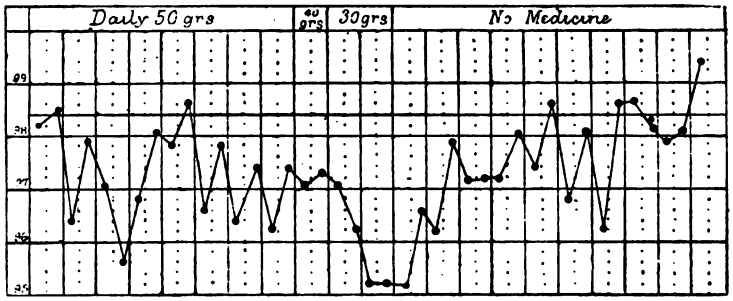
Its solubility is about one in 450 of cold, but slightly more soluble in warm water. Professor Kast has shown it to be slightly more soluble in acid and saline solutions. It is soluble readily in alcohol or ether. It has been given in hot fluids, suspended in gum, and in many other ways.

However administered, it should be first finely powdered. I invariably place it on the tongue, when this is possible, and let it be washed down.

The following variety of cases may help to illustrate the actions of the drug, and its advantages and disadvantages in disease :—

CASE I.—Anchor. T. (described under hyoscin), 2nd July, 1889—He is excited, and in strong rugs for the last six weeks, and his habits are dirty and destructive. Put on 15 grains sulphonal morning and evening. 3rd—No change apparent. 4th—He is a little quieter. 5th—His appetite is good, and he is quiet and well behaved. 6th—Improving in his habits and asleep nearly all day. 8th—Still improving, and lies quietly on a bedstead. 9th and 10th—Appetite ravenous. 13th—Sleeps all night and part of the day. His bowels are regular. 21st—He is up to-day, and is quiet, tidy, and respectable. Sulphonal discontinued. 28th—Relapsed again, and is in bed as wild and untidy as ever. The 15 grains sulphonal twice daily resumed. 15th Aug.—Improved again and up to-day. 20th—Sulphonal discontinued. 25th—Relapsed again. 16th Oct.—In bed still and unimproved. Weight, in strong shirt, 120lbs. As a rule he is noisy all night. Put on 30 grains sulphonal in the evening

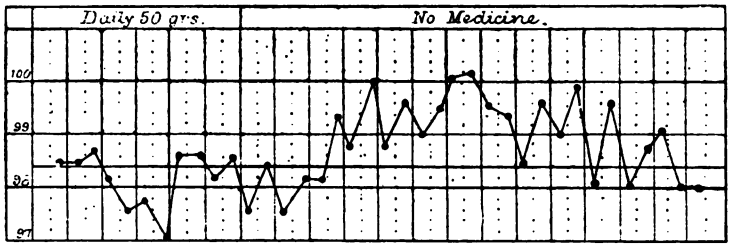
and 20 grains in the morning. 17th—Slept 8½ hours last night. He is quieter to-day and taking all his food. 18th—Slept all night, but is shaky on his legs and inclined to sleep to-day. 19th—He is unable to stand unassisted, but is clean and not destructive in his habits. Sulphonal discontinued. 20th—Getting noisy again, but asleep part of the day. 21st—He has recovered the use of his legs, but is untidy in his habits, and lies quietly until roused. 22nd and 23rd—He is clean, quiet, resting all day, and his appetite is good. 24th—Talkative again at night. Sulphonal in doses of 20 grains in the morning and 30 in the evening resumed. 25th—Restless last night, but quiet to-day. Habits tidy. 26th—Slept six hours last night, but he is restless to-day. 27th and 28th—Clean, and not destructive, and asleep all day except at meals. 29th, 30th, and 31st—Gait ataxic. Weight 121lbs. 1st Nov.—Asleep all day. 2nd—Habits untidy while asleep. 3rd—Never attempts to leave his bed, and sleeps almost continuously. Morning dose reduced to 10 grains. 4th—Morning sulphonal discontinued. He sits in a chair, being unable to stand without assistance, and never speaks unless spoken to. His habits are clean. 5th—Sulphonal discontinued. 6th—Weight 127lbs. Wherever he is placed he never attempts to leave, and never speaks except in answer to questions, and then very briefly. 7th—Slowly recovering the use of his legs. 8th, 9th, and 10th—Slept all night and part of each day. 13th—Weight 137lbs. 20th—Weight 142lbs. 27th—Weight 140lbs. He is up daily,



works in the flock room, and goes to our weekly dance, in which he takes an active part, being quite a new experience for him here. 2nd Dec.—Relapsed again, and remains the hopeless chronic maniac. The temperature in degrees Fahrenheit at 9 a.m. and 6.30 p.m. is recorded on the chart from 26th Oct. to 15th Nov.

Case II.—Arthur H., single, æt. 21. Suffering from acute mania. Oct. 14th, 1889—He is sleepless, sometimes violent, destructive, and noisy, stuffing his pockets with rubbish, and looking pale, pasty, and exhausted. Oct. 15th—Weight, 139lbs. Hæmoglobin 82 per cent., red cells 4,940,000, white cells ·32. To-day he is put on 30 grains sulphonal in the evening, and twenty in the morning. His habits are dirty. 16th—Slept eight hours last night

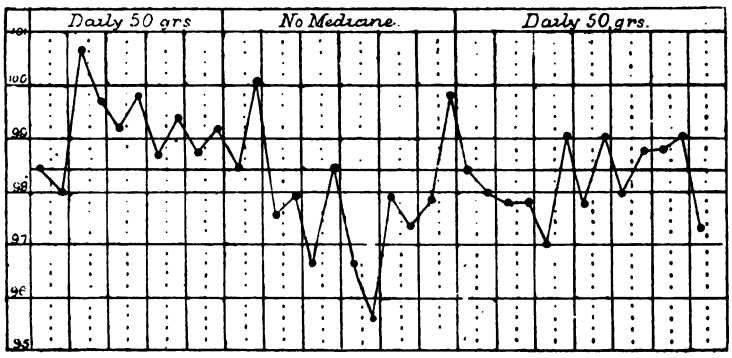
he looks stupid, but is noisy still. Reflexes active. 17th—Slept all night. To-day he is so ataxic as to be sent to bed, saying he feels nervous, seasick, and shaky. 18th—Slept all night, but is unable to stand unaided to-day. Never tries to leave his bed, and is not destructive. Appetite good. Complaining of noises in his ears. Reflexes feeble and slow. 19th—Slept all night. His habits are clean, but he is drowsy and inclined to lie still. Sulphonal discontinued to-day. Superficial reflexes elicited easily, but knee jerk very faint. 20th—Patellar reflexes absent, he slept all night. Nine a m. shouting for his dinner. He is clean and not destructive. Pulse full and soft. He looks drowsy. 21st and 22nd—Slept all night, but is noisy to-day and stronger on his legs. Complains of humming in his ears. Pupils large, skin moist and clammy, and reflexes still in abeyance. 24th—Reflexes elicited, and he is noisy and destructive again. Sulphonal resumed to-night in doses of 20 grains in the morning, and 30 in the evening. Weight, 139lbs. 25th—Slept 7½ hours during night, but is still restless. 26th—Slept 9½ hours last night, and is slumbering all day, but easily roused. Reflexes absent. He is clean and not destructive. 27th—Slept all night and sleeping all day; ataxic, complaining of noise in his ears, and cannot hold the pen or stand unaided. Muscles flaccid, and reflexes exaggerated. He never asks for anything. Habits untidy, especially when asleep. When wakened for his food, he mumbles, "Let me sleep." Intensely drowsy, and soft food is spooned into his mouth. Pulse soft, full, and regular. 29th—Reflexes still increased, right plantar more than left, and the left patellar larger and more active than the right. Asleep day and night, and untidy in his habits. Weight 139lbs. 30th—A pin driven into the muscles of his arm or nose, but no response or sign of waking; when shaken in addition, he takes in a long breath and drowsily opens his eyes. Habits untidy. Sulphonal discontinued. 31st—He is unable to sit or stand without help, and is



sleeping day and night, except when fed. 1st Nov.—Untidy during the night, and sleeping on. 2nd—Still untidy. Can stagger out of bed now, however, and weeps and cries for his mother as if he had overslept himself. 3rd—Slept 9½ hours last night. Reflexes very faint, patellar scarcely appreciable, and is very infrequent. Still

ataxic in gait, but he is up and dressed, clean, and behaving well. 4th—Appetite good, but he is still emotional. 5th and 6th—Behaving well. Weight 141lbs. 10th—Sleeps well, but undressing himself and noisy all day. Habits clean. 13th—Weight 136lbs. 1st Dec.—Working in grounds and well behaved. The chart shows the morning and evening temperature from 25th October to 13th November.

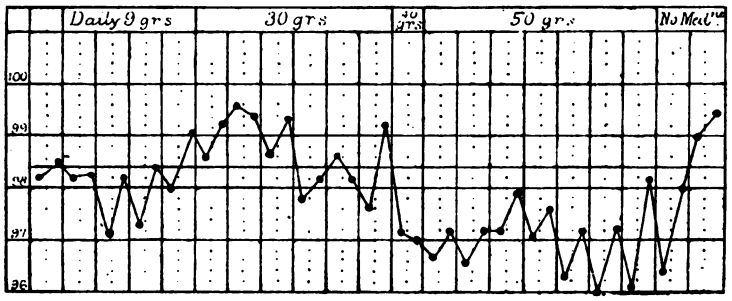
Case III.—George L., single, æt. 25. Suffering from acute mania. 15th Oct., 1889—He is sleepless, untidy in his habits, and his appetite is poor. Weight in strong shirt 121lbs. Hæmoglobin 90 per cent., red cells 4,880,000. Put on 30 grains sulphonal at night and 20 in the morning. 16th—He slept for 9½ hours last night, and he lies quietly in bed this morning. Pupils large, tongue covered with whitish fur, he is sleepy, but easily roused up, and says he feels giddy and drunk. 17th—Slept all night, stupid, but destroyed his shirt, pupils large, accommodation sluggish, and complaining of impaired sight. 18th—Slept all night. Gait more ataxic than yesterday, lies in bed this morning for the first time. 19th—Patellar reflexes in abeyance, but the superficial ones are present. His habits are untidy, he lies quietly all day, and the sulphonal is discontinued. 20th—Ataxic, but not so drowsy; skin surface warm and moist. Complains of "buzzing" in his ears. He recognizes where he is. 21st—Slept eight hours last night, and is not so shaky on his legs, but is getting destructive again. 23rd—Mischievous, but clean in his habits. 24th and 25th—Slept all night. 26th—Restless all night. The 30 grains sulphonal at night and 20 in the morning resumed. He is up to-day, and helping in the wards, and is clean and tidy. 27th—Slept all night, and is sleeping this afternoon. 28th—Slept six hours last night and is drowsy to-day. Gait ataxic. 30th—Staggering about the ward, is idle, and trying to undress himself. 31st—Gait reeling, and for safety to himself he is ordered to



bed. 1st Nov.—Slept all night, but is restless and destructive to-day. Left patellar reflex is larger than the right, but both

plantars are faint. 2nd—Asleep all day. The temperature chart is from the 15th October to the 1st November. 3rd—Drowsy to-day. There is no response to a pin prick that draws blood, but tickling the sole or ribs elicits instant response. Weight 114lbs. The morning dose of 20 grains discontinued. 5th—He is up to-day and very quiet, his gait is reeling, and he never ventures to move off his chair. 7th—Sulphonal discontinued. 11th—Well behaved, sleeps all night, and as a rule an hour after dinner. 12th—Working daily. 29th—Weight 120lbs. 20th March, 1890—He is discharged recovered.

CASE IV.—William H., æt. 60. Acute melancholia. Sits all day with his hands clasped, determined and depressed, and often quietly groaning "Lost." Appetite poor, skin pale, dry, and parchmented looking. He is big, but thin and poorly nourished. Aug. 21st, 1889—Put on one drachm paraldehyde as a night draught. Aug. 26th—He made a determined effort to cut his throat to-day. Oct. 14th—Weight 169lbs. He is now in bed, where he sits more than half the night. Oct. 21st—Weight 167lbs. Oct. 22nd—Put on six grains sulphonal at night and three grains in the morning. 23rd—Slept at intervals during night. 24th—Slept for 3½ hours. 25th—Slept at intervals, a total of 5½ hours. 26th—Slept 3 hours. 27th—Slept 4½ hours. 28th—Slept 3½ hours. Weight 168lbs. 29th—Slept 2½ hours. Dose increased to 20 grains at night and 10 grains in the morning. 30th—Slept none all night. 31st—Slept at intervals, a total of 6½ hours. 1st Nov.—Slept a little. 2nd—Slept a total of 8½ hours. 3rd—Slept 4½ hours. 4th—Slept 3 hours. He is given 40 grains sulphonal to-night. Weight 168lbs. 5th—Slept a total of 6½ hours. Dose increased to 50 grains in the evening. Complaining of noises in his ears. 6th—Asleep at intervals. 7th and 8th—Slept 6½ hours each night. 9th—Slept 8½ hours. Tongue whitish and bowels constipated. 10th—Slept 9 hours. He cannot stand unaided. The reflexes are exaggerated. Weight 170lbs. 11th—Slept all night. Sulphonal discontinued. 12th and 13th—Slept very little. Temperature record is from 24th Oct. to 13th Nov.



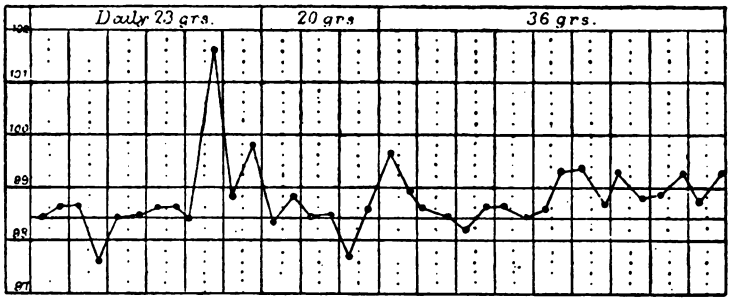
14th—Sleeping better, but often complains of pain over abdomen. 15th—Wakeful. 16th and 17th—Very restless. 18th—Weight

162lbs. 19th—Slept 4 hours. 20th—Sick last night, but slept 5 hours. 25th—Weight 170lbs. From 21st to 28th he slept fairly well. 29th and 30th—Wakeful all night. 1st Dec.—Slept fairly well. 10th—Intensely miserable. Jan., Feb., and Mar., 1890—He is in bed. In April his weight is 136lbs., and, if possible, he remains more miserable than ever.

Case V.—Richard T., married, æt. 45. He is gloomy, suspicious, and depressed, and the mental portion of his admission certificate begins with "sleeplessness." His appetite is poor, but he is well nourished, tall, and powerful. Feb. 24th, 1889—Gets 60m paraldehyde every evening. 26th—Sleeps better at night. 30th March—The almost invariable night report is "restless most of the night." 4th April—Works in the wards, but says he is not so well in his mind. 14th April—Still restless, and his cheeks are, as a rule, high coloured or ruddy, with a cyanotic tinge. The paraldehyde is discontinued to-day at his own request. 6th June—Very depressed and says he is to be "carried down by a concealed stair and thrown into a vacuum below." Goes to the flock room, but sits all day with his face buried in his hands. Put on 15 grains sulphonal morning and evening. Weight 162lbs. 20th—He sleeps better and his appetite is good, but complains of feeling stupid and giddy. Dose increased to 30 grains twice daily. Weight 166lbs. 21st—He had to be assisted from the flock room to-day, being unable to walk or leave his chair; a slight push would unseat him. When asked a question he either shakes his head or says, "Don't know." His memory seems asleep and requires rousing up. Tongue moist, but covered with a whitish fur; pupils much dilated. Pulse 60, regular and full, and respiration 18. He seems unable to speak, and is shivering as if suffering from intense cold. He is sent to bed and says, "I feel quite stupid and scarce knows what am doin'." In a letter to his wife incoordination is very apparent, for he repeats himself and spells much as he speaks. This is very marked when compared with letters written before the sulphonal was begun and after it was discontinued. 5th July—Almost constantly asleep, except when roused for meals. Sulphonal discontinued. 7th—Locomotion steadier, and he is up daily. 13th—His appetite is good, he is bright, expresses no delusions, and sleeps well. 12th Aug.—Working in the grounds. 20th Aug.—Discharged recovered.

Case VI.—Eleanor L., æt. 19. Suffering from puerperal mania. Her first child is just six weeks old. 13th Oct., 1889—She is untidy in her habits and quite idle. 16th—Weight, dressed, 112lbs. Hæmoglobin 60 per cent., red cells 2,880,000, white cells ·4 per hæmic unit. 24th—She is on 10 grains sulphonal in the evening and three grains in the morning. She is clean in her habits, up daily and sewing a little, but very quiet. 30th—Put on 20 grains at night, but from the 2nd to the 13th November she is getting 30 grains at night and six in the morning. Temperature record from 24th Oct. to 10th Nov She is much improved mentally and bodily. 14th—Sulphonal dis-

continued. She works in the laundry. 19th Feb.—Discharged recovered.



CASE VII.—E. S., æt. 40. Puerperal maniac. The drug was blamed for giving her diarrhœa, and discontinued on that account, but she also made a perfect recovery.

CASE VIII.—James H., æt. 29. Suffering from acute mania. Tried with sulphonal and paraldehyde, both of which appeared to benefit him. The further record of this case is given on Table IV.

CASE IX.—William W., æt. 53. In the advanced second stage of general paralysis. Gait very ataxic, speech characteristic, difficult, and indistinct. He, too, had a course of sulphonal and paraldehyde as detailed on Table V. When on his third successive 50 grain dose of sulphonal, the paralysis became almost complete, and the drug was at once discontinued.

CASE X.—Louisa S., single, æt. 38. She is sleepless, suspicious, and living in the expectation of something that is going to happen to her, such as to be poisoned, destroyed, mesmerised, or shaken up with electricity. She is thin and poorly nourished, and looks as if she lived on tea. 17th Oct.—Weight 101lbs. She is restless and sleeps very little. She is put on 10 grains sulphonal. 18th Oct.—Slept for 8 hours. 19th—Slept for $8\frac{3}{4}$ hours. 20th and 21st—Restless all night. 22nd—Sewing in the morning and reading in the afternoon. 23rd—Slept for $9\frac{1}{2}$ hours. Sulphonal increased to 20 grains. 24th—Restless all last night and sick to-day. 30th—She is refusing her food. 2nd November—Appetite very poor. Sulphonal discontinued. 3rd—She is sick and in bed to-day, and looks pale, cold, and collapsed. Pupils very large, and tongue covered with whitish fur. 6th—Appetite very fair. January, 1889—Much improved in every way.

From the tables it may be observed that the phosphates in the urine are increased by small doses of sulphonal, but diminished by large ones. The urea is probably, if anything, similarly influenced, as was also observed by Dr. Gordon (Aberdeen), who, however, concludes from his experiments that the phosphates are diminished, which, in my experience, takes place only under large doses.

Table IV.

James H.; æt. 29; Acute Mania.

"Diurnal"—6.30 A.M. to 6.30 P.M.															"Nocturnal"—6.30 P.M. to 6.30 A.M.										In the 24 Hours.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp.		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of Urine.	Phosphates.	Urea.
	Solids.	Fluids.						9.15 a.m.	2 p.m.	9.15 a.m.	2 p.m.	9.15 a.m.	2 p.m.									7 p.m.	7 p.m.	7 p.m.			
1890	Grms.	C.C.	C.C.			Grms.	Grms.								Grains.	C.C.			Grms.	Grms.	Hours				C.C.	Grms.	Grms.
Apl. 25	1219	1987	748	Acid	1013	1·42	12·8							April 25-26	None	816	Acid	1017	1·99	18·2	5				1564	3·41	31·
,, 26	,,	,,	630	,,	1022	1.57	18·9							,, 26-27	,,	550	,,	1023	1·59	14·4	4				1180	3·16	33·3
,, 27	,,	,,	784	,,	1018	1·56	13·9							,, 27-28	,,	674	,,	1017 5	1·38	13·3	5				1458	2·94	27·2
,, 28	,,	,,	800	,,	1014	·88	11·3							,, 28-29	,,	996	,,	1014	1·19	14·3	none				1796	2·07	25·6
,, 29	,,	,,	884	,,	1015	1·57	16·5							,, 29-30	,,	660	,,	1014·5	1·28	13·1	6				1544	2·85	29·6
,, 30	,,	,,	462	,,	1027	1·24	15·2	99·	99·	66	68	20	22	,, 30-31	,,	770	,,	1020	1·64	17·5	4	97·	56	20	1232	2·88	32·7
May 1	,,	,,	1664	Alk.	1010	·94	17·1	99·	98·4	66	62	21	24	May 1-2	,,	638	,,	1017	1·02	14·5	4	98 4	80	25	2302	1·96	31·6
,, 2	,,	,,	900	Acid	1016	1·18	16·4	98·4	98·6	80	86	20	22	,, 2-3	,,	1484	,,	1013	1·24	19·6	2	98·	70	25	2384	2·42	36·
,, 3	,,	,,	654	Alk.	1020	1·17	14·3	98·6	98·	80	74	26	23	,, 3-4	Sulphonal 10	558	,,	1018	1·23	15·2	7	98·4	62	23	1212	2·40	29·5
,, 4	,,	2100	390	,,	1022	·68		98·8	99·2	60	80	22	22	,, 4-5	,,	1400	,,	1007	1·23	14·	7	98·	62	21	1790	1·91	
,, 5	,,	,,	600	,,	1016	·66	10·6	98·6	98·6	66	76	20	24	,, 5-6	,,	716	,,	1015	1·32	16·3	8	98·4	62	22	1316	1·98	26·9
,, 6	,,	,,	794	,,	1015	·67	9·9	99·4	99·	84	84	24	22	,, 6-7	,,	1450	,,	1007	·9	13·2	7	98·4	64	22	2244	1·57	23·1
,, 7	,,	,,	832	Acid	1015	·83	15·1	98 6	98·4	72	76	22	24	,, 7-8	,, 20	1030	,,	1011	·82	11·2	6	97 6	70	24	1862	1·65	26·3
,, 8	,,	,,	1054	,,	1011	·66	12·	98·4	98·4	70	78	24	24	,, 8-9	,,	872	,,	1009	1·04	10·	5	97·4	64	24	1926	1·70	22·
,, 9	,,	,,	878	,,	1013	·96	13·	98·6	98·4	64	72	22	24	,, 9-10	,,	574	,,	1017	1·12	13·1	8	98·4	66	23	1452	2·08	26·1
,, 10	,,	,,	852	Alk.	1016	·97	14·9	98·8	99·2	84	96	26	24	,, 10-11	,,	890	,,	1012	1·06	11·1	8	98·	74	23	1742	2·03	26·
,, 11	,,	,,	640	Acid	1019	·91	13·8	99·	99·2	72	80	20	24	,, 11-12	None	810	,,	1013	·95	13·8	4	98 8	66	23	1450	1·86	27·6
,, 12	,,	,,	430	Alk.	1015	·43	8·1	99·	98·8	68	92	20	24	,, 12-13	,,	740	,,	1015	1·06	15·	6	98 4	74	24	1170	1·49	23·1
,, 13	,,	,,	838	Acid	1013	·93	14·7	99·	98·6	84	80	22	24	,, 13-14	,,	780	,,	1011	·93	12·1	4	98·2	68	22	1618	1·86	28·8
,, 14	,,	,,	984	Alk.	1012	·86	12·7	98·2	98·8	72	92	22	24	,, 14-15	,,	646	,,	1018	1·31	12·5	4	98 0	74	24	1630	2·17	25·2
,, 15	,,	,,	408	,,	1022	·64	11·9	98·8	98·	72	72	20	22	,, 15-16	Sulphonal 50	630	,,	1008	·97	9·3	7	99·0	78	20	1038	1·61	21·2
,, 16	,,	,,	638	,,	1015	·70	12·6	99·2	98·2	80	86	22	22	,, 16-17	,,	492	,,	1006	·24	3·4	9	98·	72	25	1130	·94	16·

TABLE IV.—(*Continued.*)

"DIURNAL"—6.30 A.M. TO 6.30 P.M.														"NOCTURNAL"—6.30 P.M. TO 6.30 A.M.									IN THE 24 HOURS.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp.		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of Urine.	Phosphates.	Urea.
	Solids.	Fluids.						9.15 a.m.	2 p.m.	9.15 a.m.	2 p.m.	9.15 a.m.	2 p.m.									7 p.m.	7 p.m.	7 p.m.			
1890	Grms.	C.C.	C.C.			Grms.	Grms.							1890	Grains.	C.C.			Grms.	Grms.	Hours.				C.C.	Grms.	Grms.
May 17	1134	2100	1330	Alk.	1011	1·33	19·4	97·6	98·	72	88	24	24	May 17-18	Sulphonal 50	52	Acid		·11	1·3	10	98·2	76	24	1382	1·44	20·7
,, 18	1219	,,	936	,,	1015	1·26	14·7	98·4	98·4	72	80	22	22	,, 18-19	,,	402	Alk.	1011	·43	4·8	12	98·4	76	24	1338	1·69	19·5
,, 19	,,	,,	596	,,	1018	1·9	8·5	98·	97·	97	78	20	18	,, 19-20	None	492	Acid	1015	·72	9·1	9	97·6	66	20	1088	2·62	17·6
,, 20	,,	,,	1278	,,	1013	1·4	16·6	98·2	97·8	97	68	22	18	,, 20-21	,,	584	,,	1015	·73	10·1	8	98·8	70	21	1862	2·13	26·7
,, 21	,,	2071	1128	,,	1017	1·67	16·7	98·8	98·8	98	84	20	24	,, 21-22	,,	934	,,	1015	1·49	19·1	8	98·4	76	22	2062	3·16	35·8
,, 22	,,	,,	1098	,,	1011	2·49	8·5	98·4	99·6	80	92	24	24	,, 22-23	Paraldehyde 60 m	816	Alk.	1015	1·29	14·5	6	99·	84	24	1914	3·78	23·
,, 23	,,	,,	1154	,,	1021	1·53	21·3	98·8	99·	72	84	24	22	,, 23-24	,,	No urine passed	Noct	urnal			4	98 6	72	20	1154	1·53	21·3
,, 24	,,	,,	672	,,	1016		9·1	99.	99·6	88	88	24	22	,, 24-25	,,						5	99·	84	22	672	—	
,, 25	,,	,,	1030	,,	1025	1·64	25·	99·2	99·2	74	80	22	26	,, 25-26	,,						6	98 8	64	21	1030	1·64	
,, 26	,,	,,	784	,,	1022	1·45	25.9	98·8	98·	64	68	20	20	,, 26-27	None	438	Acid	1020	·98	12·2	4	98·2	60	21	1222	2·43	38·1

NOTES TO TABLE IV.

April 25th. Very talkative, restless, and idle, but habits clean.
April 26th. Weight, 9st.
May 2nd. Very restless at night.
May 6th. Sleeps better.
May 9th. Appetite good.
May 13th. No change.
May 17th. Slight ataxia in the morning.
May 18th. Slept two hours to-day.
May 20th. Going about saying he is drunk.
May 21st. Last of ataxia gone to-day.
May 23rd. Not sleeping so well.
May 24th. Refuses to pass urine during the night.
May 26th. Restless at night.

Table V.

William W., æt. 53; Advanced Second Stage of General Paralysis.

"Diurnal"—6.30 A.M. to 6.30 P.M.															"Nocturnal"—6.30 P.M. to 6.30 A.M.										In the 24 Hours.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp.		Pulse.		Resp.			Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of urine.	Phosphates.	Urea.
	Solids.	Fluids.						8.40 a.m.	2.15 p.m.	8.40 a.m	2.15 p.m.	8.40 a.m.	2.15 p.m.										7.20 p.m.	7.20 p.m.	7.20 p.m.			
1890	Grms.	C.C.	C.C.			Grms.	Grms.								1890.	Grains.	C.C.			Grms.	Grms.	Hours				C.C.	Grms.	Grms.
Apl. 25	1871	2100	440	Acid	1021	·92	9·7								April 25-26	None	1856	Acid	1012	1·09	21·7	1						
,, 26	,,	,,	904	,,	1015	1·59	14·4								,, 26-27	,,	1506	,,	1010	1·68	17·8	5						
,, 27	,,	,,	834	Alk.	1016	1·41	13·7								,, 27-28	,,	1422	,,	1013	1·27	17·8	4						
,, 28	,,	,,	1470	,,	1013	1·61	16·7								,, 28-29	,,	1348	,,	1013	1·07	17·8	7						
,, 29	,,	,,	712	Acid	1018	·76	11·8								,, 29-30	,,	1358	,,	1011	·51	15 8	6				2100	1·27	27·6
,, 30	,,	,,	580	,,	1023	1·71	13·2	98·6	98·6	62	62	16	16		,, 30-1	,,						5	97·4	64	15			
May 1	,,	,,	512	,,	1019	·51	11·	98·2	98·6	62	62	16	16		May 1-2	,,	1994	,,	1007	·61	13·6	7	98·8	70	17	2506	1·12	21·6
,, 2	,,	,,	952	Alk.	1014	1·02	13·	98·	98·4	60	61	16	16		,, 2-3	,,	1370	Alk.	1010	·82	13·1	6	99·2	72	17	2322	1·84	26·1
,, 3	,,	,,	850	,,	1015	1·08	12·	98·2	98·6	62	68	18	16		,, 3-4	Sulphonal 10	1394	Acid	1010	1·15	19·4	7	98·6	66	18	2244	2·23	31·4
,, 4	,,	,,	851	,,	1016	1·27	15·2	98·6	98·8	68	60	17	17		,, 4-5	,,	1670	,,	1008	8·00	17·9	8	99·2	70	18	2521	2·27	33·1
,, 5	,,	,,	711	Acid	1017	1·06	14·5	98·6	98·8	64	60	16	17		,, 5-6	,,	1890	,,	1010	1·15	21·5	9	98·8	65	17	2601	2·21	36·
,, 6	,,	,,	640	,,	1020	1·11	14·8	98·	98 6	62	60	17	17		,, 6-7	,,	1520	,,	1007	1·06	17·3	6	99·	62	19	2160	2·17	31·6
,, 7	,,	,,	686	,,	1013	·92	11·8	98·4	98·6	60	66	16	16		,, 7-8	Sulphonal 20	1360	,,	1008	1·26	14·8	7	98·4	62	20	2046	2·18	26·6
,, 8	,,	,,	942	Alk.	1014	1·41	16·3	98·4	97·4	72	60	16	18		,, 8-9	,,	1640	Alk.	1007	1·14	14·2	8	98·4	62	17	2582	2·55	30·5
,, 9	,,	,,	1094	Acid	1013	1·23	13·2	98·2	98·4	60	66	16	16		,, 9-10	,,	1480	,,	1009	1·21	17·5	8	97·	56	15	2574	2·44	30·7
,, 10	,,	,,	900	,,	1013	1·32	14·9	97·6	97·6	60	60	16	16		,, 10-11	,,	1700	,,	1009	1·19	17·4	8	98·	64	16	2600	2·51	32·3
,, 11	,,	,,	1032	,,	1013	1·29	15·5	98·2	98·8	62	64	18	18		,, 11-12	None	961	,,	1010	·72	12·3	9	97·8	60	17	1996	2·01	27·8
,, 12	,,	,,	1196	Alk.	1015	1·41	23·1	98·8	99·2	70	68	18	19		,, 12-13	,,	1470	,,	1010	1·32	16·7	9	98·4	68	19	2666	2·73	39·8
,, 13	,,	,,	538	Acid	1018·5	1·21	13·2	98·6	98·6	68	76	15	16		,, 13-14	,,	1524	,,	1015	1·29	17·3	8	98·	62	16	2062	2·50	30·5

TABLE V.—(*Continued*).

"DIURNAL"—6.30 A.M. TO 6.30 P.M.														"NOCTURNAL"—6.30 P.M. TO 6.30 A.M.										IN THE 24 HOURS.		
Date.	Diet.		Urine passed for the 12 hours.	Reaction.	Specific Gravity.	Phosphates.	Urea.	Temp.		Pulse.		Resp.		Date.	Medicine.	Urine passed for the 12 hours.	Reaction.	Specific gravity.	Phosphates.	Urea.	Sleep.	Temp.	Pulse.	Resp.	Quantity of urine.	Phosphates.	Urea.
	Solids.	Fluids.						8.40 a.m.	2.15 p.m.	8.40 a.m.	2.15 p.m.	8.40 a.m.	2.15 p.m.									7.20 p.m.	7.20 p.m.	7.20 p.m.			
1890	Grms.	C.C.	C.C.			Grms.	Grms.							1890	Grains.	C.C.			Grms.	Grms.	Hours				C C.	Grms.	Grms.
May 14	1871	2100	906	Alk.	1016	1·54	17·5	98·6	98·	64	64	16	19	May 14-15	None	1306	Alk.	1010	1·80	15·7	9	98·6	64	16	2212	2·74	33·2
,, 15	,,	,,	974	,,	1012	1·21	13·1	98·6	98·6	68	70	16	16	,, 15-16	Sulphonal 50	1180	,,	1013	1·32	16·4	9	99·	72	21	2154	2·53	29·5
,, 16	,,	,,	964	,,	1016	1·49	15·8	98·6	98·2	64	66	16	16	,, 16-17	,,	1380	,,	1010	1·36	13·8	10	98·8	70	20	2344	2·85	29·6
,, 17	,,	,,	711	,,	1018	1·27	14·6	98·8	98·8	72	74	18	19	,, 17-18	,,	950	Neut	1009	86	10·1	11	98·2	66	18	1661	2·13	24·7
,, 18	822	1530	310	,,	1015	·67	3·8	99·	98·4	96	68	20	16	,, 18-19	None	630	Acid	1015	1·10	11·3	18	98·4	68	16	940	1·77	15·1
,, 19	1871	2100	792	Acid	1013	1·27	12·4	98·2	99·	64	72	16	16	,, 19-20	,,	622	,,	1012	·77	10·5	13	98·8	66	17	1414	2·04	22·9
,, 20	,,	,,	974	,,	1016	1·6	20·2	98·6	98·6	68	70	16	16	,, 20-21	,,	1038	,,	1010	·88	11·6	11	97·8	62	16	2012	2·48	31·3
,, 21	,,	,,	464	,,	1018	·91	9·	98·8	98·	70	72	16	16	,, 21-22	,,	1480	,,	1007	1·11	17·5	9	98·4	66	16	1944	2·02	26·5
,, 22	,,	,,	1500	,,	1010	1·32	18·8	99·	98·	70	68	16	16	,, 22-23	Paraldehyde 60 m.	956	Alk.	1009	1·22	11·9	10	98·4	58	16	2456	2·54	30·7
,, 23	,,	,,	628	,,	1017	·92	15·5	98·4	98·4	74	74	16	16	,, 23-24	,, 60 ,,	1400	Acid	1005	·84	14·3	10	97·6	58	16	2028	1·76	29·3
,, 24	,,	,,	444	,,	1022	1·01	13·1	98·4	98·4	68	68	16	16	,, 24-25	,, 60 ,,	1000	,,	1011	·74	15·5	10	98·4	58	16	1444	1·75	28·6
,, 25	,,	,,	1056	,,	1013	1·29	16·3	98·	98·2	62	60	16	16	,, 25-26	,, 60 ,,	1464	Alk.	1007	·80	13·3	9	98·4	58	16	2520	2·09	29·6
,, 26	,,	,,	1130	Alk.	1007	·62	10·3	98·6	98·4	74	72	16	16	,, 26-27	None	840	Acid	1007	1·07	13·6	9	98·2	58	16	1970	1·69	23·9

NOTES TO TABLE V.

April 25th. Weight 10st. 7lbs.
April 26th. Appetite ravenous.
April 28th. Too ataxic to be employed.
April 30th. Nocturnal urine lost.
May 5th. Resting more.
May 9th. Sleeps well, is quiet, and very facile.
May 17th. Slept two hours during the day.
May 18th. Some urine lost; habits untidy; slept nearly all day, and cannot walk without support.
May 20th. Habits tidy to-day.
May 22nd. Sulphonal effect gone.
May 24th. Sleeps well, and is otherwise as usual.
May 26th. Weight 11st. 8lbs.

The case Henry T., already referred to, had an intoxicated gait, but his speech was stammering and slow, and from his letter-writing, his ideation seemed to share in the inco-ordination. He wrote as he spoke, and probably as he thought, for there is an attempt to put this on paper—by repeating himself and spelling the words much as he spoke them; in short, his writing is a phonetic representation of his speech. Inco-ordination was one of the symptoms recorded by Professor Kast. In his experiments on dogs, this observer records their intoxicated and drowsy behaviour, and traces the activity of the drug to the central nervous system, especially the cerebrum. Dr. Leech, in his paper on "Recently Introduced Hypnotics and Analgesics" ("British Medical Journal," 2nd Nov., 1889), refers to the muscular inco-ordination, quoting the similar observation of Bornemann, Fischer, Burnett, Rehm, and Perregaux—the latter recording ataxic disturbances of fine movements of the hand, while Fischer, in referring to the ataxia, refers also to the speech becoming affected. While this, however, comes near to the letter-writing character, the literature, as far as I know, contains no reference to it, or to what seems like the ideational stammering. When well under the influence of the drug patients experience the helplessness, motor difficulties, and, to a less extent, the mental confusion of intoxication, without, however, much of its hilarity or sense of well-being. They appreciated, and frequently expressed this, irrespective of their mental condition, for the wild chronic maniac, who was never coherent on anything else, in response to the usual salutation, answered "drunk" or "tipsy."

Small or medium doses.—The circulation.—The giddiness sometimes complained of is apparently a result of the same cause, and probably not proceeding from a circulatory disturbance. Comparison of the strength and frequency of the heart's action before, during, and after the observation was discontinued, show that in large doses the drug has an action on the heart, opposed to that of digitalis. Beyond, however, an apparent softening of the pulse, no other action is observed in doses sufficient to aid sleep and make the action of the drug very apparent. This pulse-softening is due probably, in part, to the warm, moist skin surface from vaso-motor dilatation, as is seen in natural sleep. Dr. Leech found that sulphonal had a local dilating influence on the vessels in cold-blooded animals, and recommends its use when the circulation is depressed. Dr. Cranstoun Charles found that arterial pressure was slightly lowered, though, he says, in three cases

a subsequent slight rise was noticed. In these doses, however, the heart is not apparently affected beyond the softening of the pulse, and a probable slightly diminished frequency as a result.

Temperature and respiration.—There is at first reduction of temperature, as observed from the tracings, which, however, soon recovers itself, going above the normal—an action, as far as I can find, not recorded by any previous observer. Stockman, in his report on the coca alkaloids, observes that Ott, experimenting on himself with cocaine, found a rise of pulse and temperature. Mosso also found, with the same drug, an increase of body temperature; and considers cocaine the most energetic drug yet known possessing this action.

Reichert found that division of the spinal cord prevented this rise, showing that the action is of central origin.

To sulphonal, therefore, may be accorded a place on the but short list of substances possessing what may be called a pyretic action.

Respiration at first becomes somewhat less frequent, but deeper; then coincident with the rise in temperature and vasomotor changes, it becomes again frequent, but of regular rhythm.

Reflexes.—The skin and tendon reflexes become increased, but on continuing the same dose, gradually subside, and in some cases the patellar reflex eventually disappears altogether. Shick observes that sulphonal sometimes depresses and sometimes exalts reflex excitability; while Gordon, in a recent paper ("British Medical Journal," 29th March, 1890), found the reflex function of the spinal cord reduced in frogs. There is a gradual increase in the motor disturbances. The gait is of a drunken type, going from slight inco-ordination to staggering, reeling, and, on large and continued doses, entire suspension of voluntary movements. The conjunctival, skin, tendon, and plantar reflexes, when the patient is asleep, and for some time under the influence of the drug, are frequently abolished, but that of the nose, while seldom abolished, is often faint and infrequent.

Mental and sense phenomena.—Some patients, when not sufficiently under the influence of the drug to cause sleep, expressed themselves as nervous, shaky, and sea-sick. The pupils become dilated and sluggish. Some, on being under the influence of the drug for a week or more, complained of defective vision, and others of seeing colours. The senses of taste and smell are not affected. Noises in the ears were an invariable complaint, the majority describing it as buzzing,

others ringing; a female melancholiac that her head was "queer;" another, that her head felt as if made of wood; while a third complained of hearing voices; but all the three complained of "queer things" before. Hallucinations are, however, referred to by Bornemann, who records that his patient thought he had four arms, four hands, and two heads. This probably was a form of diplopia, which this patient is recorded as having had. The sense of hearing seems acute, out of all proportion to the other senses, more especially when the patient is asleep. The majority said they did not dream at all; others had dreams of an agreeable kind, such as dreams of home and flower gathering. A male acute melancholiac complained of disagreeable dreams when on doses of 40 grains, but would not tell their nature. A young maniac, who had been pricked with a pin when asleep and then roused up, said he was dreaming of lions and tigers.

In the skin-sense there is a short initial hyperæsthetic stage, which is soon lost, however, and, as will be seen further on, gives place to a well-marked analgesia on larger doses. It may be observed here that sulphonal disputes the claims of quinia to a separate *ism,* for there is seen, in what one might call sulphonalism, many of the phenomena of cinchonism. To the maniac, with robust circulation, or hyperæmic conditions, it seems to bring rest, while in melancholia, with weak circulation, or brain anæmia, the gloom is frequently intensified, and there may be a stupor superadded, which often obscures the original condition, but which fortunately always disappears on withdrawing the drug.

Digestion and the gastro-intestinal tract.—The appetite was never in any case impaired, but as a rule improved, and in some cases became excessive and ravenous. The case of Louisa S. may be regarded as the exception, and an example of what may occur in the case of an anæmic brain and feeble circulation, but this probably is not an unmixed anorexia due altogether to sulphonal, as she was sent here partly for refusing her food. This variety approaches what one might call the anorexia already recorded by others. Sickness was rare, but was more frequent in the depressed than in the exalted. The tongue of sulphonal is probably a typical one, and, as a rule, is covered with a milky white fur, as if the organ had its first coating of white-wash; is always moist, however, and the saliva seems increased. In some cases there is diarrhœa, more frequently in females than in males, but as a rule the bowels are not at all affected.

Large doses.—When large and continuous doses are given the patient may sleep on almost day and night; the muscles become quite flaccid, and locomotion impossible. If the drug be pushed further, voluntary power subsides, and when he is roused up for his food, he looks at it, but cannot stretch forth his hand to take it, and when put into his mouth he cannot masticate. There is now considerable skin-anæsthesia, especially to painful impressions, which is most marked during sleep.

Although Dr. Leech, in his paper, refers to sulphonal and other recent hypnotics as possessing little, if any, analgesic influence, Dr. Gordon found peripheral sensation diminished in frogs. The reflexes become now again increased and amplified; a tap on the right patellar tendon is followed at once by a large kick out, with many smaller oscillations, and by smaller but similar movements of the left leg. On stroking the sole, even slightly, the limb is at once drawn up; the untouched one promptly following the movement. His habits now become untidy, and the temperature that has been above the normal goes slowly down, and may touch 95° F. or under. The pulse becomes small, soft, and infrequent; the skin cold and clammy, and respiration slow and shallow, or in some cases slow and gasping. It would seem that the prolonged abeyance of vaso-motor activity, has led to loss of heat, aided by a condition of asystolism, which most of all contributes to the collapse. He is disinclined to speak or be roused up, and a fairly strong shaking elicits but a grunt or monosyllable; then he lapses back again. He is intensely drowsy. If the medicine is now discontinued, the reflexes slowly return in the inverse order—first toning down, then the patellar reflexes probably disappear altogether, but get increased again before resuming the normal. The temperature, too, retraces its course with an inverse curve, going above the normal, and then finally coming down to it, when the muscular and locomotive evidence of the drug disappear, and the patient recovers.

Antidotal treatment.—Adam P., æt. 46. Suffering from acute recurrent excitement. From seven p.m. April 24th to seven p.m. April 25th he had no medicine. Quantity of urine passed in these twenty-four hours, 741 c.c., and phosphates 1·35 grammes. From seven p.m. on the 25th to seven p.m. on the 26th—the next twenty-four hours—he had a total of 220 grains sulphonal. Quantity of urine passed, 695 c.c., and phosphates 1·03 grammes. Two hours after the last dose

he became comatose or nearly so, and impossible to rouse up. Pulse over 100, irregular, intermitting, and scarcely perceptible. Respiration very shallow and infrequent; skin surface cold and clammy; muscles quite flaccid; reflexes abolished, and pupils immensely dilated and paralyzed.

A tube was passed into his stomach, it requiring no effort to keep the mouth open, and four ounces of brandy and a pint of strong hot coffee injected. He was then shaken, and roused up by flecking his face, hands, and feet. In less than ten minutes after the stomach injection he was singing at the pitch of his voice, and in twenty minutes more he was up and dressed. He never looked behind him, and the bout was completely cut short.

In addition to the foregoing clinical evidence, the sulphonal antidote receives further confirmation in the case of J. M., æt. 65, who died from pulmonary apoplexy, and had been on sulphonal at the time. The post-mortem examination showed that the heart, which was very flaccid, stopped in diastole. All its cavities were gorged with blood, the valves and vessels atheromatous, and the aortic valves incompetent. The brain contained several ounces of clear serum, with a large part of the falx cerebri ossified.

The whole evidence, therefore, points to the condition as that of cardiac failure, or asystolism, with cerebral anæmia.

The indications for treatment, therefore, lie in the speediest and most effective method of stimulating and increasing the cardiac systole—the action of the digitalis group.

Cumulation.—The form of cumulation observed by Mairet accords with my experience. He says that when the patient is saturated with the drug small doses have a soporific influence in keeping it up, which they did not previously. This looks to Dr. Leech, who quotes it, as a cumulative action in the case of sulphonal. I have found in such patients as L. S., a debilitated female, with no very obstinate insomnia, that with small doses of five or six grains at bedtime the effects were almost inappreciable for the first night, but then night after night the sleeping intervals lengthen, and go on doing so for some time, but soon, however, the dose, to keep up its effect, must be increased. But probably there is no cumulative power proof against habit, for sooner or later it overcomes and defeats the storing-up claims of the most cumulative drug. Females, probably, require smaller doses than males, but in my experience this is, however, by no means a rule, for probably sex is no more a determinant of dosage in regard to

sulphonal than it is in regard to other drugs. The cumulative action and potency of the drug is most marked in general paralysis, where its first apparent action is to intensify the ataxia and make the subjects tired. Six noisy and sleepless cases of this variety were given ten grains nightly. Sleep was enjoyed by the majority after the third dose, but rest by all.

The sleep of sulphonal is never sudden, and in ordinary doses never profound, especially to begin with. Rabbas says that sulphonal acts for a longer time than chloral hydrate, and that it will act where paraldehyde fails. Dr. Leech observes that all the hypnotics he refers to fail occasionally to produce sleep.

Dr. Morton ("Brit. Med. Journal," December 14th, 1889) records a case in which sulphonal succeeded in giving relief when morphine caused excitement. These examples go to show that hypnotics, like other drugs, have their characteristic indications, which is probably responsible for much of what appears as idiosyncrasy or sporadic failures. For why! The pathology of insomnia is almost *non est*, and therefore necessarily the whole subject of hypnotics uncertain and highly empirical, if not *in nubibus*.

From the form of cumulation already referred to it will be apparent that the smaller the dose the longer is the soporific influence delayed, but this is also favoured by the vigour of the patient and obstinacy of the insomnia. I agree with Dr. Leech that sulphonal, more than chloral or any other drug, is slow in producing its effects, though sleep may follow from one-half to three-quarters of an hour. A dose, however, that is no more than sufficient to induce sleep at night will, if administered during the day, do no more than keep them in a drowsy condition between sleeping and waking. When well saturated with the drug the effects are apparent from one to four days after it is discontinued. Like Garnier, I prefer large single doses to accumulated small ones. Burnet records cyanosis and a semi-comatose condition in a case after thirty grains, and Wolff the case of a child suffering from chorea, who, after taking four grains of sulphonal four to six times daily for six days, became apathetic and sleepy for many hours, with vomiting and frequent and irregular pulse.

What is natural sleep?—Kohlschütter judged of the depth of ordinary nocturnal sleep by the intensity of the noise required to wake the sleeper. Sleep, he found, reaches its maximum within the first hour. Dr. Wilson Philips, as quoted by Sir Henry Holland, believed that no sleep is healthy but that from which we are easily aroused.

In the sleep of sulphonal the whole sentient surface is slowly but completely cut off from conscious contact with the external world. When well wrapt in this sleep the skin anæsthesia is considerable, while a moderately conversational tone is sufficient to cause the sleeper to expose his pupils, which are much dilated, and but faintly react to a strong lamp-light. According to Rählmann and Witkowski, stimulation of any sensitive surface during sleep causes pupillary dilatation, but no such change, however, is elicited in the sleep of sulphonal. Sir Henry Holland considered that that which is often felt and described as *heavy sleep* is generally, we have cause to presume, the least perfect form of it, proving that it is not natural or complete. "That may be presumed generally the soundest sleep," he observes, "in which the tranquillity of the bodily organs commonly dependent on the will is most complete, and as to the varying effect of stimuli applied to sensation or perception, the other great function of the brain involved in this state." This test he regards as perhaps the most certain, were it not, he says, that we have cause to believe the different senses to be often unequally closed, even at the same moment of time. The unequal closure is very apparent as observed in the sleep of sulphonal. The best proof given by the patient himself of the soundness of his sleep is, says that observer, the absence of consciousness or the recollection of having dreamed, which comes into closest connection with our waking existence. The absence of recollected dreams was to him, however, no proof that no dreams in such cases existed, for he believed, in common with such distinguished men as Aristotle, Sir William Hamilton, and others, that no moment of sleep is without some condition of dreaming, although this is no dogma of modern physiology. When we wish to go to sleep, says Michael Foster, we withdraw our automatic brains from the influence of all external stimuli. From a very different standpoint the monopolism or monotonism of Mr. Braid is a recommendation to much the same effect. Hypnotism or suggestive therapeutics is probably a still further development. Professor Bernheim, in his treatise, says that there is nothing by which to differentiate the induced sleep from natural sleep, although, he observes, suggestion may be realized with or without sleep, for "sleep is not possible in all cases, but the idea of being hypnotized must be present." Dr. Binns, in his "Anatomy of Sleep," I think, quoting from Richerand, and referring to the succession in which the organs of the senses are laid to sleep, says: "We hear and understand the

conversation of those around us when we can no longer distinguish their persons." "The organs of the senses laid asleep in succession awake in the same order." Schroff, as quoted by Stockman, in describing the onset of narcosis from cocaine in the frog, says: "One bridge after another which connects the organism with the outer world is broken," until at last "only the heart works on quietly and strongly, caring for the inner organism." These observations show, therefore, that natural sleep, and sleep however induced, are in many of their apparent manifestations very similar phenomena, although experience knows but one sleep of nature, and what is it?

Defects in the Working of the Lunacy Act, 1890.* By R. PERCY SMITH, M.D., F.R.C.P., Resident Physician, Bethlem Royal Hospital.

I feel greatly honoured by being allowed to open a discussion on the working of this Act; but as Bethlem admits more private cases in the year than any other institution in the kingdom, and as the chief alterations in the law concern the admission of private patients, it is perhaps appropriate that the discussion should be opened by someone resident at Bethlem. I feel I cannot do this better than by bringing before your notice facts which have occurred, and if in doing this I weary you, it will be merely a small reflection of the weariness we have experienced in the last six months from this new law.

I will not waste time by further preliminary remarks, but will commence enumerating instances where there has been difficulty or defect in the working of the Act, as far as this hospital is concerned. The difficulties have been grouped according to the clauses of the Act.

Clause 6 (1).

"Upon the presentation of the petition the judicial authority *shall* consider the allegations," etc.

One of the greatest difficulties in the working of the Act, as far as the admission of patients is concerned, has been in getting a justice or magistrate to consider the petition, *e.g.*:

1. Case of L. W. (admitted to Bethlem Hospital, 14/5/90).—Upon presentation of the petition two justices in succession for trivial reasons declined to sign; but did not appoint a time for

* Read before the Medico-Psychological Association, Nov. 20, 1890.