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Opium

EXPERIMENTS AND OBSERVATIONS
ON THE
MEANS OF COUNTERACTING
THE
DELETERIOUS EFFECTS OF OPIUM,
AND
ON THE METHOD OF CURE
OF
THE DISEASE RESULTING THEREFROM.

BY FRANKLIN SCOTT, ✓
OF VIRGINIA.

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“ Nisi utile est quod facimus, stulta est gloria.”

PHILADELPHIA:

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1803.

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MS
CH 21N44 MMT

AN INAUGURAL ESSAY,
FOR
THE DEGREE
OF
DOCTOR OF MEDICINE;

SUBMITTED
TO THE EXAMINATION
OF THE
REVEREND JOHN ANDREWS, D. D. PROVOST,
(PRO TEMPORE;)
THE
TRUSTEES, AND MEDICAL PROFESSORS
OF THE
UNIVERSITY OF PENNSYLVANIA,
ON THE 8th DAY OF JUNE, 1803.

TO CASPAR WISTAR, M. D.

ADJUNCT PROFESSOR OF ANATOMY, SURGERY, &c.

IN THE

UNIVERSITY OF PENNSYLVANIA,

THIS ESSAY

IS INSCRIBED,

BY

HIS SINCERE FRIEND

AND VERY GRATEFUL PUPIL,

FRANKLIN SCOTT.

Et præstantissimum sit remedium, cardiacum unicum
pene dixerim, quod in rerum natura hactenus est repertum.

SYDENHAM.

Experiment the means, Utility the end.

EXPERIMENTS AND OBSERVATIONS
ON THE
MEANS OF COUNTERACTING
THE
DELETERIOUS EFFECTS OF OPIUM.

THE fatal effects produced by Opium on the human species, are known from the history of those unfortunate persons, who by accident, or design, have taken excessive doses. Opium, like many other drugs, may be given in very minute portions as a medicine; but when taken in doses very inconsiderable in bulk or weight, it produces deleterious effects. The small quantity of Opium, sufficient to produce death in those unaccustomed to its use, has caused it to be considered as a poison: and such it may literally be termed.

I believe it is an opinion, very commonly received among mankind, that for every poison, there is some antidote; hence probably we may account for the great attention, which was paid to Alexipharmics, in ancient times. Several substances have been recommended as antidotes to Opium: these are the acid of vegetables, both the native and fermented, and especially the citric acid, the vegetable alkali, oils, milk, aromatics; of late coffee has been recommended. Ipecacuanha, and camphire have been mentioned as having some power as antidotes. By

what principles the ancient physicians were guided in an inquiry of this kind, it is difficult to determine; doubtless every one who recommended an antidote, was governed by some theory. It is probable that their first ideas were directed either by a theory of its mode of operation on the human body, by its sensible or chemical qualities, or by the analogy it might be thought to have in its effects, in common with other poisons. If by the word antidote, be meant a medicine, which, when united with an over dose of it, either before or after it is taken into the stomach, would render it innocent, or form a chemical union with its deleterious part, and thereby neutralize it, I do not believe that such an one is to be found; and all inquiry after such a specific, would, I apprehend, be little less chimerical than that for the Philosopher's Stone, or the Immortal Elixir. I wish to be understood by the term antidote, a medicine which is capable of counteracting or diminishing in some measure, the deleterious effects of another medicine; and it is only in this sense that I use it, when speaking of Opium. Of those medicines recommended as antidotes, no satisfactory account has been hitherto given, so far as I know, concerning their real effects in this way. To me it appears that neither any theory of its *modus operandi*, nor a knowledge of its chemical qualities, nor even the analogy with other poisons in its effects on the body, will lead with any certainty to the discovery of an antidote; it is only by laborious and multiplied experiments, that we could attain to any truth, in a subject of this sort. It would require many more experiments than it is in my power to make at this time, to form a proper estimate of the comparative merits, between the very few substances, which are most celebrated as antidotes to Opium.

However different may have been the opinions of physicians concerning the effects of those medicines recommended for this purpose, most of them have allowed that the acids, really do possess a power of counteracting the dele-

terious effects of Opium, to a considerable extent, and this has been attributed, particularly to the vegetable acids. This opinion seems to have originated from its being observed, that the vegetable acid corrected the acrimony of some other medicines; and hence by analogy, and perhaps afterwards by experience, it was considered as fact. It is at least of very ancient origin. Dr. Percival in his essays, speaking of the power of acids in neutralizing bitters, observes that "in a posthumous work of the learned Dr. Boerhaave, published by his pupil Van Ems, it is asserted, that the deleterious effects of Scammony, Colycinth, and Spurge, are corrected by vinegar. These, says Dr. Percival, are all vegetable bitters, and probably the action of the acid consists in neutralizing them. If this be the case, the use of vinegar as an antidote, may perhaps be more extensive than is commonly supposed. For many of those substances, which, on account of their virulent and pernicious effects on the body, are termed poisons, have a considerable degree of bitterness; as may be instanced in *Lauro Cerasus*, *Nux Vomica*, *Heleborus*, *Nicotiana*, *Camphire*, *Opium*, *Euphorbium*, *Asarum*, *Bryonia*, *Coloquintida*, *Elaterium*, *Cheladonium majus*, &c. And it is at least as probable, that their noxious qualities reside in their bitter, as in any other part of their composition." Dr. P. observes further, that on communicating this idea, to his ingenious and learned friend Dr. Dobson of Liverpool, he furnished him with the following experiments in confirmation of it. I shall just mention the result of them. Dr. Dobson gave to a pointer bitch, twelve grains of Opium, and marked its effects on the pulse, &c. till she had recovered entirely, which was at the end of sixteen hours. In seven days after, he gave to the same bitch a similar dose, with thirty drops of the Sulphuric acid diluted; and at intervals of an hour he repeated the acid, till one hundred drops in all had been taken: in eight hours she had almost entirely recovered; nor were the effects so violent, as in the first trial. Dr. Dobson observes that he had

made some other experiments, to ascertain the effects of acids in counteracting the deleterious qualities of Opium; but he does not give us the results of them; nor does he inform us whether he gave the acid before or after the Opium, in his remaining experiments. However he seems to be of opinion, that they are of use after very large doses of Opium. In order to ascertain whether the diluted sulphuric acid would counteract or diminish the effects of Opium, when taken after it, I made the following experiment.

EXPERIMENT I.

I procured two pups of the same litter, and about two months old; to each, six grains of Opium was given: to one I gave the Elixir of Vitriol in doses of twenty drops, three or four times an hour, during the first two hours.* The other was left as a standard. The natural standard of the pulse in both was about one hundred and fifty in a minute; in 12 minutes they both puked. In two hours the pulse in the one taking the acid was at one hundred and sixty-eight; in the other at two hundred in a minute—they had slavered a good deal; now and then fell asleep, but soon awoke on my approaching them. In four hours the pulse in both at one hundred and sixty-eight,—the one which took the acid, was least affected from the beginning of the experiment, had not been so drowsy, and appeared more sprightly, and had now entirely gotten over it. The other was still dull, slept soundly, and when awoke appeared much affected. I did not attend to them any longer.

Several days afterwards I repeated this experiment, on the same pups, but with this difference, that the acid was given to the pup, which before took nothing after the Opium. I could not discover that the acid diminished the effects of the Opium in the smallest degree.

* The acid was began in five minutes after the Opium.

EXPERIMENT II.

I gave a pointer bitch, about six months old, twelve grains of Opium. In five minutes I gave thirty drops of the elixir of vitriol, and in four hours had taken one dram and a half of the acid.—I marked the symptoms and pulse every hour, till nine hours had expired, when she had recovered. Several days after, I gave the same bitch twelve grains of Opium, and nothing to counteract it; I observed her regularly till nine hours had past, when she had recovered. Upon a comparison of the effects of the Opium, on the animal in the two trials, I could not perceive that the symptoms were diminished at all by the acid.

EXPERIMENT III.

To two pups, of the same litter, about six weeks old, I gave each fifteen grains of Opium, rubbed down with some water. For the sake of distinction I shall call them No. 1 and 2. To the first I gave a table spoon full of Vinegar immediately after the Opium. In ten minutes slavered considerably, and began to respire more slowly—was purged by the Opium—moaned at intervals; the acid repeated.

In thirty minutes subsultus tendinum came on. Respiration was performed slowly, with difficulty, and stertor. Had less sensibility than the other. The acid was repeated.

In sixty minutes the acid was repeated: respiration was slow and stertorous; opened the mouth very wide at every inspiration—moaned constantly—foamed at the mouth—subsultus more violent—the stomach much swelled.

In one hour and a half—Respired not more than four times a minute—at last respired only once in a minute: life gradually declined, and it died.

No. 2. In ten minutes it slavered; moaned, with quick respiration. In thirty minutes had slight tremors: moaned a little; but not so much affected by the Opium as the other. In sixty minutes—Respiration still quick; the stomach much swelled; moaned, and seemed to be in great pain: appeared much better than No. 1. At the end of six hours was somewhat relieved, but continued sick two or three days, and finally recovered.

This experiment was afterwards repeated on two pups of the same litter; neither of them died: the dose was, however, only six grains; they were made very sick by this quantity: the acid was taken in fifteen minutes after the Opium. I compared them at different periods of the experiment, till the effects of the Opium had nearly subsided, which was in eight or ten hours. It appeared that the acid did not counteract or diminish the deleterious effects of the Opium.

EXPERIMENT IV.

To Mr. T——, aged twenty-three years, and a very temperate man, I gave one hundred and eight gtt. of Laudanum, of the common strength; it was three hours after a light dinner; his pulse was at seventy-six strokes in a minute. In twenty-five minutes after the Opium, he took the juice of one lime, and repeated the acid every ten minutes after, till four were taken.

In—— 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60,
Pulse beat 76. 76. 76. 84. 84. 84. 76. 72. 74. 72. 72. 72.
65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 140, minutes.
72. 68. 64. 64. 64. 60. 56. 52. 52. 60. strokes.

In thirty minutes he had perceived no effect from the Laudanum. In forty minutes the pulse declined in force: he experienced some sensation of turgescence in the head. In sixty minutes the pupils of his eyes dilated; his face suffused; the eyes more red than natural; some exhilaration

of mind: about this time he felt a vertigo, and something like intoxication. In seventy-five minutes, the pulse much weaker, and more soft to the touch than at the last period. The exhilarating effects of the medicine having subsided, he was somewhat dull and languid. In one hundred minutes, all the effects of the Laudanum had subsided, and felt as usual with the exception of a slight giddiness. Mr. T. experienced no disagreeable effects from the tincture of Opium after this time, but he was costive in consequence of it.

EXPERIMENT V.

Several days after this, I gave Mr. T—— five grains of Opium. I gave him the acid of a lime in ten minutes after the Opium; this was repeated every fifteen minutes after, till the acid of five limes was taken. The pulse was not increased in frequency. The effects of the Opium the same as above till the end of two hours, when all unusual sensations were gone off except a giddiness, and some diminution of the power of voluntary motion. Six or eight hours after the Opium was taken, a nausea and vomiting supervened, with languor and anxiety of the præcordia, and tendency to syncope: these symptoms subsided after puking three or four times; soon after he felt as usual.

EXPERIMENT VI.

To my fellow graduate Mr. Prendegrass, who was so obliging as to become the subject for this experiment, I gave seventy drops of the tincture of Opium, equal in strength to two grains of Opium. A wine glass full of coffee was taken every five minutes, for the first half hour. It was two hours after Mr. P. had dined very sparingly. The pulse was at eighty strokes a minute.

In———— 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55,
Pulse beat 84. 84. 76. 76. 76. 72. 76. 76. 80. 84. 76.

60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120,
76. 72. 76. 72. 72. 72. 72. 68. 60. 64. 64. 60. 56.

125, 130, 135, 140, 145, minutes.
56. 60. 60. 60. 60. strokes.

In thirty minutes after the tincture of Opium was taken, Mr. P. experienced a slight pain in the head, particularly at the frontal suture, and slight languor. In forty minutes, a sense of heat over the surface of the skin. In forty-five minutes, the pulse felt languid and intermitting. A slight tremor in the arms, and a dryness in the palms of the hands. In sixty minutes, some pain in the forehead; suffusion of the face; a turgescence on the surface of the skin; the pupils of the eyes dilated. In seventy-five, had no unpleasant sensations. In one hundred minutes, a flushing and heat on one side of the face. In one hundred and forty-five minutes, a sense of dryness in the fauces, and diminution of expectoration from the trachea at the time of coughing, to which he had been accustomed for two months previous to this; indeed his cough was more dry than usual, the whole time he was under the effects of the tincture of Opium. In one hundred and fifty minutes, he felt some pain in the stomach; as the pain of the stomach was of a spasmodic nature, Mr. P. proposed taking ten drops of the same tincture to relieve himself; he did so, but felt no relief. From this time to the end of the experiment the pulse varied both in force and frequency: it ranged in frequency between fifty-four and sixty-eight strokes in a minute; in force and fulness it would increase by degrees to a certain height, then subsiding would be almost insensible to the touch. In three hours the pain in the stomach continued, but it was so slight as not to incommode him. I did not attend to Mr. P. any longer; he informed me that nothing remarkable occurred to him in consequence of the Opium, subsequent to my leaving him.

EXPERIMENT VII.

I made two more experiments to ascertain the effects of coffee, in diminishing the power of Opium: the result of which I will state. My friend Mr. Cunningham took

forty-five drops of the Tincture of Opium; a small cup of strong coffee, was drank immediatly after: the coffee was repeated at intervals of fifteen or twenty minutes, till nearly a pint was used. The pulse was very little increased in frequency or volume, nor did much depression of it ensue from its small increase. His sensations deviated very little from those of ordinary health: in three hours the slight effects which it produced had subsided, and he felt as usual.

EXPERIMENT VIII.

My friend Mr. Firth took one dram of the tincture of Opium by wt. In fifteen, or twenty minutes after, he drank four ounces of strong coffee; which was repeated once in every ten or fifteen minutes, till he had drank one pint; it relieved the nausea considerably, every time it was taken. The narcotic effects, however, were very evident, though by no means so great as were to be expected, as he was not at all accustomed to the Opium. In six or eight hours after the dose had been taken, nausea, and severe vomiting supervened: after evacuating the contents of his stomach, some relief was procured. He felt dull and languid for some hours.

EXPERIMENT IX.

In order to ascertain if possible, the comparative advantages between coffee and lime juice, in diminishing the deleterious properties of Opium, I made the following experiment. For the sake of brevity, I shall give only the general result. I procured two pups, six or eight weeks old, of the same litter, and gave to each fifteen grains of Opium, rubbed down with a little water; this quantity was sufficient to endanger their lives, as I had previously ascertained. Immediately after the Opium was taken I gave

an ounce of strong coffee to one of them: to the other an ounce of lime juice a little diluted was given; this was repeated once in twenty minutes during the first four hours. They were violently affected by the Opium. They respired very quick directly after the dose; had constant tremors: moaned continually: in two hours they were much swelled in the abdomen, and seemed to be in much pain. Respiration was very difficult, and spasmodic; sometimes quick, at others slow. A slight subsultus, was observed in each, at times: at the end of nine hours, their extremities became cold; seemed to have a return in some measure, of sensibility; the abdomen was enormously distended with flatus. They finally recovered. In comparing them at different periods, I could not perceive that one was less affected than the other; nor do I believe that either the coffee or lime juice diminished in the smallest degree the deleterious properties of the Opium.

EXPERIMENT X.

To see if the olive oil, or milk, would diminish the effects of Opium (given in a mortal dose), when taken immediately after it, I gave three pups half a dram of Opium each;—they were five weeks old, and of the same litter. For distinction I call them A. B. and C.

To A. was given half an ounce of the olive oil every ten minutes for one hour. It soon began to respire very quick, and moaned constantly. In five hours the respiration was slow and difficult, but sometimes quick and convulsive. The abdomen was very much distended, owing entirely to the air extricated in the stomach. In six hours it died. On dissection, the stomach was found enormously distended with air, so as to fill up the greater part of the abdomen: it was inflamed to a very high degree, as was also the small intestines. The meninges of the brain were preternaturally distended with blood.

To B. was given half an ounce of milk, immediately after the dose of Opium: the milk was repeated every ten minutes during the first hour. B. was similarly affected, though not so violently as A. It died in twelve hours. On dissection no morbid appearance was seen in the stomach, or intestines, except that the stomach was much swelled: the vessels of the brain rather more full than natural.

C. Had the same quantity of Opium, and was kept as a standard. The symptoms were the same as in A;—it died about the time B. did.—The morbid appearances were the same as in A.

EXPERIMENT XI.

To my friend Mr. Bouquier, whose pulse was at eighty strokes in a minute, I gave fifty-four drops of the Tincture of Opium. In five minutes after, he took five grains of camphire, rubbed down with a little water; this was repeated at intervals of twenty minutes, till the expiration of one hour, when he had taken fifteen grains of the camphire in all.

In..... 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55,
Pulse beat 80. 80. 80. 80. 80. 84. 76. 76. 76. 76. 76.

60, 70, 80, 90, 100, 150, Minutes.
72. 68. 68. 72. 72. 72. Strokes.

I marked its effects on his sensations, till the end of four hours, at which time he felt nearly as usual, except a giddiness, and diminution of the power of muscular motion. The Opium had exerted its narcotic as well as stimulating effects, very manifestly on Mr. B. though not to the extent which it might be expected to have done, as he was entirely unaccustomed to take it, was a very temperate young man, and easily affected by other medicines. Upon the whole, the camphire appeared to counteract the Opium, but not to any considerable degree.

EXPERIMENT XII.

To Mr. J. A. aged twenty-three years, (of a delicate constitution, very temperate, easily acted upon by medicines, and who never took opium previous to this,) I gave forty drops of the Tincture of Opium; his pulse was at eighty strokes a minute.

In.....	5,	10,	15,	20,	25,	30,	35,	40,	45,	50,	55,
Pulse beat	84.	84.	84.	82.	80.	72.	80.	76.	76.	76.	76.

60, 65, 70 minutes.

76, 80, 80 strokes.

In ten minutes after the dose, he experienced some turgescence in the head, and heat on the skin, particularly of the face. In thirty minutes after, a sensation which he compared to intoxication; presently a vertigo and heaviness over his eyes. In forty-five minutes an exhilaration of the spirits; had some nausea. In sixty minutes after, the sense of intoxication had subsided considerably. In sixty-five minutes a tinnitus aurium, dimness with very obscure vision. In seventy-five minutes the nausea increased—it was now seven o'clock in the afternoon; the stupor and lethargy was so great that he went to bed at nine o'clock. The sleep which he had that night, was not natural; he passed the night in some jactation, attended with delirium, and frightful dreams.

Several days after, I made the following experiment on the same man.

EXPERIMENT XIII.

To Mr. J. A. I gave sixty drops of the Tincture of Opium; his pulse was at eighty strokes in a minute. Ten minutes after the Opium was taken, I gave him five grains of powder of ipecacuanha; the pulse being at this time very sensibly increased in fulness.

In—— 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60,
Pulse beat. 80. 82. 84. 84. 80. 76. 80. 80. 76. 76. 80. 80.

70, 80, 90, 100, 110, 120, minutes.
72. 72. 76. 72. 72. 80. strokes.

In ten minutes he experienced some nausea, a warmth on the face, and palms of the hands ; the pulse more full. In thirty minutes the pulse much weaker ; the ipecacuanha was repeated. In forty-five minutes the pulse declined in force ; said he felt better, and had a sense of coolness over the skin In one hour he had a slight nausea ; as yet he perceived no effects which could be ascribed to the Tincture, except a very trifling fulness in the head ; the ipecacuanha was repeated. In ninety minutes the nausea increased, and was now considerable. In two hours the pulse was natural in force and frequency. He puked twice, which relieved him of the sickness at stomach ; had no sensations of drowsiness or stupor previous to this. In two hours and an half he vomited again. In three hours, the nausea continued to affect him a little, and for several hours thereafter, with some debility and tendency to tremor ; he slept as well as usual the succeeding night.

REMARKS.

First. From the experiments above mentioned, on the effects of acids given after opium, it appears, that neither the sulphuric acid, the native, nor fermented acid of vegetables, are to be relied on as antidotes to an over dose of this medicine. This is corroborated by the authority of Dr. Leigh, who, after having ascertained by experiments on men, that vinegar given just before a dose of forty, or one hundred drops, would diminish considerably its action on the system, supposed that from similar experiments must have arisen the idea, that acids administered after a large

dose of opium, would correct its dangerous properties. He observes, that "To satisfy myself on this subject, I made several experiments on dogs and frogs; and found, that the acid, if given after the opium began to operate, had not the smallest power of correcting its dangerous properties."*

It is said that among the eastern nations, who use Opium as we do tobacco, they have a notion that vinegar will counteract its bad effects; and that they often use it for this purpose. But even among them it is no antidote to an over-dose of it. Chardin states the following circumstance: "When a Persian finds himself in a distressed situation, he has recourse to a piece of opium as big as his thumb, and immediately after taking this he drinks a glass of vinegar; this throws him into a fit of laughter, and every extravagancy of mirth, which terminates in death; hence this common saying among them—when you are wearied with life, have recourse to Opium and vinegar, and then you die merrily."† We do not suppose the acid to act, in these cases, by any specific quality of its own. When vinegar is taken immediately after a lump of Opium, it acts on a larger surface of the nervous coat of the stomach, stimulates it, and thereby renders it less liable to be acted upon by the succeeding stimulus, viz. the Opium. It may act also by an astringent power, in corrugating the villous coat of this organ. Whatever be the mode of operation of the acid, it is probable that the Persians, mentioned above, find its use in suspending nausea, vomiting, and some other violent effects, for a time, by which the pleasurable sensations are prolonged, and the period of death protracted.

From the fourth and fifth experiments, I am inclined to think that the acid of limes, if given within ten or fifteen minutes after an ordinary dose of Opium, will diminish its effects very sensibly: If the acid be given immediately after one dram of the Tincture of Opium; it will in some measure

* See Dr. Leigh on Opium.

† Ibid.

diminish its narcotic as well as stimulant power: but in six or eight hours after, the patient may expect nausea, vomiting, tremors, delirium, debility, cold-sweats, and a tendency to syncope, of which a difference will obtain, both in number, violence, and duration, according to the constitution. This acid is of no service after mortal doses of Opium are taken. It has been highly recommended after a large dose has been puked up, when the subsequent symptoms of nausea, vomiting, languor &c. are urgent. It does not seem to be so good for any of the above purposes as strong coffee.

2d. It appears that coffee given within ten or fifteen minutes, after an ordinary dose of Opium, will very perceptibly diminish its effects; and when given immediately after, its effect will be almost entirely counteracted. If a dram of the Tincture of Opium be taken, and some strong coffee immediately after, the effects produced, would I believe, be not equal to an ordinary dose without coffee; the patient would often experience in six or eight hours after it, some nausea and perhaps vomiting, with debility; this however is seldom the case unless the dose should be considerably over-proportioned to the excitability of the patient.

Carminati an Italian professor has found by comparative experiments made on domestic fowls, that it requires double the quantity of Opium to destroy them if mixed with coffee. He used the coffee not browned, but dried, ground fine, and given in substance. Professor Barton has experienced even in his own person the good effects of coffee in diminishing the narcotic and stimulant powers of Opium. If he should take two grains at night, he would often be affected on rising the next morning with stupor, nausea, and retching: at other times he has taken a larger dose in a cup of strong coffee at bed time, and on the next morning had none of those disagreeable sensations. In the intermittent, Dr. Barton, has, in particular cases, prescribed Opium and coffee, an hour or two before the recurrence of the paroxysm, or even at the time of accession

with the effect of preventing it. It is upon this fact, to wit, that the stimulating power of Opium is moderated by coffee, that Dr. Barton has been induced to prescribe it in cases where the Opium alone would be inadmissible, and with the happiest effects. In all my experiments on Opium with coffee, I have witnessed this antidotal effect: it counteracts the stupifying and soporific effects, much more however, than it does its action on the heart and arteries. In Experiment eighth, where one dram was taken and coffee after it, much of the narcotic effects were obviated; and the stimulant power was also evidently diminished for a time: but in four or five hours the pulse became full and tense, with some vertigo, which continued three or four hours. Coffee is of itself considerably stimulating to the system of the brain, and one of the most grateful cordials to the stomach. Hence in those indirect symptoms which succeed a large dose of opium, such as nausea, vomiting, stupor and lethargy, pain in the stomach, debility, and occasional tendency to syncope, nothing is preferable to strong coffee. It dispels stupor, relieves nausea, and anxiety about the præcordia, by restoring excitement to the stomach and brain, which soon resume their natural and healthy actions. That coffee is indicated in these last circumstances and to be preferred to the citric acid, I hope to shew in the sequel. The power of coffee as an antidote is, however, not so great as to be relied on, after excessive doses are taken.

3dly. From the tenth experiment it appears that sweet oil and milk, are not, as is commonly supposed, antidotes to Opium, when given after an immoderate dose: nor did they seem to moderate the violence of the symptoms. It was remarked that the animal which took milk after the dose of Opium, and died, had not its stomach and intestines inflamed, nor any of the morbid appearances, usually seen in those viscera. Whether this was owing to the action of the milk, or to some accidental circumstance, I do not pretend to determine.

4thly. From the eleventh experiment made to ascertain the effect of camphire given directly after Opium, I am not prepared to estimate its value as an antidote; I confess, however, that the issue of this experiment, did not induce me to think favourably of its effects in this way.

That Ipecacuanha will counteract much of the deleterious nature of Opium, I have little doubt. The Dover's powder which consists of Opium, ipecacuanha, and neutral salt, when taken in considerable quantities has a much less violent effect on the system, than the same quantity of Opium without the ipecacuanha. In the twelfth and thirteenth experiments we find the comparative effects on the same person, of Opium taken with and without ipecacuanha: we there observe that the ipecacuanha taken soon after the opium, which was given in double the ordinary dose, counteracted its deleterious effects almost entirely: and that it had this effect both before and after vomiting was produced, which did not happen until two hours had elapsed, from the time the Opium was taken. The opinion that ipecacuanha has this antidotal power independent of its producing emesis, receives additional support from the following fact. My friend Mr. Hartshorn of the Pennsylvania Hospital, swallowed two drams of the Tincture of Opium, by mistake; he immediately discovered the error, and took half a dram of Ipecacuanha which did not act as an emetic; but notwithstanding, it obviated the usual effects of Opium; insomuch that Mr. Hartshorn was not in the least incommoded by that inordinate dose. Hence when an over dose of Opium is taken the ipecacuanha is indicated both as antidote, and as an emetic.

PATHOLOGY OF THE EFFECTS OF OPIUM.

IT is foreign to my purpose to say any thing concerning the *modus operandi* of Opium, strictly speaking. Nor

do I pretend to be acquainted with its real mode of operating on the human body. I shall content myself with pointing out some of its morbid effects, when taken in large doses. I shall endeavour to shew these effects, first by a few experiments; secondly by the history of some cases, wherein persons, through accident, or design, have been so unfortunate as to take this poison; and thirdly by some additional remarks. The first experiment contains a statement of the manner in which I was affected by two grains of Opium, which I took with a view of marking its effects on myself in the first place, and after a few days to take a similar dose with an antidote. But its effects were so violent, that I was induced to desist from its use a second time.

EXPERIMENT XIV.

Thirty-five minutes after twelve o'clock I took two grains of Opium rubbed down, with a little water. My pulse beat seventy-two strokes in a minute, the natural standard.

In.....	5	10	15	20	25	30	35	40	45	50	55	60
Pulse beat	72,	72,	72,	72,	78,	78,	80,	80,	80,	84,	84,	72,
	65	70	75	80	85	90	95	100	105	110	115	120
	68,	76,	80,	80,	80,	84,	80,	76,	76,	76,	72,	72,
	minutes.											
	strokes.											

In fifteen minutes after taking the dose, I felt exhilarated, in twenty-five a slight nausea, in forty minutes had sensations of turgescence in the head: the face was suffused, in fifty minutes the pulse declined in force, but was full and frequent: fulness of the head continues—began to feel languid. In eighty minutes the power of muscular motion was diminished; slight pains were felt in the recti and vasti muscles of the thigh; also pains in the arms and legs when I attempted to move them. In eighty minutes a slight nausea; the face continued flushed; the eyes red. A sense of heaviness and oppression at the heart. In one hun-

dred minutes a weakness in those muscles which support the head erect: the nausea continues, with stupor. In one hundred and fifteen minutes a relaxation in the muscular system. In two hours after; the skin appears more full as if elevated or swollen, particularly on the face and hands; nausea continues with anxiety at the præcordia: a drowsiness is now came on; with vertigo, which is much worse on trying to walk. In three hours the sickness at the stomach increased; a considerable debility and relaxation had supervened: no appetite for dinner.

In four hours, I took some lemonade to remove the disagreeable symptoms, but found no relief from it: the stupor and drowsiness increasing I went to bed; but slept only half an hour. In five hours had vomited two or three times; in consequence of which I felt much relieved; though I continued very stupid: whenever an attempt was made to walk I staggered a little, and felt as if intoxicated with wine. At seven o'clock that evening I walked out, and returned at nine; went to bed at eleven o'clock, and rested tolerably well. When I awoke on the next morning, considerable stupor was felt, with pain in the head and over the eyes; nausea was almost constant, which caused me to puke once or twice an hour: debility was great, and such languor and lassitude that I could scarcely walk across the room.

I continued to feel much stupor and drowsiness, and slumbered at intervals when the pain of the head, and sickness of the stomach, would admit of it. At eight o'clock could eat no breakfast; my appetite was so impaired, that I could take no food of any kind, since I took the Opium: a deadly nausea came on me every half hour, and a puking, at first of phlegm, but soon after a copious discharge of bile ensued; every kind of drink was thrown off from my stomach soon after it was taken. My pulse was slow and full without much tension: respiration was slow and difficult. At ten o'clock the pain in the head in-

creased, attended with a sensation of throbbing in the brain, which was almost intolerable: sometimes I felt great relaxation and tendency to syncope. At twelve o'clock no abatement of the symptoms: slight rigors were frequent; a strong pulsation in the carotid arteries. At one o'clock; took a draught of the mixture of a solution of salt of tartar with lime juice; this however was puked up immediately; it increased the nausea and sickness. I vomited at last a dark greenish looking liquid, which deposited in the bottom of the bowl a sediment of the same colour. Finding no relief I lost sixteen ounces of blood: in a short time after I felt much better. At three o'clock I eat some veal broth. By this time my head was easy and my stomach composed; and I continued better.

The blood which was drawn had an inflammatory crust formed on the surface; it coagulated very firmly, and the edges by retracting within the bowl, and turning up, exhibited the cupped appearance: there was a large proportion of serum.

EXPERIMENT XV.

To a small dog about six months old I gave half a dram of Opium rubbed down with three drams of water. He began to slaver profusely as soon as it was taken, and seemed much offended at the taste. In ten minutes after the Opium was taken, he puked a quantity of frothy and mucus matter, together with most of the Opium. The natural standard of his pulse was about one hundred and fifty strokes in a minute. In one hour after, the pulse one hundred and eight strokes, and intermitting, I gave half a dram more of Opium, rubbed down with water as before. The pulse was now full and intermitting; slavered constantly; had slight tremors: after a while he slept soundly—In two hours; pulse one hundred and twelve in a minute; is very sick. In three hours; pulse one hundred

and eight—staggers as he walks: the dose was repeated. In five hours; pulse one hundred; no material change. In six hours; the pulse is diminished in force and frequency: is much affected; has tremors all over his body.

In eight hours; pulse beat eighty-eight in a minute; and intermitting. A partial paralysis had seized his hind extremities; so that they appeared to be dragged after him when he attempted to walk: is very dull and stupid. I gave one dram of Opium in the same way.

In nine hours; the pulse is weaker, and the dog is becoming worse. In eleven hours; the pulse weak and thread-like; and so quick that it cannot be counted. He was now unable to rise upon his feet; the fore legs stretched out, and the hind extremities drawn up to the belly; the head thrown back towards the spine; and the abdominal muscles drawn up, as in tetanus: the eyes stretched very wide open, and pupils dilated: groans at intervals: respiration quick and convulsive, but sometimes slow and laborious. In this situation he laid stretched out on the ground, affected with tremors, subsultus tendinum and universal spasm.

In twelve hours; continued to be violently affected, and appeared as if he would die every minute. It was now eleven o'clock at night, and I left him, with a full expectation of finding him dead, on my return. On the next morning I was surprised to find him alive. The convulsions had subsided: the whole body was affected with a partial paralysis; and so debilitated that he could with difficulty hobble along. He exhibited a very miserable spectacle. I gave one dram more of Opium rubbed down with six drams of water. He was immediately seized with tremors and subsultus, and laid down. In half an hour all his legs were extended; some very sudden twitchings were soon seen about his head and neck; foamed at the mouth, and snapped his teeth together by sudden twitches. The pulse which at first was regular, now became very quick and irregular; it was upwards of two hundred strokes in a

minute, and very quick. Respiration was quick, irregular, and sometimes convulsive. The head was thrown back as before; the abdominal muscles drawn up towards the back. The eyes were opened wide, and pupils dilated; the mouth stretched wide open. In this situation he was seized with spasms at intervals of fifteen or twenty seconds, which would continue about the same time; by which the lower jaw contracted, shutting the mouth with violence, gnashing and grinding the teeth. He was now thrown into a profuse sweat; a frequent involuntary discharge of flatus from the bowels; and sometimes a bloody mucus. *It was now two hours since the last dose, and wishing to put an end to his misery I gave two drams more: one half by mouth, the other by injection into the rectum. The symptoms continued very violent: the respiration being more and more slow and stertorous, he died in three hours after the first dose.

APPEARANCES ON DISSECTION.

The Brain. The meninges of the brain were preternaturally filled with blood: no extravasation could be seen in any of its cavities.

Thorax. The lungs looked darker than natural; and the left lung was more dark than the right. The left ventricle of the heart was not entirely free from blood, though it had less than the right. The pulmonary artery and its ramifications were very full of blood: also the cava.

Abdomen. The stomach was observed to be full of the solution of Opium, mixed with the saliva and gastric liquor.

* The respiration was slow, and stertorous; but when a spasm seized him it was quick and convulsive. The heart contracting more than two hundred times in a minute would be suddenly stopped by a spasm, and contract only five or six times, in the same period. Sometimes both the pulse and respiration would be suddenly stopped by a spasm.

The whole stomach was much inflamed, especially about the lower orifice, which was so contracted, thickened and inflamed, that nothing could pass well into the duodenum: the villous coat seemed to be disorganized; it appeared to be much thicker than natural, and its adhesion to the muscular coat destroyed; insomuch that it was scraped off in the way that cream is taken from the surface of milk.

Liver. Some of its lobes were of a yellow cast: the gall bladder was distended with bile of a very dark green colour.

The Spleen and Pancreas were enlarged.

Intestines. Following the tract of the small intestines, I found the duodenum, as well as the greater part of the jejunum filled with an effusion of pus, the effects of violent inflammation: the lower part of the small intestines had an effusion of bloody mucus: their villous coat seemed destroyed by inflammation. Upon wiping off this mucus, the intestine was in some places of a bright red, in others livid, and with purple spots. There was an accumulation of fæces in the coecum. The colon was inflamed, and seemed contracted in its diameter. The excretions of urine and fæces were much diminished. The blood in the cava was of a very dark red colour. In five hours after death, which was the time the dissection was made, the blood in the descending cava had not coagulated perfectly; only here and there a coagulum was formed. I took some in a spoon, and exposed it to the air two or three hours, it coagulated, but the separation was very imperfect; the serum appeared to have a portion of the red globules dissolved, and intimately united with it.

EXPERIMENT XVI.

In order to see the effects of Opium on fish, I procured four catfish, all perfectly alive and just out of the water: they were about ten inches long. I placed two in one bowl

of water, and the other two in another. To the first I gave Opium in the proportion of one grain to the ounce of water in which they swam; the Opium was rubbed down and diffused through the water of one bowl; the others were left as a standard. As soon as they were put in the Aq. Sol. of Opium, they respired very quick, flirted about, and threw it out of their mouths in blubbers, upon the surface of the fluid. In fifteen minutes they began to respire more slowly; they respired only twelve times a minute, and it was performed by a sudden effort. The standard fish respired forty-eight times a minute, and with regularity. Once in ten or eleven minutes those in the Aq. Sol. of Opium would flirt about, they seemed to be much dissatisfied with their situation: indeed one of them jumped out of the bowl. In one hour, they respired eight times a minute, were dull and languid. In one hour and a half, respired only six times a minute. In two hours, respired only once or twice in ten or fifteen minutes, and they were very seldom seen to move their bodies. The standard fish continued to respire as often as at first, and were as lively as usual; they were often compared with those in the aqueous solution of Opium, which now shewed very few signs of life. In three hours after the immersion, they were torpid, and very limber, and soon became dead to all appearance. I then placed them in a bowl of fresh river water, to see if they would recover, but they did not. The standard fish lived ten or twelve hours after the others were dead. I dissected the two destroyed by Opium; and none of the solution of it was to be seen in the stomach or intestines. I then dissected one of the standard fish, and upon a comparison of them, with those which died of the effects of the Opium, I could not perceive any morbid appearances in the latter.

CASE I.

This case contains an account of the morbid appearances, on the dissection of a woman, who died in consequence

of taking a large quantity of Opium. It was communicated to the French national institute by Cit. Pierre Lassus, and lately published in their Memoirs. In the Medical Review the case is stated, from whence I obtained it.

A woman aged sixty, who for many years had been troubled with occasional fits of melancholy, swallowed thirty-six grains of Opium, in the middle of the night. Five or six hours after, she was found in a deep and profound sleep, breathing with stertor like a person in apoplexy. She revived however for a few moments at a time; and in those intervals informed her attendants what quantity of Opium she had taken. Some ipecacuanha was given her but without exciting vomiting: they then made her swallow, though with some difficulty, a few spoonsfull of vinegar and water. At this this time Citz. Lassus visited her with Citz. Fourcroy. She had now no knowledge of any thing that passed about her, or shewed the smallest sign of sensibility. Her respiration was loud and laborious, her skin warm, her pulse quick, the pupils of her eyes considerably dilated; her joints were flexible, and the muscles of the whole body in a state of relaxation. She died in ten or eleven hours after taking the Opium.

On opening the body, the whole internal surface of the stomach appeared to be inflamed, but it was in no part eroded. The inflammation was extended through the whole of the small intestines, on which there appeared large gangrenous patches of a greenish colour. In the cavity of the stomach, was found, five or six spoonsfull of a turbid fluid, of a redish colour; it was the vinegar mixed with the ipecacuanha, the mucus of the stomach, and we suppose the Opium, which was so completely dissolved, that not the smallest particle could be collected. The small intestines were flaccid and lying on one another. The cæcum and colon distended with flatus: the rest of the abdominal viscera, as well as those of the thorax were in a sound and healthy state; ex-

cepting that three large sized stones were found in the gall-bladder, although the relations of the deceased were not conscious she had made any complaint that could be attributed to that cause.

The blood contained in the cavities of the heart, and in the large blood-vessels, was of a blackish colour, and congealed as it usually is in those parts. The brain was in a healthy and sound state, and the vessels not over distended with blood, neither was there any serum in the ventricles. In a word, all the diseased appearances were confined to the stomach and small intestines. It follows from hence says Citz. Lassus, first, that Opium taken in large quantities does not produce a true apoplexy; that is, it does not produce a congestion of blood in the vessels of the brain.

Second, that the earlier it is dissolved in the stomach, the greater is its activity, producing by irritation, inflammation, speedily degenerating into gangrene.

Third, that the vegetable acids recommended by practitioners as antidotes against the poison of Opium, are only efficacious in that way, when the Opium has been taken in small quantities.

CASE II.

CASE OF THE FATAL EFFECT OF OPIUM OBVIATED, PUBLISHED IN THE FOURTH VOLUME OF THE MEDICAL AND PHYSICAL JOURNAL, BY CALEB CROWTHER, M. D. OF WAKEFIELD, ENGLAND.

On the 30th September 1800, I was sent for to see J. R. a young man about nineteen years of age, who, one hour before had taken one ounce of Laudanum with a view of destroying himself. He was then in a deadly stupor, and his pulse one hundred and twenty strokes in a minute. I ordered him to be stripped, and directed two men to rub his body and limbs very freely with salt, which was persevered in, with occasional short intervals of rest, for upwards of four hours.

As soon as any particular part became hot, or had a tendency to excoriate, I ordered the men to discontinue the friction on that part. He had already taken a large dose of ipecacuanha. I afterwards gave him half a dram of Sulph. of zinc dissolved in one ounce of water. It was got down his throat in this way: two tea spoonsfull were put into his mouth, he being laid on his back; his nose was then irritated with a feather dipped in Spt. Cornu. Cerv. Vol. upon which he was roused, and deglutition took place. In this way the juice of three lemons was got into him. The emetic did not operate for more than one hour, and at last vomiting seemed to be effected by irritating the throat with the feather mentioned above. Afterwards he had administered to him in the same way some wine and water, and a mixture of æther and cordial confection. Stimulating the nostrils roused him for a few seconds, and made him exert considerable muscular strength; but he relapsed again into his former stupor. I ordered his nostrils to be irritated every ten minutes. He took the laudanum at eight o'clock in the evening and the stupor did not leave him till two o'clock in the morning. At eight o'clock A. M. he seemed perfectly recovered; complaining only of soreness from the friction.

CASE III.

Mrs. H—— a very delicate woman, in a paroxysm of temporary derangement, took at eight o'clock A. M. six drams of Tincture of Opium with a view of destroying her life. Two hours had nearly elapsed before her physician saw her. She then complained of a pain in the head, and difficulty of breathing; also had an unpleasant sensation about the region of the stomach. Her eyes were very red, the face pale, and the extremities cold: the pulse very feeble and quick. She had not slept during the interval between the time it was taken, and when the physician saw her;

nor was the least inclined to sleep. On the contrary was very much agitated; frequently rising from the bed, and walking with haste across the floor. The sulphate of zinc was given her at different times to the amount of fifty grains, before it produced the desired effect: this however operated very copiously. Whilst the emetic was operating, there was a great propensity to sleep; but this was of short duration: she did not sleep till some time in the night ensuing, which was seventeen hours after the Opium was taken: she then slept four hours, after this was much relieved, and tranquil for several hours. In the forenoon of the second day, the stomach became much affected with nausea and vomiting, every thing she swallowed was as soon rejected. Her mind was now very much disturbed at intervals and by paroxysms; during one of these she would leap out of bed, and, notwithstanding all opposition made by the nurse, would run down stairs and escape from the doors. These exertions would exhaust her strength, and before she could get far, would become faint, fall down and beg to be carried to her bed: she would then be composed for a time, till seized with a second paroxysm. These were repeated several times during the day. Towards the evening, she was very weak and languid. In the course of the second night, her stomach became much swelled with flatus; respiration difficult as if almost suffocated; the pulse was small and frequent, and the extremities grew cold. Under these circumstances very strong coffee was given her to drink, with the happiest effect. The stomach was soon relieved of the nausea, oppression and flatus—respiration became easy. The mind from this time was more calm, and at length became perfectly tranquil. She continued to convalesce, and in a few days was perfectly well.

CASE IV.

Mrs. C— aged twenty-three years, of a plethoric habit, and addicted to the use of spiritous liquors, having

her mind much confused, and perhaps in a paroxysm of temporary insanity, took half an ounce of the Tincture of Opium which she had procured for the purpose of destroying herself. In twenty minutes after a physician was called. Her face was now flushed considerably, the pulse at eighty, and increasing in force and fulness. Eight grains of tartar-emetic was given her immediately: and twelve ounces of blood drawn from the arm: after this the pulse was pretty full but not so tense as before. In half an hour no emesis was produced; fifteen grains of the Sulph. of zinc was given every ten minutes after, till one dram was taken; warm water with salt dissolved in it was given her frequently to excite the stomach into action; also a feather was often thrust down the fauces, with the same intention; but it was not until eighty minutes had expired, that all these means could produce a vomiting. In the mean time such stupor and drowsiness came on, that the exertions of two or three could scarcely prevent her from falling asleep. Full vomiting was, however, produced by the means above mentioned; and it was repeated often by causing her to drink frequently of the salt and water. The pulse was increasing in frequency, from the time the physician saw her till the present, which is about one hundred minutes from the time the Tincture of Opium was taken: it was at one hundred and fifty-six strokes in a minute. In two hours after the dose, the stupor and drowsiness were so great, that the united exertions of several could not prevent her from falling into a profound lethargy. The pulse was diminishing in force and frequency; and a state of insensibility ensued. Sinapisms were applied to the wrists, soles of the feet and stomach. This had the happiest effect; they produced such irritation on the surface, and so much pain, that the patient was roused completely from the stupor in which she lay. A thirst now came on which was very considerable; and as she was much debilitated, spirit and water were allowed her. In five hours after, she

was affected with tremors, languor and other symptoms of debility. The cure was finally completed by the free use of spirit and water.

CASE V.

In the afternoon of the 25th of April, 1803, Dr..... visited a young woman about eighteen years of age, of a robust and healthy constitution, who had taken half an ounce of the saturated Tincture of Opium. Half an hour after, she complained of considerable heaviness, with throbbing in the head, vertigo, the pulse being very full, though not much increased in frequency. Ordered a dram of the zinc. vitriolat. dissolved in three cupsfull of warm coffee, which had been made for the patient previously to his seeing her. Of this she took one third every ten or fifteen minutes till it operated. The first dose, however, produced no effect. The inclination to stupor increased, with pulse rather more slow. He took sixteen ounces of blood from her, and repeated the solution. The emetic operated shortly after the bleeding: the remaining part of the solution of zinc. vit. was given, and the operation promoted by copious dilution with warm weak coffee. The stomach was evacuated of its contents by repeated and copious vomiting. She complained, some time after, of her head and stomach, which continued nearly two hours, attended with heat and dryness of the skin. He ordered seven ounces more of blood to be taken from the arm. A mild laxative medicine was given, which operated well. The patient was perfectly well on the next day.

CASE VI.

Dr. was called on the night of the 20th of February, 1803, to visit a child of twenty months of age, who through the mistake of the mother, had taken a tea-

spoonfull of the Tincture of Opium instead of paregoric elixir. The error was not discovered until three hours after, when he saw it; it was then completely comatose, with stertorous apoplectic respiration, a slow and very full pulse, and great insensibility. He gave ipecacuanha, with two grains of the zinc. vitriolat. every ten minutes. The first dose or two producing no effect, and the symptoms increasing, three ounces of blood were taken away.* After this the emetic operated copiously. The difficulty of breathing was considerably relieved: the stupor continued, though not to such a degree as before. In two hours after, the symptoms appearing much relieved, he ordered an enema, and left it till morning. In the morning, the disposition to coma still continuing, with some febrile heat, and increased frequency of pulse, three ounces more of blood was drawn, and the injections were repeated, which operated well. The child appeared to grow better in the course of the day and evening; seemed entirely free from all disease; sucked freely of its mother and was remarkably lively. It continued in this convalescent state till the evening of the second day, counting from the time the Opium was taken, when convulsions the most violent he had seen for some time supervened, and continued till ten o'clock of the same evening, when it expired.

CASE VII.

To a child of J. D. aged five months, was given, by mistake, nearly a tea-spoonfull of the Tincture of Opium, at nine o'clock in the evening. Dr. saw it in half an hour or forty minutes after the accident. Ipecacuanha to the amount of half an ounce was given, at different times, in the course of two hours, without proving emetic, or seeming in any way to diminish the deleterious effects of

* Nausea immediately supervened, which was increased by irritating the fauces with a feather.

the Opium. The throat was irritated frequently with a feather, but without producing emesis. At length a strong solution of common salt in tepid water was gotten down, which soon produced puking: the stomach was completely evacuated by its repeated operation.

In somewhat more than three hours from the time the Opium was taken, the child had recovered its sensibility, and took the breast freely. On the next day, in twelve hours after the accident, the narcotic effects had entirely subsided: the child, however, was extremely ill: the pulse was so rapid as not to be counted: the smallest pressure on the region of the stomach gave it much pain: the respiration was quick and difficult; its thirst so great that it never seemed happy but when drinking or sucking. These symptoms continued till death put a period to its sufferings, which was in eighteen hours after the Opium was taken.

ON THE MORBID APPEARANCES FOUND UPON DISSECTION AFTER DEATH FROM OPIUM.

In the course of my experiments on Opium, ten or twelve dogs of different ages, from one to nine months old, were destroyed by large doses of this poison; these were dissected with care, and for the sake of brevity, I will state the appearances as they were generally found in the several viscera. And first,

IN THE BRAIN.

The meninges of the brain were invariably found more or less preternaturally filled with blood: in the longitudinal sinus this morbid accumulation was frequently the most remarkable. I did not perceive, in any one instance, effusion in the ventricles of the brain: in one case, however, an effusion of serum, tinged with red blood, was observed in the lateral sinuses, and between the dura and pia mater. The vessels in the substance of the brain were very full of

blood, and the whole substance of the brain itself more soft and yielding.

The lungs were, in by far the greater number, of a darkish colour, and their vessels seemed to be more full than natural. Indeed all the blood-vessels about the heart were very full.

The heart generally had its right ventricle distended with blood, and a small quantity in the left.

The stomach was constantly inflamed, except in the pup which took milk after the Opium. I have seen the inner surface of the stomach almost as red as scarlet: the inflammation is greatest towards the lower orifice. The villous coat of the stomach was destroyed by the effects of the inflammation; was eroded in some parts, and its adhesion to the muscular coat so slight that it might often be wiped off. The coats of the stomach appeared much thicker than natural, especially at the pylorus, which being at the same time inflamed and contracted, prevented almost entirely any passage of the contents through it; and hence the Opium is found in the stomach, if it has not been previously puked up. A very small proportion, however, does pass the pylorus; livid spots were often seen on this viscus.

Intestines. The small intestines were much inflamed, through the whole tract, from the pylorus to the valve of the colon; and frequently an effusion of pus or bloody mucus filled nearly their whole cavity. The coats of all the intestines were thickened. Some parts of them looked red, others livid, or almost gangrenous. The large intestines were never so much inflamed as the small; seldom containing fæces, except about the cæcum.

The liver very red, or in some parts yellow; either a great secretion of bile into the duodenum, or the gall-bladder distended with it, or perhaps both. The bile is mostly of a dark green colour.

The spleen and pancreas were sometimes enlarged. The veins were generally seen full of blood, which had a dark

colour; it coagulated slowly; when separated the serum appeared red as if some red globules were dissolved in it.

REMARKS.

These experiments and cases will, I trust, contribute to furnish us with tolerably correct ideas concerning the morbid effects produced by Opium. Neither the time nor the limits prescribed for this essay, will permit me to touch on, much less to investigate, all the opinions that have been held concerning the manner in which Opium produces death. I shall just mention the most common phenomena of the disease, as they occur, when an over dose is taken. The dose necessary to prove fatal cannot be known, owing entirely to the difference of excitability in different constitutions. Instances are not wanting, where some have been destroyed from four grains, and others have survived as many drams. When, however, the dose is overproportioned to the excitability of the patient, the symptoms are very generally as follow:

The pulse becomes more frequent, full, and tense; the face is more or less flushed; the carotids pulsate strongly, and there is a great determination of blood to the head. The respiration is hurried and irregular, and somewhat difficult. A fulness, followed by some pain in the head, is felt. The patient often feels a calmness and composure, perhaps with some hilarity. These are the primary effects, which continue from half an hour to one hour and an half, but longer or shorter according to the constitution, habits, and other circumstances of the patient. They are succeeded by a slow and full pulse, which becomes more or less intermitting. The respiration is slow, deep, laborious, and finally stertorous as in apoplexy. Subsultus tendinum; coma; stupor; a total insensibility to some of the most powerful stimuli; groaning at intervals; the face pale, or livid, and the countenance gloomy; the eyes fixed, and

pupils dilated; they appear towards the last, of a muddy aspect, or of a pearly white. Finally, the pulse becoming more slow, and intermitting, is at last imperceptible; the circulation retires from the surface, the skin is livid, and feels cold; singultus; sighing, and sobbing; a paralytic relaxation over the whole body; and respiration being made at intervals of several minutes, the unhappy patient breathes his last, with most of the phenomena of apoplexy. When the disease appears with the above mentioned symptoms, it has been considered a true apoplexy. Dr. Cullen has called it apoplexia venenosa when arising from Opium, cicuta, fixed air, or drunkenness.

That Opium produces death, in a majority of cases, from the injury done to the system of the brain, may be inferred.

1st. From the symptoms most generally occurring, being similar to those where the brain is supposed to be principally affected: such as dilatation of the pupil of the eyes, a slow and intermitting pulse, a stertorous and difficult respiration, tremors, subsultus tendinum, and paralysis.

2nd. In those countries where it is used as an article of luxury, those who take it to excess are affected with tremors, paralytic affections of the lower extremities, which travellers have compared to the rickets.

3dly. From the morbid appearances in the brain, upon dissection, the meninges of the brain have been generally found preternaturally turgid with blood, and instances are not rare where extravasation or effusion has been found in its cavities. Ancient writers speak of the vessels of the brain being ruptured by the effects of Opium. Dr. Cooper once made a dissection of the brain of a patient, who died in consequence of taking a large dose of Opium, (as I was informed by Dr. Barton), and found a very considerable quantity of bloody serum in the ventricles. The opinion of Lassus, in the case mentioned, is a very singular one. He confesses that when he first saw the patient, she was

“ in a profound sleep, breathing with stertor, like a person in apoplexy.” Yet he will not agree that the effects of Opium are to produce a true apoplexy, or any morbid congestion of blood in the brain, merely because in that solitary instance, none of these appearances could be found upon dissection. If we suppose that the brain has not sustained any injury, or been in an apoplectic state, in those cases, where, upon dissection, the morbid appearances, commonly seen, are wanting, we shall probably be deceived. The existence of effusion, or even congestion, in all states of apoplexy, is denied by the most respectable authority. “ The natural historian and physician Valisnerij, has given several dissections of persons dying apoplectic ; and where, upon examination, to the surprise of every by-stander, effusions of no kind, nor any morbid appearance of the brain, presented itself. Morgagni and Valsalva have both acknowledged the existence of apoplexy, without effusion or any morbid appearance of the brain. I have also seen two cases of persons, of very spare habits, about sixty years of age, where there was not the least appearance of redundance of the fluids, either sanguine or serous, in the system, and who died strongly apoplectic.”* A very respectable practitioner, of this city, Dr. Hewson, informed me that whilst he was in London, attending at the hospital, a patient was admitted with apoplexy, of which he died, and upon examination of the brain no morbid appearance was seen. We are not, therefore, surprised when death takes place in an apoplexy induced by Opium, if, upon dissection, the brain exhibits none of the usual morbid appearances.

The disease induced by Opium is sometimes purely spasmodic and convulsive as in Tetanus. In experiment 15 we observed it to be similar to opisthotonus; and in many of the dogs, which were destroyed in my experiments, convulsions were more or less frequent. Dr.

* Pyrrho on Apoplexy.

Wilson observes that in frogs and rabbits, to which he gave large doses, it produced tetanus of the same form. This may be accounted for from these animals having more irritability, and less sensibility than man. I have observed that dogs are more easily puked or purged than we are, and that it takes much more to destroy them. For the same reason I think it probable that in children, and debilitated persons, the disease will be of the convulsive kind. I have mentioned a case where a child died with violent convulsions. Tralles, on Opium, says "*memini horrendis convulsionibus affectum infantulum; cui, per errorem, datus fuerat pulvillus, matri destinatus, granulum forte dimidium extracti opii, habens.*" He quotes several other similar cases from different authors.*

The disease produced by Opium is not always entirely apoplectic or convulsive, but sometimes partakes of both. I observed the vessels of the brain in the animal which died with the tetanic spasm, to be as turgid as in those that died under apoplectic symptoms: but whether this morbid appearance was the cause of death, or only the consequence of the disease, I will not pretend to decide.

From the cases of the two children, who died several hours after they were thought to be in a convalescent state it would appear that a foundation is laid for subsequent disease. This may happen either from the great accumulation and over-distension of the vessels of the brain, whereby the power of reacting on their contents, or the vis restitutionis is lost, or more probably from the violent action of this poison on the stomach and small intestines, producing inflammation and its consequences. In some few patients who have expired under the effects of large doses of Opium, it has acted so violently or suddenly as to exhibit but few symptoms of disease: in these the powers of life are overwhelmed, and death seems to supervene, as in some other diseases, from exhaustion or inanition.

* Wilson on Opium.

The ancient idea that Opium produced death by coagulating the blood in the large vessels, because it was said to be found in that state, after life was destroyed by it, is totally void of any foundation. For the fact is otherwise, as I have repeatedly seen upon dissection, immediately after death, when the blood is fluid as in death from any other cause.

The Abbe Fontana supposes Opium to act by destroying the vitality of the blood. It is in that part of the blood called coagulable lymph, that the supporters of its vitality agree it resides: and when it does not coagulate the mass of blood, as is the case in sudden death from electricity, lightning, and many poisons, the vitality is said to be destroyed. The blood, after death from Opium, is observed to coagulate more slowly than that drawn in health: it however does coagulate the mass of blood in a few hours, and of course its vitality is not destroyed, in so far as it depends on the possibility of forming a coagulum. If the opinion is founded on some change in the coagulable lymph, not sufficiently evident to the senses, nor as yet demonstrated by any experiments, it may be considered, at least, as hypothetical.

It is impossible, in the present state of our knowledge, to explain precisely in what manner Opium operates in destroying life. For as we are entirely ignorant of the principle of life, so we cannot determine the manner in which Opium affects it. That its morbid effects on the human body are to be attributed to its stimulating power, I am induced to believe from the following considerations:

1st. From its primary effects of accelerating the pulse, and augmenting it in force and volume. Respiration becomes more quick. The heat of the body is increased, and exhalation is produced.

2ndly. From its effects in large doses, and chiefly from the morbid appearances after death, related above.

3dly. From the remarkable similarity in its effects, with other narcotic stimuli, as the solanum, belladonna, stramonium, cicuta, hyosciamus, and those acknowledged to be purely stimulant, as camphire and ardent spirits, or alcohol, whose primary effects are to increase the action of the heart and arteries, quicken respiration, increase the heat of the body, and exhilarate the animal spirits. When the dose is considerable the deleterious effects are very similar to those of Opium, producing first a more quick and very full pulse; respiration is hurried and irregular; the heat of the body much increased, with considerable determination of blood to the head. The pulse, after a time is diminished in frequency, is slow, full, and intermitting, or quick and irregular; respiration becomes slow and difficult, or quick and conclusive, and the body grows cold. The patient is also affected with vertigo, dilatation of the pupils, delirium, thirst, profuse sweats, involuntary discharges from the bowels, sometimes with blood: a drowsiness, and profound stupor are frequent; finally, convulsions, apoplexy, palsy, and death put an end to the sufferings of the patient. Dissection has shewn nearly the same appearances as in death from Opium, as congestion in the vessels of the brain, extravasation, or effusion. The stomach and bowels have been found inflamed or mortified.

4th. From its effects on those who are habituated to its use, being, in many respects, analogous to the operation of wine. It produces pleasing sensations, exhilaration of the spirits, and makes them gesticulate in a variety of ludicrous forms, and in a word to act like men intoxicated with vinous liquors. Does the abuse of vinous spirit produce a stupidity, and impair all the faculties of the mind, and at length induce a train of diseases as dispepsia, and others of debility, with tremors and paralysis; in like manner does Opium. A farther proof of the analogy in the operation of Wine and Opium may be drawn from this fact; that among those who have been in the habit of eating Opi-

um, if they are at any time deprived of the usual dose, they are rendered miserable; and in this situation, wine has been found an excellent substitute. Of this, Acosta relates a remarkable instance, "There were (says he) some Turkish, Persian, and Arabian captives, aboard the ship in which I returned from the Indies to Portugal, who had a small quantity of Opium concealed, and used it only as a medicine. When they had consumed it all, one of them, a Turk of Aden, said to me, since you have the care of the sick, I must let you know, that, unless you give me and my companions opium, we cannot outlive two days. I denied I had any. The only remedy, then, said the Turk, whereby we, who have been accustomed to eat Opium, can be recovered, is, to give each of us a draught of pure wine every morning. Though this is very hard and uneasy to us, being contrary to our law; yet, since our health depends on it, we must of necessity bear it. By his advice, I gave them all wine; they recovered, and in a month's time would taste no more wine, and neither needed nor desired Opium."*

Haller says, "*Uno verbo, eadem ratione, qua vinum, ea et opium agit. Hinc qui opio, adsweti, eo destituti languent perituri, si caruerint diutius, solo vino refocillantur, quod opii vires supplet.*"† In a famine which once prevailed in the East-Indies, Opium was used to supply the stimulus of food.

Fifth. From its use as a medicine, Opium is generally forbidden in all inflammatory diseases, or where there is febrile irritation in the pulse, and heat on the skin. The old maxim, to wit, that where the lancet is necessary, that there we should not administer Opium, is certainly a good general rule, and is adhered to by most practitioners, whatever may be their theory of its mode of operation. It is on the contrary, a sovereign cordial in certain typhoid states of the system, where wine and other diffusible stimuli are indicated.

* Alston on Opium.

† *Elementa Phisialogiæ*, tom. v. page 600.

I do not deny that Opium possesses some difference in its effects, both from other narcotic stimulants, and also from those acknowledged to be purely stimulant, as wine : but may not this result from a peculiar modification in its degree of action as a stimulant ?

The different degrees of diffusibility and durability of the stimulating power of Opium, account for the phenomena of its mode of operation. The degrees of each, however, do differ in some measure, in different constitutions : this is, I believe, particularly the case with regard to its durability, which is much more striking in some. It is difficult to determine a priori, how long it will exert its stimulating effect on particular constitutions, or habits. Upon this depends the rationale of the management of the patient, where large doses are taken. In a word, to deplete according to the diffusibility and durability of the stimulating agent, and to guard against the subsequent state of indirect debility, or to support the system by adequate stimuli, after it has supervened, is perhaps the cardinal rule in cases of this kind.

EXPERIMENT.

To see the results of different methods of cure, where large doses of Opium are taken, I made the following comparative experiment. Having procured two pups, more than two months old, and of the same litter, one scruple of Opium was given to each of them. One, which I call A, slavered considerably. In ten minutes he was purged, and in 30 minutes appeared very sick ; at this time we began to bleed him, and at the end of one hour, we succeeded in getting six or eight ounces of blood. In seventy-five minutes, was very languid and dull ; respires slowly. I gave half an ounce of spirit and water.*

This was a table spoonful of equal parts of proof spirit and water.

In one hour and thirty minutes, was laid down, in a profound sleep; pulsation of the heart scarcely to be felt: repeated the spirit and water.

In two hours, respired slowly; very stupid: the spirit and water repeated.

In three hours slept soundly, and when roused, was dull and stupid; respiration was slow and difficult; the pulse weak and intermitting: repeated the spirit and water.

In four hours, no alteration, except slight subsultus: repeated the spirit and water.

In five hours, the symptoms had all increased. The pulse was imperceptible; he lay stretched out, the mouth wide open, with singultus and stertorous respiration: the spirit and water was increased in quantity, and repeated oftener, but it did not rouse him. As he seemed about to die, I used stimulating injections of salt and water, and laid on large sinapisms to the belly and thighs. It was all to no purpose, for he died in five hours and an half from the time the dose was taken. Upon dissection, the usual morbid appearances were seen.

Case of B. In twenty minutes after the dose, he appeared very sick, and similarly affected with A. The shower bath and plunging bath were used alternately, three times an hour, from this time to the end of two hours.*

In one hour, had constant rigors; the respiration very quick; moans at intervals. When the cold bath was used, he was roused from the stupor into which he seemed very much inclined to fall. Was not so dull and stupid as A.

In two hours I applied sinapisms to the inside of the thighs. The tremors continued; did not lie down to sleep; the bath was discontinued.

In three hours the tremors subsided; respiration more natural, and the sensibility returned; was in every respect better than A. The sinapisms excited considerable pain; after this they were applied to the abdomen.

* The water was fresh drawn from a pump, and ver cold.

In four hours the sinapisms were removed. The effects of the Opium had in a great measure subsided, and sensibility nearly as great as in health.

In five hours and an half, when A died, B had nearly recovered.

This experiment was repeated, and the results were nearly similar.

EXPERIMENT.

To a small dog about nine months old, I gave half a dram of Opium, rubbed down in a little water. In five minutes after, I flagellated him with rods; this was repeated every ten minutes during the first hour, and twice an hour afterwards, till the end of nine hours. As soon as the Opium was taken, he began to slaver very profusely, retched frequently, and in ten minutes vomited up food, even though he was under the smart of a severe flagellation; none of the solution of Opium, however, was discharged at this time.

In two hours he vomited again; was very dull and drowsy, and was severely affected by the dose. He continued very sick for twelve or eighteen hours thereafter; a partial paralysis affected his hind extremities, insomuch that he walked with great difficulty, for two or three days subsequent to the experiment.

Upon the whole, the flagellation did not appear to obviate in the least, the deleterious effects of the Opium.

EXPERIMENT.

Having caused two cat-fish to swim in a watery solution of Opium (which was made in the proportion of one grain to the ounce of water) till they were so torpid, as to exhibit to all appearance only a few signs of life. I made on them the following experiments.

First. I tried whether muscular contractions could be excited by punctures with a lancet, but none appeared. A few drops of the sulphuric acid was poured on different parts of the body ; the same was done with the nitric acid, and also with some of the essential oils ; but no muscular contractions were excited by either of them.

Second. I then placed the fish on an insulated stool, and connected them by means of the chain to the prime conductor of the electrical machine ; upon taking sparks from them, contractions were excited throughout their bodies. This was repeated five or six times, in two hours ; during which, they seemed to be reviving ; sometimes small shocks were passed through them. They, however, became less and less excitable, and at the end of three hours from the time the electricity was began, no contractions could be excited by small shocks of electricity.

Third. They were immediately subjected to the influence of Galvani, by a weak apparatus. As soon as they were placed within the circle of this power, very strong muscular contractions were excited in every part of the body ; they were much more powerfully excited by the influence of galvanism than by electricity. It was repeated several times in one hour, at the end of which, the contractions became very weak. Several hours after all signs of life were extinguished, this influence excited some contractions.*

OF THE METHOD OF CURE.

The indications of cure where large doses of Opium are swallowed, are—1st. To evacuate the contents of the stomach—2d. To moderate the excessive action of the arterial system, and—3d. To obviate the impending depression of

* In all these trials, the fish were kept out of water, no longer than the applications above mentioned were made, which was only a few minutes.

the system, and to support it, when in the state of indirect debility.

When an over dose of any acrid substance is taken into the stomach, its healthy action is diminished or destroyed ; nausea is produced, its action becomes inverted, and nature often succeeds in casting off the poison by vomiting. This is not unfrequently the case when an over dose of Opium is taken. I have heard of a man who had taken a large dose of laudanum more than once, with a view of destroying himself, and had always vomited it soon after it was swallowed. A young man, who had a recent contusion of the arm, was in considerable pain, and could not procure sleep, took from the hand of his father, six hundred drops of Tincture of Opium, in broken doses ; it made him very sick at the stomach, and was soon discharged by vomiting. Unfortunately, however, this is too seldom the case. Many facts might be adduced to prove that the Opium has lain in the stomach a long time, without being acted upon, or changed in its properties, or even passing the pylorus, at least in a comparatively small quantity. " I have myself, when trying experiments on the different parts of Opium, often vomited up what appeared to me to be the entire quantity of the medicine I had taken, after its having affected me in a very violent manner."*

Dissections after death from large doses of Opium, have found the greatest part remaining in the stomach. It is presumed therefore, that as long as it remains in the stomach, it will continue to injure that organ.

I prefer ipecacuanha to any other emetic, because of the power which I believe it possesses, of counteracting to a certain degree, the deleterious effects of this poison. It should be given to adults in doses from one to four drams in cases of this kind. After taking a considerable quantity of ipecacuanha, if an emesis is not produced, the sulphate of zinc

* Crumpe on Opium, page 136.

must succeed it, in doses of one dram for an adult; sometimes less, but often more.

In the mean time mechanical means should not be neglected. A feather dipped in some bitter or pungent liquor is to be passed into the fauces and upper part of the œsophagus, to irritate those parts, and produce puking; this has often succeeded in producing nausea and vomiting, when other things have failed. If however this irritation be not sufficient for the purpose, I would recommend a probang to be dipped in a decoction of tobacco, and passed down the œsophagus, even to the upper orifice of the stomach. Frictions on the epigastric region with the hand, or flesh brush, might in all probability have its use in exciting the stomach into action.

The patient ought to swallow frequently some liquid, as chamomile tea: it ought to be drank in very large quantities. Copious dilution is of service, both by rendering the poison less active, and by mechanical distension of the stomach, which has been known to produce vomiting in such cases, where the largest doses of emetic medicines have failed. A strong solution of common salt in water, had the desired effect, in two cases mentioned above, after large doses of ipecacuanha, sulphate of zinc, and tart. antimony had been taken without producing emesis.

When there is reason to suppose the stomach is very torpid, and the difficulty of exciting vomiting of course increased, these remedies should be aided, by a cataplasm of tobacco to the epigastric region. Dr. Barton has prescribed this application in such cases with the happiest effect. The tobacco is particularly indicated, in cases where the power of deglutition is suspended or paralysed, and where of course no emetic medicine can be gotten into the stomach. Experience has proved, that tobacco injections will quickly produce nausea and vomiting, and they deserve a trial. This is a powerful medicine when taken internally, and care must be had, not to give too large a dose, as it will

often create very alarming symptoms. From half a scruple to two scruples infused in four ounces of boiling water, will be sufficient for an adult. It is better to give it in small doses, and repeat them till the desired effect is produced, than to give a large one. If these remedies be used sufficiently early, and with diligence, they will seldom fail to evacuate the *contents* of the stomach.

Inordinate action of the heart and arteries, is one of the primary effects of an over dose of Opium. This is to be moderated, first *by blood-letting*. This does not interrupt the emetic plan, mentioned above; on the contrary it is one of the best auxiliary means to render it speedy and effectual. This is observed in some of the cases mentioned above: and I have observed in my experiments on bleeding in this disease, that upon giving an animal a large dose of Opium, and in one hour after, opening a vein, a free and copious discharge of the Opium ensued, whilst the blood was flowing. It is impossible to lay down any positive rules concerning the use of the lancet in this disease. The quantity to be taken must depend on a variety of circumstances, the particulars of which cannot be pointed out in this place. The pulse however, and the existing circumstances of the case, will regulate every judicious practitioner in the quantity of blood, that should be taken.

Although this be one of the most useful remedies, and indeed an indispensable, one in by far the greater number of cases, yet we cannot employ it so largely in this disease as in one purely inflammatory. In *pneumonia vera* we may take away a large quantity of blood, and the system will react; not so in the disease from Opium: this being one of the most powerful stimuli, quickly diffusible through every part of the system, is the more suddenly exhausted, leaving the patient in a state of great indirect debility. Hence when the Opium has exerted its stimulating effect, and the system is at the highest pitch of excitement, if then a large quantity of blood be drawn, the powers of life sud-

denly decline, and are finally sunk below the point of reaction. I have seen this effect produced by one large bleeding, in two experiments.

Secondly; cold effusion. I am inclined to believe this will be found an useful auxiliary to bleeding; first, from the good effects produced by it in the experiment related above, which was repeated twice. It was used during the first two hours after a large dose of Opium, and always with the effect of moderating the violence of arterial action, suspending stupor and insensibility for some time, and when the stupor was present, the animal was roused considerably. Upon the whole, the effect of the *cold bath* in suspending and diminishing the symptoms, was beyond all expectation; especially as no other remedy was used. Second; from the close analogy which subsists between the effects of an over dose of Opium, and one of alcohol, we should be induced to use the same remedy in the two diseases.

The use of this remedy in drunkenness is so well known even to the common people, in Philadelphia, that when a man is found intoxicated, in the summer season, they often drag him to the nearest pump, and expose his head to a stream of cold water, by which he is soon roused from stupor, and rendered perfectly sober. Effusions of cold water may be used as soon as the pulse becomes increased in force and fulness, and continued occasionally whilst the pulse is full, a heat on the skin, with stupor and drowsiness: but when the pulse grows weak, and the skin cooler, it should be omitted.

The cold bath, probably acts in two ways: first by its sedative power in preventing, or moderating, the excessive action of the heart and arteries: and secondly after some time, disposes the surface to take on a more vigorous action, thereby diminishing disease in the brain and other parts more vital.

When by vomiting the poison is evacuated, and the increased action of the vessels diminished; if the stupor and debility be inconsiderable, nothing more is necessary than some very strong coffee. From its known cordial and stimulating quality to the brain and stomach, it is particularly indicated in circumstances of this sort: and experience has shewn its utility in removing nausea, anxiety of the præcordia, and languor, symptoms which are almost invariably observed, after the poison has been discharged. A case is related above, where it succeeded in relieving these symptoms, when the acid of limes failed.

The state of the patient however, is seldom so favourable at this period: either from the Opium acting suddenly, or an accumulated excitability, or remaining a considerable time in the stomach, a prostration of strength sooner or later ensues, attended with stupor and insensibility, the pulse becomes slow and weak, intermitting, and sometimes imperceptible. This is a state of indirect debility, which is more or less dangerous in proportion to the loss of excitability. It may perhaps be obviated, by a minute attention to the state of the patient, and particularly of the *pulse*. In no disease is such a minute, and constant attention to the state of the *pulse*, so necessary as in this. When the pulse begins to flag, and the skin becomes cool, we must support the patient by wine and water; sinapisms may be laid on the ancles, and on the wrists, if occasion should require; and these can be increased or diminished, according to the state of the pulse, and other circumstances. By so doing, we might be able to *arrest* the impending evil at the very *threshold*.

If extreme indirect debility has supervened, we must endeavour to rouse the excitability, by stimuli adequate to the depression. These stimuli are either internal or external. The internal stimuli are, strong coffee, wine and water, or pure wine, the volatile alkali, alcohol pure or diluted, sulphuric æther, and injections of salt and water. The external are, frictions with the hand, flesh

brush, or common salt; sinapisms to the extremities, and to other parts of the body; flannels wrung out of hot water and applied to the surface: among the most powerful may be reckoned electricity, and the galvanic influence. In the application of these stimuli, we begin with those sufficiently powerful, until the system reacts, after which, less diffusable ones are used. From the power of galvanism in exciting muscular contractions when other stimuli have failed, it deserves a trial in desperate cases. It is moreover useful as a test of the excitability remaining, and thereby shews the physician the *ne plus ultra* of the exertions of his art.

In the convalescent state, the patient may take the Peruvian Bark and wine as his state may require. The pulse should be attended to, in order to form a correct idea concerning the state of the inflammation in the stomach and intestines, which is so frequent a consequence. I suspect this inflammation is rather of the ulcerative or gangrenous sort, or at least is attended with debility, and consequently requires the bark and wine. The diet must be light and nourishing, or generous and cordial as the circumstances of the case may be. On account of the remarkable tendency of the stomach and intestines, to generate flatus after large doses of Opium, the physician must forbid all flatulent food. I knew a patient, in the convalescent state of this disease, who was very near dying, from the sudden production of air in the stomach, by which it became enormously distended. In this case the stomach was perfectly relieved both of spasm and distension, by exceedingly strong coffee.

In the convalescent state, the patient is in a situation rather precarious, and should not be neglected by his physician: the particular circumstances respecting the non-naturals (as they are termed) must be regulated by his special directions.

If the patient be one of those unhappy persons who has sought Opium as the instrument of suicide, he ought not to be

left entirely to himself, even after recovery from the effects of the poison. In a majority of cases, and perhaps I may say in all, the attempts at suicide are made, when in a paroxysm of mental derangement. The physician should visit him occasionally, converse cautiously, and analyze the state of his mind. If there is reason to suspect derangement, the treatment should be in every respect similar to the forming state of mania. Fortunate is that physician who can administer *medicine* to our bodily infirmities; but far more fortunate is he, who in addition to this, can administer successfully to mental derangement.

THE END.

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