A Gifford Esq.
From the Author

A LECTURE

ON

TOXICOLOGY,

DELIVERED

BEFORE THE CLASS,

OF THE

MEDICAL COLLEGE OF OHIO,

JANUARY 15, 1841.

BY JOHN LOCKE, M. D.,

Professor of Chemistry and Pharmacy.

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OHIO MEDICAL COLLEGE,
February 15, 1843.

Professor Locke,

Dear Sir:—The members of your Class are anxious to have your valuable Lecture on Toxicology. We, therefore, address you, respectfully soliciting a copy for that pupose. Knowledge of all kinds is valuable only in proportion to its utility; and, as we consider your Address of the most useful kind, and as containing information which should be generally known, we hope that you will permit its republication.

In adding our sentiments of respect and esteem for you personally, we are sure that we express also the sentiments of our fellow students.

Yours, truly,

Symmes Moore,	Cha's. S. Muscroft,
A. T. Mc Clure,	Geo. H. Stewart,
F. B. Mussey,	J. J. Pennington,
C. Clark,	John Pritchett.

MEDICAL COLLEGE OF OHIO,
February 20, 1843.

To Messrs. Symmes Moore, and others,

Committee of the Class, of the M. C. O.—With the hope that your opinion of the utility of my Lecture on Toxicology may not be unfounded, I am happy to furnish you with a copy, revised and corrected, for the pnblication of a second edition. Please to accept the assurance of the high estimation in which I hold the kind personal regards of yourselves and the Class, expressed in your communication.

Affectionately, Yours,

JOHN LOCKE.

LECTURE ON TOXICOLOGY.*

The topic proposed to be discussed, is that of Toxicology or Poisoning, whether it takes place by accident or by criminal design. The main object of the discussion will be to communicate such information as will enable all persons, in cases of poisoning, to afford that timely assistance by the administration of simple remedies, which in many instances, will save from great suffering or even from death itself. This kind of popular information is the more important, because many poisons act so speedy, that the only opportunity for the saving of life may be lost before a physician can be procured. Nor is it quite certain, that every person who is called Doctor, knows how to apply, even, the known and certain antidotes.

Perhaps there is no class of remedies which can be more safely trusted, to well informed domestic management, than certain cases of poisoning. The *cause* of the disease is known to a *certainty*, and the remedies are reduced to *one* or *two*, and these, if seasonably applied, are as certain of cure as the permanency of the laws of nature. Many antidotes have been lately discovered by chemists, by which the most deadly poison is rendered bland and harmless, and the devoted victim rescued from certain and immediate destruction.

What gives peculiar interest to this part of the subject is, that the poison and the antidote are often both kept in your houses as domestic articles, and your children may swallow the one and die in your arms, while the remedy is literally within your reach. Should this happen, and you should afterwards learn the circumstances, you would feel sensibly that "*knowledge* would have been *power*."

Possibly an ordinary practitioner might be no wiser in this essential point than yourselves, and even a modern graduate, unless he has thought chemistry of more value than some have done, might in one of these cases be guilty of homicide, scarcely excusable.

Many of you make use of salt of sorrel, oxalic acid, sometimes called "essential salts of lemon," to remove iron-moulds from linen. This may be taken by mistake for lemon juice, or for tartaric acid, to make an acidulous drink. It would make an agreeable one. It may be taken, as it has been, for sulphate of magnesia, or epsom salts. It looks like them. It has been taken for the purpose of self-destruction, and administered criminally to others. In

* In the following discourse a free use has been made of such learned and eminent authors on the subject as best suited the purpose. I did not mark the quotations, and now it is too late, unless I re-examine the whole matter, which my engagements do not permit. Christison is the author to whom I am most indebted.

either of those cases let me ask, parents and physicians, what is to be done? No time can be lost—twenty minutes or an hour seals the fate of the sufferer for ever,—some can answer, but not all: Chalk, or powdered limestone is the simplest remedy.*

DEFINITION OF POISONS.

The writers on Toxicology have included in their definition of poisons, most substances which produce death or serious injury, when applied in considerable quantities, either externally or internally.

It is necessary to include in the definition the consideration of quantity; for it is not probable, that there is any substance in nature which is an absolute poison, in any dose, however small, and in every state of the system. Most of the active poisons are used in moderate quantities as medicines or even as food, condiments, or common beverage. Arsenic, iodine, and mercury are all valuable remedies; and vinegar, which, when most concentrated, is an active poison, is a common condiment to our food. Alcohol, which may act as a slow or a quick poison, is too commonly used in a state of poisonous concentration, but in the dilute state of wine, it has been consecrated by a miracle, and is an element of one of the Sacraments.

To some persons, certain articles of food are poisonous, or, as it is commonly expressed, they do not agree with the stomach, producing nausea, vomiting, loss of pulse, extreme weakness, and sometimes death. The richer kinds of fish, as salmon, trout, and especially shell fish, not unfrequently produce these effects. Even beef, and more frequently veal, and the meat of young animals generally, although of the best quality, are to some persons absolute poisons. In some rare instances, the same article shall operate on an individual as food one day, and as poison the next. Even the secretions of the body itself, become in disease, poisonous, contaminating the contiguous atmosphere so as to infect others who breath it, as is exemplified in Small Pox, Measles and other similar diseases. The causes of disease are a distinct class of poisons called malaria, a subject not proposed to be discussed at present.

It is evident, from these facts, that it is difficult to define a poison, and that the difference between poison and food is often so slight, that the skill of the chemist and of the physiologist are, at certain points, entirely baffled. The action of mineral poisons is more permanent on the system, than those of the animal or vegetable kingdoms, but is better understood by the chemist, and more under the control of antidotes. Animal and vegetable poisons are more difficult to be destroyed by antidotes or detected by tests, and on these accounts offer temptations to the murderer, but as they are more transient in their effects as they seem, after a little time, to be decomposed in the system, they are less certain, and therefore, not often resorted to.

Toxicologists treat many substances as poisons, which are noxious, chiefly by producing merely local mechanical injury. Sharp fragments of glass applied externally, produce a simple wound. When taken internally, although the same substance acts mechanically, yet it sometimes produces such symptoms by sympathetic action as have given it a place among poisons.

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* Part of this lecture had been previously addressed to a popular audience.

Nitric acid applied externally, destroys, as would a heated iron; when taken internally, its action may be compared to a burn; yet, such are the sympathies of the stomach, that it may suspend the action of the heart and produce sudden and mortal faintness; it is therefore, classed with internal poisons. It would be a question fit for a debating club, whether the molten gold poured down the throat of the miserly king of Lydia, was, or was not a poison. Gold is *now* undoubtedly a poison, but it acts not by means of the caloric which it contains.

MODE OF OPERATION OF POISONS.

It is a common impression that poisons all act generally, or that when they have once entered the system, they pervade it universally and produce their effects at every point. This has probably originated from the fact, that a sensation of universal weakness is a common and early symptom. This sensation may, and often does, arise from a suspension of the function of some vital organ, as the heart.

Some poisons are much more general in their effects than others, but mostly their action is determined to one or to few organs. The mineral acids act on the heart, depressing its powers, and causing weakness, faintness, imperceptible pulse, and cold extremities. Tobacco, although classed with narcotics, affects the heart in a similar manner, and this too, in whatever way it enters the system; Tartar Emetic, is said to act on the lungs; the Norcotics, such as opium, act on the brain, producing exhilaration, giddiness, delirium, and stupor; Nux Vomica and its essence Strychnia, irritate the spinal marrow, producing extensive tetanic spasms; Arsenic inflames the mucus membranes; Mercury, the glands of the throat; Chromate of Potash, the eyes; Manganese, the liver; Iodine acts on the lymphatic glands, and ergot or spurred rye, besides its well known local action, produces gangrene of the limbs. Several poisons act on many organs. Arsenic, besides inflaming all of the mucus membranes, acts on the heart, the brain, and the lungs. Oxalic acid inflames the stomach directly. In a large dose, it paralizes the heart, and produces death in ten minutes; in a less dose, it effects the spine, and, like Strychnia, produces mortal tetanic spasms. In a quantity still less, the spasms do not prove mortal, but subsiding, give rise to a loss of the senses, followed by stupor and death, evincing a violent effect on the brain.

The Pancreas and Spleen, are said, never to be effected by poisons. But as the functions of these organs are not known, we must remain equally ignorant of what disturbs them, and I connot see how the point has been determined.

The effects of some poisons are confined to the part to which they have been applied, while most of them affect distant organs. The first are called *local*, and the second *remote* poisons. A local poison may merely effect the contiguous nerves. It may irritate and inflame, or it may corrode and decompose. M. Robiquet ascertained that if the end of the finger be held over the end of a tube containing Prussic acid, it became benumbed and remained so for more than a day. M. Brodie mentions, that when Monkshood is chewed, it causes a sensation of tingling and numbness in the lips, lasting for hours. These are examples of effects produced locally on the nerves without any organic change, not even redness.

The examples of local irritation and inflammation are numerous. Alcohol applied to the skin produces a transient redness; cantharides, inflammation with vessication; tartar emetic, a deeper inflammation followed by a pustular eruption; arsenic, inflammation followed by ulceration and gangrene.

We have examples of *external* corrosions in the concentrated mineral acids and the caustic alkalies; and of *internal* ones in oxalic acid, lunar caustic, and corrosive sublimate.

These local poisons excite less surprise than those which act at a distance seeming to violate the philosophical axiom, that matter cannot act where it is not. That tartar emetic should produce vomiting, whether taken into the stomach or injected into a vein in the foot; that mercury should affect the throat and the gums by being applied either to the stomach, the skin or the lungs, are curious and interesting problems, for the solution of which, two theories have been advocated.

One is, that the poison operates through the medium of the nerves, as do sensation and volition; and the other, that it is absorbed and carried in the blood to the place where its effects are produced. In the first case, it is said to act by *sympathy;* and in the second, by *absorption.* Important and violent actions do take place naturally by sympathy; that is, when an application is made to one part of the body, another remote part is instantly caused to act. If snuff, or other irritating substances be applied to the nose, there results a slight spasm of the muscles of respiration and sneezing is the consequence. The application of any foreign solid or liquid, even water, to the glottis, the entrance into the wind pipe, brings the same muscles into a different action, and causes *coughing.* Both of these sympathies are evidently established by the Creator to guard the lungs against the intrusion of any other substance than air. The one speaks plainly against snuff taking, until the persevering offender has been given up by nature as an outlaw, and no further notice taken of his crimes. The particular cause of this and of all other sympathies is unknown. The nerves are the organs in which it takes place. But whether it be by a nervous fluid, by electricity, or by undulation has not been determined.

We suffer something similar to sympathetic action in a common accident:—A blow at a particular point on the elbow causes a numbness in the little finger. In this instance the cause is evident to a certain extent. The blow is on the trunk of a superficial nerve, and the sensation is felt in the part in which that nerve is distributed.

Now, as sympathy is undoubtedly a physiological law operating extensively in the system, it was natural that it should be applied for the explanation of the remote action of poisons. At one period, toxicologists were mostly persuaded of the truth of this theory.

Although poisons undoubtedly are modified in their operation by the laws of sympathy, yet their absorption and presence in the circulating blood has been incontestibly proved.

The experiments on this point have been numerous and varied. Doctors Christison and Coindet, injected 4oz. of strong solution of oxalic acid into the peritoneal sack of a cat which killed the animal in fourteen minutes. On open-

ing the body, although this sack has no natural opening, and one of the solution had escaped by the wound, they found scarcely a drachm 1—64 remaining: the rest having been absorbed.

Magendie, separated a part of the body of an animal, say the leg, cut it entirely off, and afterwards connected the cut ends of the principal artery by one quill, and those of the vein by another, to keep up the circulation without any nervous communication. He then introduced poison into a wound in the separated limb, and the effects of the poison soon exhibited themselves in the body of the animal. Here the poison must have been absorbed and carried in the blood as all nervous communication had been litterally cut off.

Poisons do not act where the circulation has been interrupted, although the nervous communication may be left entire. Emmert, tied the blood vessel which supplies the hinder extremity of a dog, and afterwards introduced hydrocyanic acid into the hind leg of the animal. The poison, which would otherwise have killed it in a few seconds, produced no effect until the ligature was removed, and the circulation restored, when it acted rapidly.

The effects of nux vomica, thrust into the paw of a dog, may be arrested by a ligature around the limb so tight as to stop the venous, without impeding the arterial circulation, that is, the blood is permitted freely to enter the limb, but not to return from it to the body. If then, the blood so confined in the poisoned limb, be drawn from a vein just below the ligature, and injected into the vein of another dog, it will cause his death with symptoms of poisoning.

These facts with respect to the effects of the ligature were ascertained by M. Veniere, and are applicable to the prevention of poisonous action on vital parts.

Poisons act with greater or less rapidity, according as the parts on which they act, have a greater or less absorbing power. They act most rapidly when injected into the veins; next by insertion into a wound, still more slowly by application to the serous membranes, as the lining membrane of those cavities which have no outlet, and slowest of all when applied to the mucus membrancs, as the lining of the stomach. This supposes that they do not act at all on the skin, which is only partially true.

All these experiments show that poisons are absorbed, but still their effects are, to some extent, referable to sympathy; for some poisons produce death in two or three seconds, which is sooner than could be accomplished by means of the circulation.

Mr. Morgan and Dr. Addison reconcile many of the effects of poisons by supposing that the inside of the arterics and veins is lined by an expansion of nerves peculiarly sensible to poison and possessed of powerful and extensive sympathies, constituting an interior exquisite sense not unlike the exterior cuticular sense of touch.

TREATMENT.

Having given some of the points of the general physiology of poisoning, we proceed to a few remarks on the remedies and means of cure.

In cases of internal poisoning the great object of the physician is to administer an *antidote* or counter poison. Antidotes are of two kinds: one takes

away the deleterious qualities of the poison before it acts fully and destructively. The other controls its poisonous action after it has been established, by exciting a contrary action on the system. Much can be *imagined*, but little can be *executed*, by this last kind of antidotes. But chemistry has been remarkably triumphant at several points by means of the former kind, and it is chiefly with regard to these that I shall occupy the few remaining minutes, during which, I may expect your attention. The only example given by a late writer of an antidote operating by exciting a counter action, without changing the poison itself, is that the effects of lead may be counteracted by mercury given to salivation, and the salivation caused by the mercury may be corrected by nauseating doses of antimony. It is indeed, a general principle that one violent action in tho system destroys, or temporarily suspends another; but generally, that of poison is too rapid and violent to be so controled. Besides chemical remedies which change and destroy a poison, mechanical means are often resorted to with success. An emetic of sulphate of zinc speedily expels the contents of the stomach and with them, a part at least, of any deleterious substance which it may contain. The stomach pump is a modern invention of great utility. By its means the stomach may not only be evacuated, but by the repeated injection of water it may be literally washed. In case of a poisonous wound, as by the bite of a rabid or venomous animal, instantaneous excision will remove the venom before it is absorbed. A ligature around the limb above the wound, so as to interrupt the circulation, will, at least, suspend the absorption of the poison, but it will be liable to destroy when the ligature is removed. But the ligature and bleeding from the distended veins below it may withdraw the poisonous matter so nearly as to prevent serious mischief.

M. Veniere refined on this practice. Having thrust a fatal dose of poison into the foot of a dog, he applied a tight bandage or ligature around the limb, above the wound, and slowly injected as much water into the jugular vein as the animal would bear, so as to suspend absorbtion; and finally loosening the ligature a little and opening a vein in the limb, between the ligature and the poisoned wound, drew off the blood as it passed, and brought the absorbed poison along with it. After a moderate quantity had been withdrawn, he removed the ligature and the animal recovered. He then injected the blood thus drawn from the first animal into the vein of a second. It died immediately in violent spasms, showing that he had removed a fatal quantity of poison from the blood of the first animal.

Another successful mode of arresting the effects of poisoned wounds is by the application of cupping glasses over the wounded part. The edge of the cup acts as a ligature, by pressing on the surrounding parts, while the exhaustion sucks out the blood, and thus washes out the venomous matter, and prevents its absorption into the general circulation. The ancient poetical tale of the faithful friend who sucked out the poison from a wound made with an envenomed arrow, and thus saved the life of his companion at the risk of his own, is in effect revived as a modern discovery. The present improved mode of cupping, by means of a little air pump, if applied immediately, would have every prospect of success.

The object aimed at by all these mechanical means is to prevent the poison from being absorbed, or to remove it from the circulation before it has reached any vital organ. The object by chemical antidotes is, in most cases, the same. And this is often attained by rendering the substance *insoluble*, for solid substances are not absorbed, as such, by the animal body. In other cases a chemical antidote is efficient by changing the properties of a substance without rendering it insoluble. The antidotes for the simple corrosives are of this kind. The mineral acids, such as aquafortis, oil of vitrol, and the alkalies, as lime, potash, and soda, when pure, are active corrosive poisons. But the alkalies and the acids are mutual antidotes to each other, the resulting compound being a soluble mild salt. I have known persons to die from an overdose of alkali, when vinegar was within reach, and to suffer the same fate from oil of vitrol, when magnesia was at hand.

When given in time, magnesia or chalk is a complete antidote for the mineral acids, and for the oxalic acid.

Albumen, in the form of white of eggs, for corrosive sublimate and for verdigris.

Bark for tartar emetic.

Common salt for lunar caustic.

Sulphate ofsoda, or of magnesia, for sugar of lead, and for muriate of Barytes.

Chloride of calcium or common salt, for liver of sulphur, and vinegar or oil for the fixed alkalies.

Some of these antidotes are extremely simple and common, and are for poisons which are almost always in domestic use: as vienegar for the alkalies, chalk for oxalic acid, and white of eggs for corrosive sublimate.

If we include all, even of the mineral poisons and their antidotes, it is thought to be a subject rather burthensome to the memory of persons not professed toxicologists. But there is a generalization which affords assistance in this difficulty, and enables us to recollect facts by parcels.

Generally, the same substance which is an antidote for a poison, renders it insoluble or precipitates it, is a test for it, is incompatible with it. An antidote, a precipitant, a test, and an incompatible, meeting in the same article. If any one of these four can be recollected, the others are obtained by association.

As the popular treatment for poisoning is an important part of the subject, I shall proceed to notice a few of the most common poisons in detail: as lead, copper, oxalic acid, mercury and arsenic.

The double, soluble salts of lead, act as poisons, yet not so decidedly as many persons imagine. Ten grains of sugar of lead may be taken repeatedly at moderate intervals without any serious mischief. The worst effects of lead are produced by a continued, but moderate introduction of it into the system, as by being exposed to and respiring the dust of a white lead manufactory. It then produces in the first place colic, and subsequently palsy, and emaciation of the limbs, and not unfrequently apoplexy and death. I have already named sulphate of magnesia as an anidote. It acts by virtue of the sulphuric acid which it contains. This combines with the oxyd of lead and renders it insoluble and inert, forming the sulphate of lead.

The most important popular point in regard to lead is to know how far, and

under what circumstances the metal is soluble when used for domestic purposes. In our own city are we in danger of being poisoned by the transmission of water through leaden pipes? Metallic lead is not poisonous, and it becomes so only by corrosion and solution. Indeed, no metal is poisonous in its pure state, not even arsenic.[1] It would commonly be thought that water, containing any salt or other chymical agent, would corrode lead faster than pure distilled water. But it has lately been discovered that the reverse of this is the fact. Distilled water, deprived of air by being boiled, brought in contact with lead, air being excluded, does not act on it. But, if distilled water contain air, or if air have access to the vessel, then the white carbonate of lead will be generated and will form a crust on the metal which will scale off, creating a muddiness in the water.—340 grains of lead in bright sheets, exposed in a shallow open vessel containing 12 ounces of distilled water, will loose $2\frac{1}{2}$ grains in eight days, and would be consumed in four months. During this operation a small quantity of the lead is dissolved as a hydrate, and that which is suspended as a carbonate, would soon meet with solvents in the stomach and thus become poisonous." So far the facts seem to be alarming in relation to the use of leaden pipes, which were absolutely forbidden to be used in the aqueducts of Rome. But there is a salvo. If the water contain neutral salts of almost any kind, in solution, in some instances even one part in 30,000, they prevent the lead from being thus dissolved. Now the water of the Ohio contains muriate of soda, sulphate of lime, carbonate of lime, and several other salts, probably in quantity sufficient to prevent any solution of the leaden pipes. Among other problems of popular interest the examination of this subject experimentally, is one deserving of attention. Any acid in water is liable to dissolve lead, and form a poisonous solution, unless it be sulphuric. Families have been repeatedly poisoned by pickles put down with vinegar in earthen pots glazed with lead. This glazing is an oxide much more soluble than the metal itself.

Copper.—In former times, copper was scarcely suspected of being poisonous; hence much mischief was produced by a careless use of it for cullinary purposes, and by confectioners for imparting an agreeable color to their sweetmeats. In some of the old cookery books, directions are given to make pickles in a copper pan, or to put some copper half-pennies among them, to give them an agreeable color. The public are still exposed to this trick from the hands of huxters.

In modern times, poisoning by copper, although less excusable, is still frequent enough from negligence, or from the temptation to use the colors into which it enters as an ingredient. The most common source of its pernicious effects is by continuing to use vessels after the protection of tinning has been worn off; and in this city some unpleasant effects have been produced from soda water prepared in copper fountains, especially when it has remained in them for some time. Metallic copper is not poisonous, hence a large untinned copper boiler is used in ships of war for cooking most of the food. But a severe system of cleanliness is observed. After the copper has been cleaned, which is immediately after the cooking of every meal, the surgeon's mate thrusts down a stick, covered on the end with a piece of clean linen cloth along the sides and bottom of the vessel; if this is returned stained with verdigris, it is an effectual order for the cook to receive the lash. The cook, knowing the certainty with which

[1] Yet metalic arsenic is a dangerous article to the stomach, because it may meet with solvents.

it will take place, provides effectually against the evil by keeping the copper very clean. As copper communicates no poisonous properties unless it be dissolved, it is important to know under what circumstances the solution may be expected. Here we shall find two points at least in which copper has qualities which are the reverse of those of lead. Distilled water, although air may be present, has no effect on copper, and salt dissolved in water, instead of preserving it, tends to corrode it. Salt water boiled in copper will yield the metal on evaporation, but if meat or fish and vegetables be boiled at the same time, no copper is obtained. This singular fact has been ascertained by Eller, of Berlin, and confirmed by Prof. Orfila of Paris. It is justly inferred that food may safely be prepared in naked copper vessels provided they be kept constantly clean. This last condition makes the use of copper vessels dangerous to lazy people, and on the score of political economy might be useful by destroying drones.

Another delicate distinction in the use of copper is, that many acidulous substances do not corrode metalic copper, but act rapidly on its oxide. Hence if the copper be tarnished, they dissolve it. Practising on this principle, copper workers clean the metal by weak sulphuric acid, which speedily removes the tarnished green or brown coating, but does not effect the bright exposed metal. Acidulous fluids, when cold, contain air in a concentrated oxidating state, which air is expelled by boiling. Hence, it is quite safe to boil articles in copper which it is not safe to suffer to remain and cool in it. This fact is important as the following case will show.

A servant left some sour crout, for two hours only, in a copper pan which had lost its tinning. The lady of the house and her daughter, who ate of it for dinner died of twelve hours ilness. A chemist on examining the remaining food, found it so strongly impregnated with copper that it turned bright iron of a copper color.

Fatty and oily substances corrode copper, but not without the agency of oxygen, which may be derived either from the atmosphere, or from the oil itself if it be rancid. Copper thrust into fresh butter becomes green at the surface of the butter where air has access, but not where it is closely covered so as to exclude atmospheric agency. The result of all the circumstances is, that although it is possible, with *great care* to use with safety copper vessels for culinary purposes, yet as that care is not likely, under ordinary circumstances, to be used it should be rejected. Tinned copper is safe while the coating is entire, but vigilance should be used, to have it retinned as often as it becomes broken.

The most common forms in which copper is likely to be taken as a poison are verdegris and blue vitriol. These may be taken by accident or for self destruction, but their strong disagreeable taste and characteristic colour prevent their being used with murderous intentions. Children are not unfrequently poisoned by eating the cakes of paint prepared from copper.

The symptoms of poisoning by copper are similar to those produced by arsenic or corrosive sublimate. Feebleness, pain in the head, naucea, vomiting, catharsis, colic, cramp convulsions, insensibility and death. It sometimes produces jaundice. In these symptoms you see that poisons produce effects very similar to epidemic cholera.

Antidotes. The alkaline sulphurets were formerly used as antidotes for copper and afterwards sugar. Both of these are ineffectual and the former poisonous. Orfila has fortunately asceriained that Albumen, or the white of eggs is an efficient antidote. He mixed 20 or 30 grains of verdigris with the whites of 6 eggs and gave the mixture to a dog, tying his gullet so that he could not reject it. Although the poison without the eggs would have caused death in 3 hours; yet with them the animal lived seven days and then probably died of starvation in consequence of the ligature upon the esophagus.

In tender sympathy we are apt to revolt at the sufferings to which brutes are subjected in physiological experiments, but we ought to consider the subject philosophically, and ask whether we ought to sacrifice several cats, dogs and rabbits, or permit human beings to be sacrificed through time indefinite by erroneous or inefficient practice. No doubt the experiments were disagreeable to the distinguished men who performed them and had they consulted the nerves of a dandy we never should have enjoyed the advantages of their discoveries. Should your apothecary by mistake send you corrosive sublimate and your life or that of one of your family be saved by the simple remedy of a few eggs, you would then appreciate what has been gained by Orfila's sacrificing a few useless dogs. Could the people who are engaged in other pursuits, see the immense labor and study performed by such men as Berzelius, Magendie, Orfila, Christison, and others, they would admit them into the working men's party. Could they witness that tide of benevolence, which their labors send over the world, and which is to continue to the end of time, they would regard them with the highest degree of veneration due to mortals.

The various preparations of mercury, are poisonous by quality. quantity, long use, or by peculiarity of constitution. The most active preparations of the metal, as corrosive sublimate, act as rapid irritant poisons, next in rank to arsenic. The milder preparations, moderately used, act gently on the system, but by long continuance produce salivation. Sometimes the more active preparations produce, first, violent cholera like irritation, and after a day or two, salivation. No poison acts on a greater number of organs, or produces a greater variety of effects. From an ignorance of the effects, practitioners have, especially in cases of eruptions and ulcers, continued to administer mercury to cure the very disease which it had caused and was hurrying towards a fatal termination.

The preparations of lead and copper, are liable to enter the system in the form of atmospheric dust, inhaled into the lungs, as in grinding white lead and verdigris. Mercury may bo imbibed in the same manner, and is moreover, liable to enter in a more subtle form. It is converted by heat into an invisible vapor, liable to be imperceptibly inhaled with the atmosphere.*

Two Barometer makers left a kettle of mercury on a stove in the room in which they slept. The fire unexpectedly kindled during the night, and filled the room with mercurial vapor. One of the workmen was so salivated as to

* Mercury cannot be inhaled as a perfect vapor, which requires a temperature equal to the melting of lead; but its vapor condenses into a gray floating mist, like a fog, consisting of metalic mercury in a state of extreme minute division, which may enter the lungs.

loose all of his teeth, and the other was seized with shaking palsy which lasted during his whole life. This convinces me that the metals are not poisonous, as such, merely because they are not in a state in which they can be absorbed.

Mercury, as well as lead. copper, arsenic and many other poisons, produces its effects, in whatever way it enters the blood, whether by the stomach, the lungs, a wound, or even through the skin. Mercury, especially may produce its effects by outward application, either as a wash or ointment. It is almost certain to do so, if its application be continued for a long time.

There is time to consider only one of the mercurial poisons, namely: Corrosive Sublimate.

This is a heavy chrystaline salt, soluble in water and alcohol; having an intolerable copperlike taste. When taken in a dose of more than $\frac{1}{4}$ of a grain, it is dangerous. It produces instantly the intolerable astringent taste, constriction of the gullet, which sometimes resists swallowing and denies speech, nausea, vomiting, burning pain, and diarrhea. It produces more speedily than other poisons, not corrosives, discharges of blood from the mouth, even from the moment it is taken. Unlike arsenic, which produces a sunken cholera like countenance, corrosive sublimate causes the face to be flushed and swollen.

From the horrible taste of corrosive sublimate, even in the smallest quantity, there is little danger that it will he offered to you by your enemies, early detection and defeat would probably be the result. You must guard against yourselves and your friends, you may take it by mistake or receive it in the same way from your apothecary, or more likely from his boy. A solution of corrosive sublimate in spirits is now often kept to destroy noxions insects, and unless labelled, poison, and put quite one out of the way, it may be mistaken for another slower poison, the whiskey bottle.

The leather mouth of the toper is as insensible to admonition as his conscience, and eager only for the intoxicating effect of what he swallows, he has been known to gorge his stomach from a bottle of oil of vitriol before he discovered his fatal mistake.

As corrosive sublimate is composed of the same elements as calomel, differing only in proportion, it has in modern chemistry, received a similar name. Calomel is called Submuriate of Mercury, and Corrosive Sublimate, Muriate of Mercury. Calomel is now called Proto Chloride of Mercury, and Corrosive Sublimate, Perchloride, or chloride and bichloride. These names are so much alike, that fatal mistakes have repeatedly occurred from Apothecaries' dealing out the muriate instead of the submuriate, that is Corrosive Sublimate instead of Calomel.

TREATMENT FOR CORROSIVE SUBLIMATE.

In giving some points of the treatment in various cases, of poisoning, I omit all which relates to the effects on the constitution, generally. These can be managed by the skilful physician only. Corrosive sublimate may produce irritation and inflammation, and these effects must be managed as if they had been produced by any other cause. They must be subdued by general remedies. The object is to make a popular audience acquainted with what is to be immediately done, in case of poisoning, and thus to enable persons to apply a simple antidote so early as often to anticipate and prevent the most excruciating suffering, and the most painful bereavements. A mother, who had qualified herself, thus to snatch a beloved child from the verge of the grave, must, in doing so, feel a much greater satisfaction than in viewing a whole pier of well read novels. How long before it will be fashionable to be useful?

For a perfect antidote to corrosive sublimate, we are indebted to Professor Orfila. When albumen, the white of eggs, is added to a solution of corrosive sublimate, one equal half of the chlorine leaves the latter and combines with the albumen. This change reduces it to calomel.

Professor O. gave 12 grains of corrosive sublimate to a little dog, and allowed the poison to act for 8 minutes, so as to begin to poduce its usual effects. He then administered the white of 8 eggs. After several violent fits of vomiting the animal became entirely free from pain, and in a few days the animal was quite well. Similar relief has attended several cases of its administration to the human subject: when the poison had been accidentally taken. The most noted is that of the celebrated chymist, Thenard of Paris. While lecturing, he inadvertently swallowed, instead of water, a mouthful of concentrated solution of corrosive sublimate. Perceiving the dangerous error, he immediately sent for eggs, which he procured in five minutes. He took them bfore vomiting had commenced, and suffered no harm, although he retained the whole on his stomach. He acknowledged that he owed his life to Professor Orfila. When

eggs cannot be procured, gluten and milk will answer as a substitute. Wheat flour wetted into paste as thick as it can be swallowed, will furnish the gluten, which will nearly equal eggs in its effect.

ARSENIC.

Arsenic as a metal, is innocent, but in the form of oxide and salts, it is proverbially noxious, and fatal. The most common form is that of the oxide, either solid like a piece of white marble, or in the state of a white powder. This is inodorous, nearly tasteless, slightly soluble in water. As it is easily procured, and from its apparent inertness, easily administered without detection at the time, it is the common instrument of capital crime.

The means of detection, after the crime has been committed, are now more perfect than in any other case. This alone, will operate powerfully on the criminal designs of the murderer.

If he understands the subject, he will reflect that although he may succeed in administering the dose, yet the symptoms will take place so soon, a few minutes or hours, and be so marked, that suspicion will arise. This suspicion will lead to analysis, and analysis will prove the poisoning. The time will prove the meal, and probably the dish in which the poison was administered. The next enquiry is who administered it? who had a temptation to commit the crime, and who the opportunity of doing so. By close investigation, the enquiry is narrowed to a few points, and the consistency or inconsistency of a few circumstances, unforeseen by the criminal, drags him from his concealment, and exposes him to the scorching detestation of the world. It is a fact not commonly known, that in poisoning by arsenic, although there may have been repeated vomiting, and the stomach may have been repeatedly filled and evacuated by diluent drinks, yet the poison will remain in it, in quantity sufficient to be detected by the refinements of modern analysis. It becomes often a matter of importance to determine how much arsenic a quantity of water has dissolved. At a temperature of about 60 degrees it will dissolve about 1-100 of its weight; but when boiling, it may dissolve 1-10.

It is not unfrequent that wretches attempt to poison wells and springs of water. Can this be done so as to destroy life? Suppose the water to be stationary, and to become saturated when cold, is to suppose the maximum. A pint measure would then contain 70 grains. This would be a fatal dose. But as the water is often in large quantity in proportion to the poison, and much of it at considerable distance; as there is usually a current, and the water is changed by using, people are seldom killed by these attempts.

The solubility of arsenic is much impaired by the presence of animal matters. Hence it is not so readily soluble in the stomach as in water.

Arsenic produces its effects in whatever way it may be introduced into the system, and it is remarkable that it almost always produces inflammation of the stomach. It acts also directly on the heart and diminishes its action; in this way some cases terminate fatally in a few hours, with symptoms of collapse, viz: excessive prostration of strength and fainting from the commencement. In most cases there is nausea, faintness, burning in the mouth, throat and stomach, vomiting, prostration, pain, cramps, collapse and death within 24 hours, though sometimes extending to three days. These cases resemble cholera. In other cases where life is prolonged for a greater period, the nervous system is acted upon, and palsy and epilepsy show themselves.

It ought to be popularly known, that arsenic can be introduced into the system by the mucus membranes, as well as by the stomach. If it be snuffed up the nose, or applied to the eyes, it may prove fatal; and its application to an ulcer or a cancer, is liable to the same result. Applied to eruptions both in the form of solution and unguent, it has destroyed life.

When hair-powder was fashionable, arsenic was several times mistaken for it, and applied to the head, producing erysipelas of the scalp. In one case out of nine, related, it proved fatal.

Treatment for Arsenic:—Several antidotes have been recommended for arsenic, but they have all proved ineffectual, except a recent one, freshly prepared, hydrated peroxide of iron, every effort to prevent it from acting on the stomach, and remove it as much as possible from the system should be made. Milk should be given to coagulate upon it and prevent its diffu-

sion, and if it has not already produced vomiting, the stomach pump should be used, or an emetic of the sulphate of zinc should be given to induce it as speedily as possible. The hydrated peroxide of iron, as directed underneath ; should be resorted to as early as possible.

In the present state of medical knowledge, the hydrated peroxide of iron has a higher reputation, as an antidote to arsenical poisons, than any other article. The following formula for its preparation and use is from an article by Professor Fisher, in the American Journal of Pharmacy, for April 1840:

HYDRATED PEROXIDE OF IRON.

R.—Sulphuric Acid,	(67° Baume,)	8	oz.	16	parts.
Iron Wire,		8	oz.	16	"
Nitric Acid,	(49° Baume,)	5½	oz.	11	"
Water of Ammonia,		q.	s.		
Water,		1½	gal.	384	"

Mix the Sulphuric Acid with the water in a glass vessel. Add the Iron, and, after the effervescence has ceased, filter. Add the Nitric Acid in divided portions, and apply heat so long as orange colored fumes are given off. To the heated solution, pour in the Water of Ammonia until a decided excess has been added, then wash the precipitate by decantation, until the washings give no precipitate with Nitrate of Baryta. The water is then to be drawn off *until just enough remains to give the consistence of thick cream.* It should be introduced into bottles of convenient size for use, and should never be suffered to become dry, which would almost destroy its efficacy.

Bottles containing half a pint are recommended as convenient ; and the annexed direction, it is thought, will enable the most ignorant to use it until medical aid can be obtained.

☞ "This antidote must be administered as soon as possible after the discovery that arsenic has been taken, and as it produces no bad effect itself, should be given every five or ten minutes until entire relief is obtained. The dose for a grown person is a table spoonful ; for children, a dessert spoonful. The bottle must be well shaken before each dose."

In the above preparation, the operator should take care that he has continued the boiling long enough after the addition of the Nitric Acid. Should there be too little Nitric Acid or an insufficient boiling, the Precipitate, instead of a full iron-rust color, will be dark, perhaps almost black. Every country practitioner, and every apothecary should have a quantity of the above preparation ready for instant use.

I have only one general remark to make in reference to Antidotes; which is that under various circumstances, in the ordinary administration of medicine, there are probably many opportunities for the beneficial application of them. This seems to be peculiarly the case with the more active emetics, such as Tartar-emetic, and Blue and Waite vitriol. The stomach may be so torpid as not be excited by even a large dose, and with the hope of expelling what has already been administered, a dangerous quantity may be introduced What then is to be done? The common text-books are silent on this subject. In the administration of Blue Vitriol, although it may operate freely, yet some of it always remains in the tissues of the mouth, stomach and esophagus. Small as the quantity may be, there are cases where the careful physician would feel better satisfied to render its effects null, by a very harmless and bland antidote.