PURIFIED ANIMAL CHARCOAL:

AN ANTIDOTE

TO

ALL VEGETABLE AND SOME MINERAL

POISONS.

BY

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REPRINTED FROM THE TRANSACTIONS OF THE MEDICAL SOCIETY OF LONDON.

LONDON, 1846.
SAMUEL HIGHLEY, 32, FLEET STREET.

LONDON:
H. W. MARTIN, PRINTER, CURSITOR STREET, CHANCERY LANE.

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AS AN ANTIDOTE TO ALL VEGETABLE, AND SOME MINERAL POISONS.

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When we refer to works on toxicology, we find but few poisons to which a direct antidote is known: by the term *direct antidote,* I mean a substance which, being administered before the poison becomes absorbed, is capable of combining with it, and rendering it inert. We also find that the poisons, for which such antidotes are known, are derived from the mineral kingdom; but for the very numerous class of animal and vegetable poisons no antidote has hitherto been discovered: the present paper will consist chiefly of a detail of some experiments I have recently made, with an antidote peculiarly applicable to this last mentioned class.

Soluble albumen (derived from eggs, &c.,) has been found to act as an antidote to the bi-chloride of mercury or corrosive sublimate, because this substance forms an insoluble compound with the bi-chloride, which is inert. Again,—the soluble salts of lead (as the sugar of lead, &c.,) are precipitated by the sulphates, as Epsom or Glauber's salts, alum, &c., and an insoluble sulphate of lead is formed, which exerts no injurious action on the body. Common salt will prevent the poisonous action of lunar caustic, or nitrate of silver, from its power of decomposing this substance, and forming an insoluble and inert chloride of

silver. Lime, or its carbonate, will also form an insoluble and inert oxalate, when brought into contact with oxalic acid; finally, we have the acids and alkalies acting as direct antidotes to each other.

The poisons we have just considered are but few in number, when compared with the numerous class for which such an antidote has not hitherto been known. This remark applies to substances frequently taken intentionally or by accident, such as opium, and its active principles (morphia, &c.) nux vomica, (strichnia and brucia), and the numerous class of plants belonging to the order solaneæ, as henbane, the deadly night shade, the bitter-sweet, thorn apple, and tobacco; also hemlock, bitter almonds, and prussic acid, the aconites, &c., &c., and, in fact, to all vegetable poisons; to animal, also, as cantharides, &c. It is to such poisons that the antidote I am about to propose is peculiarly adapted, and the great advantage it possesses, arises from its perfectly innoxious properties, and therefore may be taken in any quantities; also, from its being applicable to poisons so numerous and diversified in character: this substance is purified animal charcoal, the *carbo animalis purificatus* of the London Pharmacopœia.

The power of charcoal (animal and vegetable) of absorbing colouring matters, gases, &c., has long been recognized; it has also been known that it possesses the power of throwing down certain substances from their solution: thus, in Professor Graham's Elements of Chemistry, it is stated, that charcoal will take iodine from its solution in water, lime from lime water, &c.; and very recently, the subject has been carefully investigated by several chemists. Mr. Warrington, last year, read a paper on the power of animal charcoal in removing bitter matters from solutions, &c., published in the Chemical Society's Memoirs.

Bertrand, in 1811, tried *wood* charcoal as an antidote to arsenious acid, corrosive sublimate, and copper salts; but in the quantities used by him, it must have been perfectly inert, and Orfila has disproved his experiments. I am not, however, aware

of any one having used *animal* charcoal as an antidote to poisons; or charcoal of any kind, as an antidote to the organic poisons. When repeating the experiments, which are detailed in Mr. Warrington's paper, and prosecuting the inquiry, it occurred to me that these vegetable principles might be held by the charcoal with such intensity, that the gastric juice could not dissolve them, and, if such were the case, the charcoal would act as an antidote to such bodies. Before, however, trying any experiments on animals, I made a solution of hydrochloric acid, of the strength of the gastric juice, and kept it at the temperature of the stomach (100° Fahr.), and from this solution I found that animal charcoal had the power of precipitating strychnia, morphia, and the various matters above mentioned; hence I came to the conclusion, that, if the charcoal removed these principles from a solution imitating the gastric juice, the action of the stomach could not again separate the poison from the charcoal. To prove this theory, I then made some experiments on animals: I first used strychnia as the poisonous agent, on account of its acting with certainty, and producing on all animals such definite symptoms. Two guinea-pigs were taken (about the same size); to the first, half a grain of the poison was administered, dissolved in water, by means of a few drops of hydrochloric acid: in about five minutes the animal became tetanic, and soon died from asphixia, induced by spasm of the respiratory muscles.

To the second animal was given the same quantity of strychnia, with the addition of animal charcoal to the solution until the bitterness was removed,—not the slightest tetanic symptom appeared.

This last experiment was repeated several times on the animal, and always with the same result. Strychnia was then given to several rabbits, and it was found that from $\frac{1}{4}$ gr. to $\frac{1}{8}$ gr. was sufficient to cause death; but when from $\frac{1}{4}$ gr. to $\frac{3}{4}$ gr. was administered with the animal charcoal, no injurious effects were produced, even when the animals took six times the amount of poison sufficient to destroy them.

Before detailing any further experiments, I may mention that a *certain amount* of animal charcoal is required; and, should less than this quantity be given, the poison will act by its excess above the antidote: for example, if an animal takes one grain of strychnia, and only sufficient of the antidote to neutralize the effect of three-quarters of a grain, tetanic convulsions, and even death, may be produced, according to the size and strength of the animal. Overlooking this fact, caused me at one time to doubt the efficacy of the antidote; for after administering one grain of strychnia, mixed with two drachms of animal charcoal, to a small cat, violent tetanic symptoms came on, and, after some time, death took place; but I afterwards found that two drachms of animal charcoal were only sufficient to neutralize about half a grain of strychnia, and therefore the cat in reality took half a grain of free strychnia, which was abundantly sufficient to kill it, and in some experiments with strychnia on dogs, I also perceived slight stiffening of the hind extremities, when scarcely enough of the animal charcoal had been given.

Experiments were also made with the strychnia on frogs, and it was found that one-sixteenth of a grain would cause death: but with animal charcoal, as much as a quarter of a grain was given, without any poisonous effect.

I then tried the effect of strychnia on dogs, and found that from $\frac{1}{2}$ gr. to 1 gr. destroyed the animals, the symptoms commencing about ten minutes after its administration, and death taking place at periods varying from fifteen minutes to an hour, according to the quantity of the poison, and the size and strength of the dogs; but when the animal charcoal was given in doses of about half an ounce to each grain of strychnia, no effect was produced. If the antidote were given in less quantities, slight symptoms, such as stiffening of the posterior extremities, &c., took place, as stated above.

These experiments were repeated very frequently, with the same result, on dogs of all sizes. When strychnia, or any other *active principle,* was administered, the antidote was

usually given with the poison, on account of the speedy action from rapid absorption; but when the vegetable poisons, in their natural state, were administered, then the antidote was given some time after the poison, varying with the nature of the substance and the digestive power of the animal.

Nux vomica was then given to dogs in doses of from ten to thirty grains; it was found to produce violent tetanic symptoms, or to destroy life, according to the size and age of the animal: When, however, the animal charcoal was given, in quantities varying from half an ounce to two ounces, no effect ensued. In these experiments, the antidote was sometimes given with the nux vomica,—sometimes at periods from five to fifteen minutes after, and the action of the poison was prevented: when, however, the period was further prolonged, the poison produced some symptoms, but life still was preserved. Hungry dogs were always used in the experiments, and their power of digestion appeared to be very much quicker, and more energetic, than that of the human subject; so that in man, the antidote would act long after the period above mentioned.

Opium was then used as the poison, in doses of ten grains, it usually destroyed the life of the dog,—in smaller doses, it produced great stupor. Animal charcoal was found to act as a perfect antidote either when given with the poison, or before the narcotic symptoms appeared.

When experimentalizing with laudanum, we must take into consideration the effect which the alcohol contained in it may produce; for I found that a very small quantity of proof spirit (less than two drachms) was sufficient to destroy a young dog, and the charcoal would not prevent the effect, as it would absorb only a small quantity of it; so that the tincture of opium, when given with animal charcoal, will often cause the death of a young animal: but this would not be the case in man. In my experiments with opium, I have generally used a slightly acidulated watery solution. Morphia, and the salts of that alkaloid, when given with the antidote, were also found to be perfectly inert.

Ipecacuanha was then tried, and in ten grain doses, was found, in about fifteen or twenty minutes, to cause violent vomiting and retching, which continued for about two hours; but when about half an ounce of the animal charcoal was given with this substance, or soon after, the emetic effect was entirely prevented. One dog, however, after taking the ipecacuanha and charcoal, brought up some matter from the stomach, but had no retching. The cause of this was easily explained; for the animal had taken some corrosive sublimate the day before, and after death, the stomach was found inflamed: so the mere presence of the charcoal would have caused the expulsion of the contents.

Three grains of good elaterium were then given to a middle sized dog, and half an ounce of animal charcoal; no effect was produced.

Two drachms of Morson's tincture of aconite (which causes tingling and numbness, when applied to any part) were given to a dog with about half an ounce of animal charcoal; the dog experienced no ill effect.

Full half a grain of Morson's "aconitina" was given to a middle sized dog; it soon caused violent vomiting and retching, which continued for some time; then, perfect loss of sensation of the whole surface came on, the heart's action became slow and feeble, and death took place. Even one-fiftieth part of a grain was found sufficient to produce the same symptoms, and cause death.

Three-quarters of a grain were then given to a dog, with about half an ounce of the charcoal, and not the slightest effect was produced, although enough was taken to destroy at least forty dogs. When aconite root, or the leaves, are given, the antidote may be administered some time after the poison.

Prussic acid was also tried: thirty minims of Scheele's strength, or that containing five per cent. of real acid, were given to a dog, this destroyed the animal; but the same quantity, with about an ounce of the charcoal, did not produce any effect. The results were found to be the same when the

other vegetable poisons were used,—as belladonna, and its active principle, atropia; datura strammonium; tobacco; digitalis; delphinium staphisagria, and delphinia; veratrum album and veratria; hemlock, &c., &c. It would be useless to detail all these experiments, as there is every reason to suppose, that animal charcoal would neutralize the poisonous properties of *all* vegetable bodies, for it seems to act chemically in the same way upon all.

The effects of cantharides were also prevented by the administration of animal charcoal: for when sixteen of the flies were given to a dog, and the antidote soon after, they produced no ill effects.

MINERAL POISONS.

I afterwards tried the antidotal power of animal charcoal on a few mineral poisons. Four grains of arsenious acid, with about two ounces of the charcoal were given to a dog; he experienced no ill effect, not even vomiting. After a day or two carbonaceous stools were passed, and these, when boiled with a strong solution of hydrochloric acid, yielded arsenious acid, which could be detected by putting bright slips of copper into the boiling solution; but the better way to detect the arsenic, would be to heat the carbonaceous matter to redness, and collect the volatilized arsenic.

To another dog five grains of arsenious acid were given, with two ounces and a half of animal charcoal; he did not appear to be affected by it, having neither vomiting or diarrhœa. So I think we may conclude, that animal charcoal is equal to any known antidote for arsenic. It has greater power of removing arsenic from its solution, than the hydrated sesquioxide of iron.

Four grains of corrosive sublimate, with about an ounce of animal charcoal were then administered to a dog; he soon suffered from violent vomiting and purging, and died during the night. From this we must conclude, either that the charcoal is not an antidote to corrosive sublimate, or that it was not

given in sufficient quantity to neutralize the poisonous effects of the whole of the mercurial salt, and a very small quantity of this poison is sufficient to kill a dog.

To another dog one grain and a quarter of the poison was given, and soon after, an ounce of the charcoal; he had slight vomiting, but recovered. Three grains were afterwards given, with an ounce and a half of animal charcoal; in about a quarter of an hour the animal felt great uneasiness, and had a viscid secretion from the mouth,—he, however, became relieved in a few hours, and had neither vomiting or purging.

There is little doubt but that the charcoal is, to a certain degree, an antidote to this poison, but not much to be depended on; whites of eggs, or albumen, in any other form, would be much superior, and would not be required in such large quantities. Animal charcoal will also act as an antidote to the copper and lead salts, and to various other metallic preparations; but when an antidote is known to any of these, as to the lead salts, which is capable of forming insoluble and inert compounds with them, they would be decidedly preferable to animal charcoal.

From the experiments detailed above, I think we may conclude,—

1st. That animal charcoal has the power of combining in the stomach with the poisonous principles of animal and vegetable substances, and that the compounds thus produced are innoxious; therefore, when given before these poisons have become absorbed, it will act as an antidote.

2ndly. That animal charcoal will absorb some mineral substances, and render them inert; but so large a quantity of the charcoal is required, that it is not so well adapted for many poisons of this class as their own special antidotes; the effects of arsenic, however, appear better combated by this than by any other antidote.

3rdly. That a certain *amount* of animal charcoal is required, about half an ounce to each grain of morphia, strychnia, or any other alkaloid,—but, of course, much less for the sub-

stances from which they are obtained,—as opium, nux vomica, &c.; a scruple of nux vomica not requiring more than half an ounce of charcoal.

4thly. That the antidote itself exerts no injurious action on the body.

Kind of charcoal to be used.—The charcoal used for most of these experiments, was the purified animal charcoal prepared according to the directions of the London Pharmacopœia, viz.: by digesting bone or ivory-black (used by sugar refiners) in dilute hydrochloric acid, washing and drying it; it is improved by afterwards heating it to redness in a covered crucible.*

Ivory black has a certain amount of antidotal power, but would be required in very much larger quantities, containing above 90 per cent. of earthy matter.

Vegetable charcoal possesses but a small antidotal power, compared with animal charcoal.

Lamp-black is totally devoid of the property.

Mode of administering the antidote in cases of poisoning.—I should recommend the charcoal to be rubbed in luke-warm water, so as to form a fluid of slight consistency, and thus it may be given in quantities of from one to four ounces, according to the nature and amount of poison that has been taken. Emetics may likewise be given at the same time, but ipecacuanha must not be used for that purpose, as the charcoal would entirely prevent its action. Sulphate of zinc, in scruple or half drachm doses, would be the best emetic; or the stomach pump may be employed, and after these, more charcoal administered.

As animal charcoal possesses this power of absorbing all principles, may it not prove a useful agent in preventing the injurious effects of animal poisons, such as rabies, syphilis, poison of serpents, &c., if applied in the form of a poultice to the parts which have come into contact with the poisons? (The

* The purified animal charcoal used in my experiments, was obtained from Mr. Morson, Southampton Row.

wounds of several patients bitten by a rabid dog, and who refused to have the parts excised, have been so treated within the last month; but sufficient time has not yet elapsed, to test the correctness of the hypothesis.)

May not animal charcoal also prove a useful remedy in some diseases, by removing certain noxious matters from the alimentary canal? *Wood* charcoal was formerly used in heartburn, &c., but has fallen into disuse. Animal charcoal would possess all the good effects of the vegetable charcoal in a far greater degree. If in diabetes, the change into sugar is effected by the presence of some catalytic agent in the alimentary canal, might not the administration of animal charcoal prevent such change? But all these hypothesis require to be brought to the test of experience.

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