HAMMOND (Wm A.)

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Its Preparation and Physiological and Therapeutical Effects.

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CARDINE;

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By WILLIAM A. HAMMOND, M. D.,
SURGEON-GENERAL, U. S. ARMY (RETIRED LIST).

In continuation of the article on Certain Organic Extracts, etc., which appeared in the *New York Medical Journal* for January 28, 1893, I have to submit the following remarks on the subject of cardine, which, as the name imports, is the extract of the heart, and in this instance of the heart of the ox. I have experimented with the heart of the sheep, the dog, and the common fowl, but that of the ox has afforded the most decided physiological effects, and is therefore to be preferred. So far as I am aware, no such preparation as the one I am about to describe has yet been used in medicine, nor has the organ, to my knowledge, been employed for the treatment of the disorders of the heart unless, perhaps, by the German physician of some forty years ago to whom I alluded in my previous communication as having proposed to cure diseases of the various organs of

the body by causing the subjects of them to eat the corresponding organs of animals. As I then stated, my reference is entirely from memory of what I had read in medical journals at about the time of the publication of his essay.

Cardine, as used by me, is prepared as follows: One thousand grammes of the finely minced fresh heart of the ox, previously well washed in a saturated solution of boric acid, are submitted to the action of a menstruum consisting of twelve hundred grammes of glycerin, one thousand grammes of a saturated solution at 60° F. of boric acid, and eight hundred grammes of alcohol. These proportions are the result of a large number of experiments and are those, I think, which are most efficacious in extracting from the heart its peculiar principle.

The mixture is made in a strong porcelain, glass, or glazed earthenware jar provided with a closely fitting cover, and every day for a period of at least eight months—and I am disposed to think that a year is preferable—the mixture is stirred and the heart substance subjected to strong pressure with a boxwood masher, such as is used in the preparation of certain vegetables for the table. If a much less period than eight months is given to the process of maceration the product is inefficient, and indeed, as I have said, it is better to let the extraction go on for a much longer period.

Experiments that I have made with the freshly expressed juice of the heart, either pure or in combination with glycerin or alcohol in various proportions, show that it is absolutely without physiological or therapeutical influence other than that of the transitory stimulating effect of the alcohol when the proportion of this substance is great.

At the end of the period of maceration the supernatant liquid is poured into the upper receptacle of a porous stone filter and allowed to percolate through into the lower vessel.

The finely comminuted heart substance remaining is subjected to very strong pressure in a metallic press and the resultant juice also poured into the filter. The filtration is a very slow process, the solution of the heart being even more refractory than that of the brain and other nervous structures, and several weeks are required for the completion of the process. Percolation through filtering paper will not answer.

As thus prepared, the solution of cardine is a clear, transparent liquid of a pale straw-color, with the specific gravity of 1·070. Under the microscope it exhibits no morphological constituents; it does not change, so far as I am aware, under any ordinary circumstances, and no bacteria possess sufficient vitality to exist in it. It is perhaps better, however, that it should be kept in a cool place in well-stoppered phials.

I have said that it is unchangeable under ordinary circumstances, but occasionally when the phials containing it have been subjected to extreme variations of temperature and to agitation, about two per cent. of them will exhibit a slight flocculent precipitate which is albuminous in character. When this occurs, filtration through Swedish filtering paper or through a funnel, the throat of which is closed with absorbent cotton, suffices for its removal. The remaining liquid, under these circumstances, loses none of its properties.

Of course the most rigid antiseptic precautions must be taken in the preparation of this and all the other animal extracts which I have used. It must be borne in mind, however, that as the extract is to be injected into the blood, the substances employed for the prevention of septicism must be such as are not deleterious to the human system or which of themselves have any marked or positive physiological effect. Carbolic acid and corrosive sublimate,

therefore, are out of the question. Heat and boric acid I have found to be entirely efficacious, and the latter, form ing as it does one of the constituents of the mixture, is especially eligible.

A great many experiments were required in regard to the dose of cardine to be hypodermically administered, and it is therefore necessary to insist upon a due observance of the proportions of the various substances entering into its composition being strictly adhered to. Regard must also be paid to the period of time during which maceration is continued. Thus action for a month or two produces a liquid which contains such a small amount of the essential principle that it is almost, if not entirely, inert. Maceration for six months results in a product the effects of which are perceptible, but of which the dose must be fifteen or twenty minims, and even then the physiological and therapeutical influence is feeble. After eight months, however, the action is much more decided, and five minims hypodermically injected is a good average dose for an adult, some persons requiring a minim or two more, while with others a minim or two less suffices. I have arranged the dose after many experiments upon healthy men and women of average size, and have accordingly fixed upon five minims as the proper dose of cardine after a maceration of from eight to ten months.

I can not too strongly insist upon proper filtration of cardine, as well as of all the other animal extracts obtained by my process. It is absolutely essential that no morphological matter should be present in the liquid used for hypodermic injection. If this precaution is not observed, abscesses, and even more serious disturbance, will most certainly follow. After proper preparation cardine is, as I have said, absolutely fatal to bacterial life. At the time of injection it is well, though not essential, to add to the quan-

tity used a like amount of sterilized distilled water. I say sterilized, for, although I am sure that bacteria will not live in pure cardine, they may be able to live in it when it is diluted with water.

The physiological effects of cardine, in their order of occurrence, as nearly as I can arrange them, are as follows:

1. Within ten minutes the pulse becomes fuller, stronger, and sometimes more frequent. The sphygmograph shows this very clearly. The accompanying tracing (Fig. 1) is that obtained from a man, thirty years of age, in

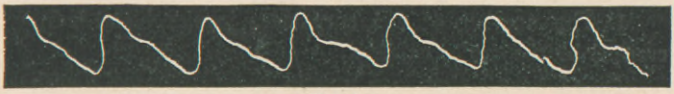

FIG. 1.

good health. The pulse at the time was beating 76 in a minute.

Fig. 2 shows a sphygmographic tracing taken from the same person ten minutes after receiving a hypodermic in-

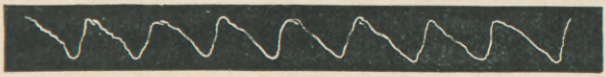

FIG. 2.

jection of five minims of cardine. It is scarcely necessary to comment on the differences which exist. The influence in increasing the force and frequency of the pulsations is

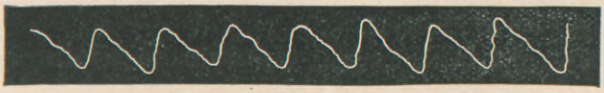

FIG. 3.

remarkable, and it is still more remarkable that a tracing (Fig. 3) taken eight hours subsequent to the injection

shows that the effect upon the heart was still present in a scarcely diminished degree.

2. These tracings show what is also evident from a digital examination of the pulse—that the arterial tension is augmented.

3. Increasing, as cardine does, the heart pressure, the effect upon the kidneys follows as a logical consequence. Many observations, made as far as possible under exactly similar conditions, establish the fact that the amount of urine daily excreted is increased by from ten to eighteen ounces.

4. The number of red corpuscles in the blood is increased by the use of cardine.

Thus I found that in a woman in good general health and development the number of red corpuscles, as determined by the hæmocytometer, was four million three hundred thousand to the cubic millimetre. After two hypodermic injections of cardine daily for five successive days the number of red corpuscles had increased to four million eight hundred and twenty thousand. By means of the hæmometer similar results were obtained, the degree of coloration being 83° before the injection of the cardine, while after the use of this substance, continued as in the previously mentioned experiment, it rose to 96°.

Many experiments of like character have led to similar conclusions. Indeed, I know of no fact more definitely established than this of the effect of cardine upon the composition of the blood.

My object in the present communication is mainly to show the physiological effects of cardine, leaving to the intelligent physician the office of drawing his own deductions as to its therapeuticul uses. It is clearly a heart tonic of great power, a diuretic of notable value, and an agent

capable of exercising a marked effect over the composition of the blood.

In cases of cardiac weakness, from whatever cause it may arise, cardine is of inestimable value. It appears to me, from the few cases in which I have employed it in this connection, to be useful in fatty degeneration of the heart, improving the nutrition of the organ not only by its action on the blood, to which I have made reference, but by its effects on the nervous organization of the cardiac tissue.

In one patient under my charge—a gentleman from North Carolina in whom the pulse was, while he was in a state of rest, only 40 in a minute, and in whom the heart impulse was exceedingly weak, and in whom also there was an anasarcous condition of the feet and legs—cardine, in five minim doses administered hypodermically twice daily, began at once to exercise a beneficial effect. The pulse rose to 64 and occasionally to 70 in a minute. The heart-beat was increased in force, the amount of urine augmented, the dropsy of the extremities disappeared, and many symptoms of gastric and intestinal dyspepsia from which he suffered were entirely dissipated, and this after about a month's treatment. Six weeks have elapsed and this good condition continues in every respect. That it will remain as at present without further treatment is perhaps scarcely to be hoped for, but I think this result is quite within the range of possibility; and should the symptoms recur, I have no doubt that cardine will prove equally effectual as in the first instance.

In another case of a gentleman in whom, from the excessive use of tobacco, the heart rhythm was intermittent and otherwise irregular, this condition disappeared after a treatment of only four days' duration, and the patient has now a heart apparently as sound as it ever was.

But I have employed cardine more frequently in those cases of nervous prostration attended with anæmia and sometimes chlorosis. In such patients its action is so prompt

and effectual as to excite surprise in all who have witnessed the change. In all these cases I have verified the great improvement in the appearance and apparent condition of the patients by the use of the hæmocytometer and hæmometer. In mild cases a week or ten days' treatment has been sufficient, but never more than four or five weeks.

A distinguished physician from the Dominion of Canada consulted me in January last for great cardiac irritability, the result of overwork, both professional and political. I treated him for two or three days with hypodermic injections of cardine, and the result was in the highest degree gratifying. The attacks of vertigo from which he had suffered, and which were clearly the result of weak heart, entirely disappeared. He returned home and entered at once with energy into an exciting political campaign, from which he emerged successfully after making over one hundred speeches. He writes me that he endured this tremendous exertion without discomfort, and that the cardine worked wonders with him.

In a similar case, that of a prominent physician of Indiana, the heart-beat was feeble and irregular, and there was constant vertigo while walking, or even while in a standing position. In this case the relief was equally prompt. He remained under my care only three days, being summoned home by telegram by sickness in his family, after making arrangements to procure a sufficiency of cardine for home use, and I advised him to continue it for at least a month. He arrived home before the cardine reached him, and, feeling the need of it, he at once telegraphed for it to be sent to him as soon as possible. He informed me that the effect upon him was so decided that, whereas formerly he was loath to walk even a few steps for fear of being overpowered by dizziness, a single injection enabled him to walk as much as he pleased for four or five hours afterward.

Of course, it is too soon to fix definitely the therapeutical value of cardine, or, in fact, of any other of the animal extracts made by my process. There is danger that over-enthusiastic and inexperienced or ignorant persons will

claim too much for them. Already I see that they are spoken of in various quarters as "elixirs of life," and that absurd stories are told of their power. No one person can be expected to determine the value of these extracts. That must be done by large numbers working toward the same end and for long periods. I do not even pretend to assert that there may not be some better method of extracting the active principle of the several organs of the body which I have subjected to experiments. I only say that I have labored more than three years in the attempt to find the best method and that my experience should go for something, and I feel called upon to warn the profession against the crude experiments of sciolists, who rush in with heavy foot where angels should tread lightly. I have heard of one of these experimenters who makes a mixture of brain substance, glycerin, and phosphate of sodium, and who injects this milky-looking compound into the blood. Of course, inflammation ensues, abscesses will probably follow, and even worse consequences are to be feared. Glycerin of itself is not a preservative of the nervous tissue, except for a very short time, whereas I know that the mixture I use will keep it for at least a year and, I presume, indefinitely.

As to the essential characteristics of cardine, while I am not able to give it a place in the nomenclature of organic chemistry, I am sure, from a consideration of the process by which it is obtained, that it is a substance derived from the heart. There is no escape from this conclusion. As to how it acts, I can at present only call attention to the theory that I proposed in my first paper on the subject, and that is briefly:

That all the organs of the body possess the power, when in a state of health, of secreting from the blood the peculiar substance that they require for their nutrition, and that they take this substance and no other, never making a mis-

take in the matter. The brain separates brain substance ; the heart, heart substance, and so on. If through disease or from derangement of function they lose this power, or if the peculiar pabulum they require be not in the blood in sufficient quantity, their functions cease to be normal. General debility, producing a diminution of nerve force, may cause the loss of this power, or it may result from local disturbance either of structure or function, or some profound shock to the organism may so interfere with hæmatosis that the blood no longer contains the material which the organ needs. In either case, if we supply to the blood the peculiar principle which a diseased or disordered organ requires, we do that which Nature, unassisted, can not or does not do.

Cardine, therefore, if this theory of its action be correct, nourishes the heart. It is the substance which an ill-conditioned heart must have for its well-being. It is already in a fit form for assimilation, and it acts with a promptitude, a certainty, and a degree of permanence of which no other heart tonic within my knowledge is capable.

It follows also that in all weak conditions of the system, and especially in those in which the blood is below the normal standard, cardine must prove to be of inestimable value. And in other and more serious affections, such as those in which depurative organs of the body, especially the kidneys, fall below the healthy standard of functionation, cardine, increasing as it does the heart pressure, may augment the bodily comfort and materially prolong life.

Cardine is not an annihilator of the influence of old age, but my experience convinces me that it lessens the effects of this factor of deterioration so far, at least, as the heart is concerned. This organ, as is well known, is one of the first to fail in physiological power, and this is shown not only by the examination of the pulse and of the heart itself, but by the accumulation of fluid, especially in the lower ex-

tremities, owing to a diminution of the heart pressure. Cardine, taken in conjunction with cerebrine, assuredly counteracts this influence, for, owing to the increase of the cardiac pressure, the passive anasarcous condition disappears, and the other indications of heart weakness are either greatly mitigated or altogether abolished. How long this power will remain in any particular case I am not at present able to say, but I know that a daily hypodermic injection continued for six months does not yet reveal any sensible loss in its influence.

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