

**DIGITALIS: ITS MODE OF ACTION, AND ITS
USE, AN ENQUIRY ILLUSTRATING THE
EFFECT OF REMEDIAL AGENTS OVER
DISEASED CONDITIONS OF THE HEART.
THE HASTING PRIZE ESSAY OF THE BRITISH
MEDICAL ASSOCIATION FOR 1870**

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Digitals: Its Mode of Action, and Its Use, an Enquiry Illustrating the Effect of Remedial Agents over Diseased Conditions of the Heart. The Hasting Prize Essay of the British Medical Association for 1870 by J. Milner Fothergill

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J. MILNER FOTHERGILL

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ASSOCIATION FOR 1870

BY

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PREFACE.

By the solicitation of friends and the permission of the Committee of Council of the British Medical Association, this essay is published in a separate form. Whether it contains matter entitling it to a permanent form, or not, time alone can say. But from the review of cardiac compensatory pathology, &c., which is unavoidable in discussing the action of digitalis the writer trusts it may be found to have some claim to so exist. It would be very gratifying to him to find this essay aid, however little, in diminishing the hopelessness with which diseases of the heart are too commonly regarded from a therapeutic point of view.

LONDON. September 15th, 1871.

ON DIGITALIS :

ITS MODE OF ACTION AND ITS USE.

IN bringing forward a subject so debated as digitalis and its action, the only apology the writer can offer is, that for years he has studied its effects clinically, having had patients continuously under its use for no less a period than three years and a half uninterruptedly. He has tried to bring to the inquiry a mind free from prejudice on either side, and impressed with the wish to elicit the truth. Physiological experiment has been largely resorted to and carefully observed; and, finally, the writer has carefully striven to give his results honestly, and to record what he thinks digitalis can do, and what it cannot, and, further, why he thinks so. It may be desirable to commence with an account of the different experiments performed, and the results obtained; and all through the inquiry he will regard digitalis as a member of a group of agents, rather than as possessing any qualities which are unique or peculiar to itself.

On Plants.—Marcet and Brunton have separately tried the effects of digitalis on the haricot bean by watering the plant with an infusion, and found it to kill it by withering it up. The writer injected a strong infusion into the hollow stems of the ordinary bean without effect for days; in time, however, those so treated withered and died, contrasting with those not interfered with. Precisely the

same results ensued from similar injections into the orange lily. A lettuce was frequently watered, in a dry season too, with a strong solution, without any perceptible injury to it either soon or late. Another was then dug up by the roots, and placed in a large basin containing a strong infusion of foxglove, and for a day or two grew amazingly; on the fourth day, it commenced to wither, and died in a day or two. The first effect of the drug was to improve the appearance of the plants to which it was administered; an impression to the same effect remains in the minds of friends who witnessed the experiments. Strong infusions were injected into the stem of the rasp, and into holes bored into a plum tree without apparent effect.

On Invertebrata.—Snails, when touched with the tincture or strong infusion, took a contractile spasm, threw off a coating of mucus, and passed on apparently unaffected. Earth-worms, when placed in an infusion for a short time, did not appear incommoded. Wasps were not affected by it when applied to them.

On Fishes.—Minnows, when placed in an infusion of digitalis, a very weak one, for some minutes were not affected; then commenced a rapid movement of the gills, which lasted till death; they were also drawn to one side in dying. After death, the ventricle was found firmly contracted and glistening like a speck of gristle; and, on being examined under the microscope, no cavity was visible. The auricle was distended and vainly tried to drive any blood into the tightly contracted ventricle, the blood merely regurgitating into the venous sinus behind, and then flowing back again, from the venous distension relieving itself on the auricular diastole. On pricking the venous sinus so as to permit the escape of the contained

blood, the auricle soon also became firmly contracted, and no cavity was perceptible under the microscope. The quickened action of the gills was probably due to the accumulation of carbonic acid in the blood, giving rise to an increased necessity for breathing, while the firmly contracted ventricle prevented the flow of blood to the branchia, and cut it off from oxygenation.

On Birds.—About half a drachm of strong infusion of digitalis was passed down the throats of two sparrows, some being spilled during the process. The animals soon became unable to move much, and gasped for breath most vigorously. The hen died first, and the cock died hard in about half an hour. On opening them immediately on death, the left ventricle in each was found firmly contracted; the lungs so congested as almost to be hepatised, the right ventricle full of blood. It was evident that the condition of the lungs and right ventricle was due to inability to drive the blood into the contracted left ventricle. The gorged condition of the lungs accounted for the gasping respiration observed. Side by side with them, ten drops of Fleming's tincture of aconite were administered to a third sparrow, who became convulsed, and died in about one minute and a half. In it, the lungs were pale, and the heart completely paralysed and distended, looking like a small Barcelona nut. The contrast between the two conditions was marked.

On Mammals.—Experiments have been made on the higher animals by Handfield Jones and Fuller, with similar effects as regards the state of the heart after death.

On Frogs.—These have purposely been put last, on account of the large number of experiments to which they have been subjected by various writers. Frogs have been made much use of by experimenters, on account of their