An experimental inquiry into the effects of tobacco fumes, on the system : and their use in cases of suspended animation, from submersion / by Daniel Legare.

AN EXPERIMENTAL INQUIRY INTO *THE EFFECTS* OF TOBACCO FUMES, ON THE SYSTEM; AND THEIR USE IN CASES OF SUSPENDED ANIMATION, FROM *SUBMERSION.*

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J. W. Mendenhall

from his friend

The author

AN

INAUGURAL DISSERTATION,

FOR

THE DEGREE

OF

DOCTOR OF MEDICINE,

SUBMITTED TO

THE EXAMINATION

OF THE

REV. JOHN ANDREWS, D. D. PROVOST, (Pro Tem.)

THE

TRUSTEES AND MEDICAL PROFESSORS

OF THE

UNIVERSITY OF PENNSYLVANIA,

On the 5th day of June, 1805.

TO

THOMAS HARRISON M'CALLA, M. D.

OF

CHARLESTON, South-Carolina.

MUCH RESPECTED SIR,

IT affords me the greatest satisfaction in being able, thus publicly, to declare those real sentiments of friendship and respect, which I have hitherto and ever shall entertain, for your person. To these, and even more than I am capable of expressing, I conceive you entitled, in the most eminent degree ; not merely on account of your attention towards me, in a private point of view, but more especially for the particular concern which you so uniformly displayed, in promoting the accomplishment of my medical pursuits, while under your tuition. Being now prepared to undertake the duties of a profession, of all others, the most important and arduous in its nature, permit me to assure you, that, in so doing, it shall be upon principles similar to your own ; the success of which, through means of your goodness, I have had abundant opportunities of witnessing. Should I be as fortunate in applying them, as yourself, my labours, I am confident, will be amply rewarded. That you may long continue to merit the honors attached to your station, and that the happiness and prosperity of yourself and family, may continually increase, is the unfeigned wish of

Your sincere friend and Pupil,

THE AUTHOR.

TO

CASPAR WISTAR, M. D.

ADJUNCT PROFESSOR of ANATOMY, SURGERY,

and MIDWIFERY,

IN THE

UNIVERSITY OF PENNSYLVANIA.

Worthy Sir,

WITH great pleasure do I avail myself of this opportunity of acknowledging how much I am indebted to you for the polite attention and valuable instruction I have received, while pursuing my medical studies under your direction. In return for which, I beg you to accept of my warmest wishes for the future welfare of yourself and family, and to be assured that I shall always remain,

With sentiments of the highest esteem,

Your obliged friend, and grateful Pupil,

THE AUTHOR.

INTRODUCTION.

IN producing the following essay, there is no one, I presume, who will not readily agree with me, in considering its subjects, as being important within themselves, and requiring the strictest investigation, by a regular series of experiments. Such however, I have been unable to bestow upon them, in consequence of the short period of time allotted me for the purpose, by the rules of this University. But as far as I have pursued them, it has been with all the attention and correctness in my power. Whether I have afforded any matter sufficiently interesting, to be worthy of notice, I leave for the decision of a candid public.

For the many scenes of cruelty, with which the following pages unfortunately abound, I must here offer an apology to my

readers. That they are highly repugnant to the feelings of humanity, no one can be more sensible of, than the Author, who speaks from experience. With no other motive, he assures them, than that of benefiting makind, would he have thus exposed his own to so painful a task. With this consideration, therefore, a hope is entertained of their producing but a momentary impression.

AN

EXPERIMENTAL INQUIRY

INTO

THE EFFECTS

OF

TOBACCO FUMES,

ON

THE SYSTEM, &c.

THE use of the fumes of tobacco, as a means of recovery, in cases of suspended animation from submersion, appears to have originated in Holland. So early as the year 1667, we read of the establishment of a Humane Society, in Amsterdam, having for its object, the restoration of the drowned. Among the various methods which it proposes to be pursued, we find tobacco fumigations strongly recommended; a remedy which in the course of my reading and re-

searches, I have not observed previously recommended by a similar institution of any other nation. In support of its efficacy, we find their reports containing numerous instances, in which they were applied with the happiest effects. Their correctness, however, appears to be doubted, from the disuse into which the fumes have fallen. But as this has chiefly proceeded from a common opinion of their proving prejudicial, by acting as a sedative, the following experiments were instituted, not only with a view to ascertain their utility as a resuscitant, but likewise the effects they produce when applied to the animal system, in its healthy state.

EXPERIMENT I.

At eight o'clock in the morning, my pulse beating sixty-two strokes in a minute, the fumes of tobacco were injected per anum.

5	10	15	20	25	30	35	40	45	50	55	60	65	70
62	62	62	62	62	64	64	70	68	66	64	64	60	62

No alteration being produced in the state of my feelings or pulse in ten minutes after, a second injection of the fumes was given; in twenty minutes, perceiving no change, they were again administered; in twenty-five, I experienced much uneasiness and heat, in the region of the abdomen; in thirty, a nausea at stomach, and vertigo of the head came on. These effects, however, did not continue longer than twenty-five or thirty minutes. The pulse, throughout the experiment, was not perceived to be the least increased in fulness.

EXPERIMENT II.

At five o'clock, an incision was made through the abdominal muscles of a living dog, thereby bringing into view nearly the whole intestinal canal. Upon examining it carefully, I could not discover any peristaltic motion whatever. The action of the mesenteric arteries was now very inconsi-

derable, both in frequency and force. Being aware that an increased action of the parts might ensue, from the pain inflicted by the wound, and their exposure to the atmosphere, I deferred administering the fumes for five minutes ; in which time, observing no alteration, they were exhibited, per anum, at the temperature of ninety, of Fahrenheit's thermometer. In two minutes after, they excited the peristaltic motion of the intestines, increased the force and frequency of the mesenteric arteries, and rendered the lacteals visible, in great numbers, which were distended with a milk-like fluid ; in fifteen minutes, arterial action much augmented in strength and frequency, but the peristaltic diminished ; in twenty-two, the circulation having become slow and feeble, I repeated the fumigation, which speedily restored it to its former state of frequency and force, revived the peristaltic motion of the intestines, and rendered the lacteals more turgid ; in twenty minutes, as the action of the arteries and intestines had abated considerably, I renewed the fumigation ; in one minute after, it increased the action

of the former, and in about three, that of the latter; in thirty-six minutes, there being little or no action in the arteries or intestines, another attempt was made, to restore it, with the fumes; but as the animal was too far exhausted, it proved ineffectual. I must here observe, that whenever the pulse and arterial action are spoken of, the mesenteric arteries only, are alluded to.

EXPERIMENT III.

Fifty minutes after one o'clock, the abdomen of a dog was laid open, so as to afford me a fair inspection of the intestines. The action of the mesenteric arteries, at this time, exceeded, in a small degree, its natural standard; but the intestines were perfectly quiescent. Upon the same principle, and for the same length of time, as in the preceding case, I deferred administering the fumes. Finding no alteration of circumstances, in fifty-five minutes, they

were injected per anum, at the temperature of ninety, of Fahrenheit. The only effect which followed, was that of the lacteals becoming visible, throughout the mesentery. At two o'clock, the fumes were again exhibited ; in two minutes after, the mesenteric arteries pulsated with preternatural force and frequency, and the intestines were excited into motion. Eight minutes after two, arterial action much reduced ; in ten minutes, the fumes were renewed ; in thirteen minutes, the pulse was considerably accelerated, the peristaltic motion of the intestines diminished, and the lacteals disappeared ; in twenty minutes, the circulation being nearly natural, the fumes were injected ; in thirty minutes it became much increased in force and frequency ; no peristaltic motion of the intestines was now visible ; in thirty-three minutes, the action of the arteries being slow and feeble, I endeavoured to revive it, but failed in the attempt.

Being well persuaded that the results of the foregoing experiments will be considered as depending more upon the heat combined,

with the fumes, than any power which they themselves possessed ; in order to obviate such an objection, I shall not only adopt a plan of exhibiting them, which will reduce their temperature to sixty-five degrees, but likewise make comparative experiments, with water, of the same and a higher temperature, than themselves.

EXPERIMENT IV.

At twelve o'clock, assisted by my friend and fellow-graduate, Mr. Evans, an incision being made into the abdomen of a dog ; the mesenteric arteries were observed to beat one hundred strokes in a minute ; at this time, there was no peristaltic motion of the intestines, perceptible. Circumstances continuing the same, at the expiration of five minutes ; the fumes of tobacco, at the temperature of sixty-five of Fahrenheit, were injected in ano, through a leaden tube, consisting of four circles, all of which were

completely immersed under water. Ten minutes after twelve, the pulsations of the arteries were the same in number, but more increased in fulness. Some little peristaltic motion of the intestines was now perceptible. In eighteen minutes, the fumes were again administered; in twenty, the pulse increased to one hundred and twenty; in twenty-five, to one hundred and twenty-six, and many lacteals rendered visible; in thirty, to one hundred and twenty-seven, and extremely full; the fumes were now renewed; in thirty-five minutes arterial action much increased; being one hundred and thirty-two in a minute; in forty, one hundred and thirty-eight; in forty-five, one hundred and forty-two, but very feeble; in fifty, the fumes were administered; in fifty-five, the pulse descended to one hundred and thirty-seven; in sixty-five, to one hundred and twenty-two; in seventy, to one hundred; in seventy-five, no pulsations of the arteries could be discerned.

During the violent action excited by the fumes, in the mesenteric arteries, particu-

lar attention was paid, in this, and the preceding cases to the state of the arterial system, in general. In every instance, the carotids were found, upon examination, to be but a little increased beyond their natural action. The mesentery, in this case, was so excessively inflamed, as to exhibit a scarlet-like appearance. This experiment was performed a second time, and attended with the same result.

For our farther satisfaction, I will next proceed to make a few comparative experiments with water of the same, and a higher temperature than that of the fumes which have been used.

EXPERIMENT V.

At five o'clock, assisted by my friend and fellow graduate, Mr. Smith, the abdomen of a dog was laid open and the intestines exposed distinctly to view. The mesenteric arteries were now beating one hundred

strokes in a minute; but no peristaltic motion of the intestines could be perceived. Circumstances continuing the same for five minutes afterwards, water at the temperature of one hundred and thirty of Fahrenheit, was injected, per anum; in fifteen minutes, the pulse increased to one hundred and twenty-five, and the peristaltic motion was excited; in twenty minutes the pulse descended to one hundred and twenty; in twenty-five, to one hundred and twelve; in thirty minutes, a second injection of water, of the same temperature, was given; in thirty-five, the pulse was raised to one hundred and twenty; in forty, it fell to one hundred and ten; in fifty, to ninety; in sixty, it could scarcely be perceived; at this time an injection of water was given, but without restoring it.

EXPERIMENT VI.

Thirty minutes after five, the abdomen of a dog was opened. The mesenteric ar-

teries at this time pulsated ninety strokes in a minute, and appeared considerably distended. The intestines were now perfectly quiescent. No change taking place in five minutes after, an injection of water at the temperature of ninety of Fahrenheit, was exhibited per anum. In forty minutes, the pulse increased to one hundred strokes in a minute; in fifty minutes, to one hundred and five; in fifty-five minutes, water of the same temperature was again injected; in sixty minutes, the pulse was raised to one hundred and six; in sixty-five it fell to a hundred; in seventy, to ninety. An injection of water was now given, but without restoring it.

EXPERIMENT VII.

Forty minutes past twelve, the abdomen of a dog was laid open, and its contents brought fairly into view. The mesenteric arteries were beating seventy strokes in a

minute. Upon examining the intestines, I could not perceive the least motion within them. Finding no alteration in forty-five minutes, an injection of water was exhibited, per anum, at the temperature of sixty-five degrees of Fahrenheit's thermometer; in fifty minutes the pulse was raised to seventy-four; in sixty it fell to seventy. An injection of water of the same temperature was now administered; in sixty-five, to sixty two: finding no increase of it in seventy minutes, the injection of water was again repeated; in seventy-five minutes, perceiving no pulsations of the arteries, I declined continuing the experiment.

Having, by the foregoing experiments, made ourselves perfectly acquainted with the effects of the fumes upon the living system in its healthy state, it only remains for us to enquire into their power as a resuscitant in cases of submersion. But previous thereto, an experiment or two will be necessary to instruct us how far they are capable of affecting the system in such a condition.

EXPERIMENT VIII.

Forty-five minutes after one, a full grown dog was submersed in common pump water, at the temperature of forty-five degrees of Fahrenheit. For one minute and a half he struggled violently, making repeated efforts to reach the surface: In three minutes, being apparently dead, I removed him, and immediately made an incision into the abdomen, so as to afford me an opportunity of inspecting the intestines. At this time not the least motion could be perceived within them; neither was there any action in the mesenteric arteries. Observing no change in fifty minutes, the fumes oft obacco at the temperature of ninety of Fahrenheit were injected, per anum; in fifty minutes a little peristaltic motion of the intestines appeared; in sixty minutes, the fumes were again administered; in fifty-two minutes a feeble pulsation in some of the mesenteric arteries was perceived; in sixty

minutes, as no action of the arteries or intestines could be discerned, the fumes were again administered, but without producing any effect.

EXPERIMENT IX.

Forty minutes after four, I plunged a dog under water, at the temperature of forty six degrees of Fahrenheit. In two minutes and a half he ceased to struggle; in three minutes, shewing no signs of life, he was removed, and the abdomen immediately opened. The intestines and mesenteric arteries were now perfectly quiescent; in forty-six minutes, observing no change, the fumes of tobacco at the temperature of ninety, were injected, per anum; in forty-eight minutes, the intestines were in evident motion; which in fifty minutes was much increased; in fifty-five minutes, a feeble pulsation of the mesenteric arteries was observed; in sixty minutes, the fumes were renewed; in sixty-

five minutes, many of the lacteals were plainly perceived; in seventy minutes, no action of the arteries or intestines could be seen: at this time also the lacteals disappeared.

The object of the above experiments being now accomplished, we will next proceed to enquire into the efficacy of the fumes as a resuscitant in cases of submersion.

But in order to ascertain this correctly, it will be necessary not only to use the fumes alone, but likewise, in conjunction with some of the means most usually employed on such occasions.

EPPERIMENT X.

Fifteen minutes after twelve, a large dog was plunged under water, at the temperature of fifty degrees of Fahrenheit. For

one minute and a half, he struggled violently ; in two minutes, being apparently dead, I removed him, and after wiping him nearly dry, injected, per anum, the fumes of tobacco, at the temperature of ninety, of Fahrenheit. These were occasionally administered for the space of an hour ; in which time, percieving no return of life, I ceased exhibiting them.

EXPERIMENT XI.

Ten minutes after one, a full grown dog was submersed in water of the temperature of fifty-two of Fahrenheit. Perceiving no signs of life in three minutes afterwards, he was taken out, and submitted to a similar process with the first. The result in this instance, was the same as in the other.

Having made trial of the fumes by themselves, we proceed, in the next place, to

exhibit them in conjunction with a few of the remedies most commonly employed in the restoration of the drowned.

EXPERIMENT XII.

Thirty minutes after three, a large dog was plunged under water, at the temperature of sixty-eight of Fahrenheit's thermometer. For two minutes, he made violent exertions to reach the surface. In three minutes, he was taken out, to all appearance dead. After having wiped him nearly dry, frictions were applied to the body, and the fumes of tobacco injected per anum. By these means, I endeavored for an hour, to recover him, but could not effect it.

EXPERIMENT XIII.

At five o'clock, a very large dog was immersed in water at the temperature of fifty-

two of Fahrenheit, and there confined for three minutes ; in which time, observing no signs of life, I removed him, and proceeded to wiping him, as in the former experiment. This being done, the lungs were inflated with common atmospheric air, and the fumes of tobacco injected per anum. Observing no symptoms of returning life, after using this process for the space of an hour, I conceived it unnecessary to continue the experiment.

EPPERIMENT XIV.

Twenty minutes after three, a dog was plunged under water at the temperature of fifty-two of Fahrenheit. In two minutes, he ceased to struggle ; in three minutes he was removed, wiped, and laid in a sand-bath at the temperature of ninety of Fahrenheit. For the same length of time, as in the preceding cases, I endeavored, by this method, and the fumes, to recover him, but did not succeed

EXPERIMENT XV.

At four o'clock, a very large dog was immersed under water at the temperature of fifty-seven of Fahrenheit. In three minutes he was withdrawn, apparently dead. Having wiped him dry, I endeavored to restore him by the fumes, in conjunction with all the means above used; but as no return of life was discovered at the expiration of an hour, I discontinued making any farther attempts.

From the results of many of the experiments contained in this essay, it must appear evident to every reader, that the principle upon which the fumes have been objected to, as a resuscitant, in cases of submersion, is wholly incorrect. Instead of acting as a sedative, as has been generally supposed, we find that when they are applied to the system, they exert so stimulant a

power, as to increase the action of the arteries in a great degree. That their use as a resuscitant, has not been attended with the success mentioned in the reports of the Amsterdam Society, I am equally ready to acknowledge, with those who have heretofore doubted it, though upon a different principle. In my opinion, they prove prejudicial, not by diminishing action, (as the term *sedative*, is intended to imply) but, on the contrary, by producing, through means of their stimulant power, an excitement disproportionate to the excitability of the system, thereby extinguishing the remaining sparks of life.