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ORIGINAL ARTICLES.

PURIFICATION AND SANITATION BY FIRE.¹

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We find the following words in the Law of Moses, Book of Leviticus:

"But the remainder of the flesh of the sacrifice, on the third day, shall be burnt with fire." (Leviticus vii: 17.)

"And the flesh that toucheth any unclean thing, shall not be eaten, it shall be burnt with fire." (Leviticus vii: 19.)

"But the bullock, and his hide, and his flesh, and his dung, he burnt with fire." (Leviticus viii: 17.)

"And that which remaineth of the flesh and of the bread, shall ye burn with fire." (Leviticus viii: 32.)

"And the flesh and the hide, he burnt without the camp." (Leviticus ix: 11.)

"He shall therefore burn that garment, whether warp or woof, in woolen or in linen, or anything of skin, wherein the plague is; it shall be burnt in the fire." (Leviticus xii: 52.)

"Thou shalt burn that wherein the plague is with fire." (Leviticus xii: 57.)

"And if aught remain until the third day, it shall be burnt in the fire." (Leviticus xix: 6.)

Latter day philosophers may question if all Scripture was written by inspiration of God, but every true Christian believes it faithfully. Wherever a weak faith would be staggered, perhaps overthrown entirely, the stronger can find secure refuge in the omnipotence and omniscience of God, and in the admitted fact that "now we see through a glass darkly." It is, however, gratifying to the believer when the progress of science brings us to a more exact comprehension and belief in doctrines and practices taught and enjoined by the inspired lawgiver over 3,000 years ago. Of such a character is the sanitary doctrine of purification by fire.

While the practice of burning up things considered to be unclean has probably always obtained to some extent, even before the Law of Moses, it is only recently that science has given us a sound logical reason for so doing—thus extending our horizon of knowledge immensely and to our manifest advantage. In this direction, after a brief preliminary review of the subject, it is our wish to call special attention to cases where we think it will be well for us and our posterity if we destroy foulness and uncleanness by fire.

It will be hardly proper here and now to dilate upon the doctrine of noxious germs, and their spores,

and their methods of multiplication around us. For our purpose it will suffice to say that all the scientific world believes them to be at least the bearers of contagious diseases, the disseminators of sickness and death with their attendant misery and unhappiness. How to limit their action—how to prevent their ravages—how to do away with them altogether, have become the pressing sanitary problems of the age. Any advance conducing to these ends should be worthy of our earnest attention and sympathy.

When the "Committee on Disinfectants of the American Public Health Association," made their report and formulated their "Conclusions," in December, 1885, the *first* and *best* treatment recommended by them "for all spore-containing infectious material," is "fire—complete destruction by burning." "For infectious material not containing spores," is "fire—complete destruction by burning." "For clothing, bedding, mattresses, blankets, rags, etc., soiled by infectious material," the first and best recommendation is, "fire—destruction by burning." Evidently this Committee, well educated and intelligent, with all the aid and assistance to be derived from the brightest lights of modern science, can only endorse and recommend the practice enjoined by Moses—and thus aid in proving, to reasonable men, the inspiration of the sacred volume.

One question remains to be discussed before we are ready to apply our doctrine of purification by fire—and that is: What are "spore-containing infectious materials?" This question opens up a boundless sea of inquiry, whose limits have been only partially surveyed by science, and its chart only here and there dotted with the islands of known facts; while numberless undiscovered continents of facts are still waiting the advent of the enthusiastic searchers who are surely on the way to find them. We know already that small-pox victims can give off contagion—that clothing, blankets, bedding, rags, soiled with its infectious germs, can disseminate the disease. Of typhus fever, typhoid fever, yellow fever, scarlet fever, diphtheria, measles, etc., we know that contagion spreads from one to another in various ways. In the lower animals we are assured that anthrax fever, pleuro-pneumonia, Rinderpest, glanders, actinomycosis, hydrophobia, hog cholera, chicken cholera, etc., are all easily transmitted after their kind. This is positive knowledge, known facts, ready for us as sanitarians to act upon in a well-defined manner and after scientific methods. But who can tell us where noxious germs do not find a habitat and

¹ Read in the Section on State Medicine, at the Thirty-Seventh Annual Meeting of the American Medical Association.

a breeding-place? Who can say in what kind of filth an innocent germ, finding a resting place, may not develop morbid tendencies, and thereafter breed agencies of death and destruction? Who can tell where the first seed-germs of small-pox and typhus fever come from? Who can deny that every decomposing dead body may not originate a poisonous something which will be inimical to the life or health of its neighbor? We know that the history of sanitary supervision of large cities and towns shows a magnificent result for feeble efforts to destroy noxious germs and their spores or seeds, and to enforce cleanliness. The earnest labors of the health officers of London have diminished its mortality nearly 100 per cent. The bringing of purer water, comparatively uncontaminated with germs, to Munich, is said to have almost banished its greatest scourge, typhoid fever, from that city. We have no doubt that the near future will see even greater benefits from scientific sanitation, more especially when purification by fire is used to its fullest allowable limit.

And now—how, when, and where, and in what cases, shall we employ this first-class, most excellent purifier?

How to make use of Fire as a Purifier.—Expensive crematories, though all right in their place, are by no means necessary even for the decent disposal of dead human bodies. We can erect at a small cost, on a side hill, something like an old-fashioned lime-kiln, consisting of stonework for the stack, an opening below and in front for ash-pit and draft, above that an opening for a fire-box, closed by an iron door, with grate bars both above and below; above that, on the upper grate bars, with entrance and exit through a proper iron door, the place for incineration of the dead body; still above and on top of the stack, a large opening, to be closed by an iron door when necessary, serving for vent to gases of combustion, and also for the introduction of dead animals whose ashes we do not wish to preserve, or for dumping a cartload of household waste that we wish destroyed. To build and operate such a crematory would certainly be inexpensive, while it would as certainly be efficient for all purposes. Convenient brush piles could be made useful for many necessities of purification. Open fireplaces in house or kitchen could destroy many things condemned by sanitary laws. A sheet-iron oven, made to be placed over an opening in a kitchen stove, has been recommended for the destruction of the organic waste of a household. The same device, fitted to an old stove in the back yard, might be utilized to destroy the poisonous excreta of cholera, typhoid fever, etc.

When and Where to use Fire as a Purifier.—Though our knowledge on this point is limited as yet, we believe that Moses was in accord with, perhaps in advance of, our modern science, in directing nitrogenous waste to be burned on the third day, without the camp. We already know that infection becomes powerful by the third day, that zymotic and septicæmic diseases at that time reach their first acme, and that putrefactive processes are then well developed in a dead body. A widespread belief, not thoroughly authenticated as yet, so far as we know, declares that

the combustion of infected material, such as bedding, can carry contagion through the air. If this be true, it would seem necessary to burn infected material "without the camp."

In what Cases shall we Purify by Fire?—First, by the cremation or complete destruction by fire of all the human dead, by the third day, if not before in the case of infectious diseases. It is not material here to do much more than to record the rapid acceptance among educated men, and especially among physicians, of the doctrine of the cremation of all human dead, as a necessity of recent advances in sanitation. Science points to it with unerring finger as the best method of disposing of the dead who are known to have been slaughtered by infectious diseases, and not much less decidedly of those whose less infectious bodies are known to develop the lethal gases of decomposition and the deadly ptomaines. Very few persons will deny the propriety of burning up the bedding, etc., of a victim of small-pox, for a sad experience has taught us that it is necessary. That a human body dead of the same disease can give off contagion is no less certain—hundreds of cases tracing their infection to a public funeral, bear witness to this admitted fact. Even if we bury such bodies hurriedly, and at dead of night, who can say how long, even in the grave, the contagious material remains efficient and powerful for evil? We know well that rags may hold infection for a long time, especially when deprived of light and air. We know that every marked excavation of earth, even in house building, or railroad cuttings, is liable to cause sickness in the vicinity, and what is the earth everywhere but the graveyard of the animal and vegetable kingdoms for ages past! We know that to build over an old graveyard is to invite death into the house. We know that water draining from a graveyard is liable at the very least to contain a dilution of noxious nitrites and deadly ptomaines, and is considered a fair explanation of a sickly neighborhood. The argument from cases of small-pox comes home more strongly to untrained intelligence, but physicians know that every dead body, not quickly and completely disinfected, is a hotbed for poisonous gases and for chemical products as deadly as prussic acid. Shall we, then, hesitate to encourage cremation of human dead, when we know that our air, soil and water, are daily making their protests against the unsanitary method of burial in the ground? With all its admitted disadvantages, and there are some hard to deny, the scale of science and reason leans most unmistakably in favor of the cremation of all human bodies.

Second. But if our present method of disposing of dead human bodies is very objectionable and decidedly unsanitary, who can defend the usual practice of allowing the dead bodies of the lower animals to lie exposed on top of the ground, or to be cast into our running streams? Do not such decomposing bodies also give off infectious diseases, and also give off the horrid putrefactive gases, and generate deadly ptomaines? Is it not a known fact that anthrax fever has been transmitted to man in the form of malignant pustule, and especially to butchers, tanners, wool sorters, furriers, horsehair cleaners, hostlers, etc., who

handle the diseased animals or their products? Is not that terrible disease, glanders, frequently caught by man? Only our great lack of definite knowledge as to the diseases of animals and their contagiousness by man limits our view in this direction. If, then, we continue to allow dead animals to decompose on top of the ground, and their remains to be mingled with the dust to be carried anywhere, everywhere, by the winds of heaven, how can we hope that the almost indestructible spores of disease may not assault us even in the seclusion of our homes and by our firesides, where we ignorantly believe ourselves secure? But even if we bury them under six feet of soil, that grand apostle of microbes, Pasteur, has conclusively proved that the humble earthworm may bring the death-dealing germ to the surface, deposit it on vegetation, or allow it to be tossed into the air by the wind, and thus permit it to begin a new cycle of destruction. Truly it would seem as if the whole animal kingdom, including man, were engaged in a most serious struggle for existence with the pestilential germ; the battle is *à l'outrance*, and we can afford to neglect no precaution that will ensure us the victory. The only safety seems to be to call to our aid the great purifier, fire, which the most recent teachings of science tell us is ready and able to utterly destroy both germs and spores that, less efficiently controlled, would increase and multiply till the whole earth might be as full of them as Russia is said to be of the dreaded Rinderpest. When will the day come when active, efficient, intelligent Boards of Health, all over the land, will bend their energies to the complete solution of this great sanitary problem; when the prevention of disease in men and in animals will be entrusted to enthusiastic and skilful hands, giving us some hope of definite progress towards health and prosperity for all?

Third. Does decaying vegetable matter breed sickness and death? Should purification by fire be applied to decomposing materials of this character? These questions have been practically answered in the actual experience of cities where great ovens have been constructed where wagon-loads of household waste, bread, meat, vegetables, bones, rags, etc., are daily purified by fire until only a valuable fertilizer remains. The decreasing mortality in such cities is a loud-voiced argument in favor of this practice, and it does not need dilating upon, because neither sentiment or reason would oppose it, except on the ground of expense.

Fourth. The most recent developments of science are warning us to be more careful about the sputa of consumption. Very few educated men are now found willing to deny that consumption is contagious, and that the germs of contagion are contained in the expectoration. If the sputa are deposited on the floor, on the street, or in running water, who can tell where the germs may finally land, or who may be the next host! Who can say that ignorance or neglect as to the proper disposition of such infected sputa, may not transform even the most eligible health resort into a place where it is dangerous to send a consumptive patient, because the germs are there becoming more and more widespread and abundant! The cer-

tainly adequate remedy is to deposit the infected sputa in antiseptic sheets of paper, or in a cheap medicated paper cup, or on rags, or even on fine handkerchiefs in an emergency—each and every one of these receptacles to be subsequently purified by fire. The sputa of diphtheria, considered highly contagious, should be carefully treated in the same way.

The excreta of typhoid fever, and of cholera, are certainly known to contain the particulate germs of those diseases. The sad experience of Plymouth, Pennsylvania, where the excreta of one case of typhoid fever were carelessly allowed to contaminate the drinking water of the city, is trumpet-tongued in its commands to us to thoroughly purify all such excreta. What purifier can be so safe, so cheap, and so easily applied as fire?

Fifth. Does the allowable limit of purification by fire end here? Not at all. Every blighted or dead tree, or a branch of a tree, or a plant, or a vine that threatens to carry infection to its kind, should be utterly destroyed by fire. Failure to do this is a sad mistake that horticulturists frequently make, to their damage and discomfiture. They should fight the germs of infectious disease in their orchards and gardens whenever they can be found, and no agency can be used so certain and sure in its action as fire; let them tear out the offending plant and allow this beneficent purifier to do its perfect work.

The infectious diseases of the graminaceous plants are most efficiently treated in this way. The diseases called smut and rust are the best known, and cause very serious damage to crops. The straw and the stubble of such grain should be sedulously burned. Rotting corn shocks, decaying straw stacks, decomposing hay ricks, are generally the sources of infectious disease after their kind—that farmer who permits such uncleanness will surely regret it. To detail all the cases where such an efficient purifier can be, ought to be, used, would extend this essay beyond proper bounds, therefore we enunciate as a general doctrine which admits of very few exceptions—that *infectious material, foul-smelling things in process of decomposition, organic waste, useless rubbish, should be burned up completely.*

PLEUROTOMY FOR EMPYEMA. RECOVERY.¹

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J. M. T.; male; colored; aged 40; married; one healthy child; always well until two years ago, when he had a severe attack of dysentery, followed by a hepatic abscess that pointed in the epigastrium, where it was opened by a physician; a drainage-tube was inserted and antiseptic injections employed; no antiseptic dressings; discharge ceased in four months, after which he regained his usual health.

He had no other illness until April of this year, when he began to have malaise. In June he began to have pain in right shoulder and arm; no pain, however, referable to hepatic region; later pain

¹ Read before the Medical Society of the District of Columbia, on October 20, 1886.