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FILTH AS THE SOURCE OF PREVENTIBLE DISEASE.

In his charming little poem, preaching resignation to the stroke of the "Reaper whose name is Death," Longfellow says:

"Let us be patient: These severe afflictions  
 Not from the ground arise:  
 For oftentimes celestial benedictions  
 Assume this dark disguise."

This has ever been the sentiment of piety: beautiful in the abstract, comforting in times of personal bereavement, but a deadly delusion when applied in mass. Not patience but impatience, not resignation but resistance, is the proper attitude in the presence of disease and death, more especially in those cases—and they are in the majority—in which the causes of "these severe afflictions" are preventible or removable: causes which, poetry and piety to the contrary notwithstanding, do from the ground arise.

This is a question of fact, not one of sentiment. The Mussulman says: "It is the will of God," and impassively shuts his eyes to the palpable causes of plague, pestilence, and famine, which shorten the lives of millions. The Christian, quite as criminally, dreams of possible "celestial benedictions" in conditions which contribute to make the average death rate double what it ought to be, while he holds up his hands in holy horror at the apathy of the Turk.

It is appointed of all men once to die: so far we have to submit to natural law, and there may be virtue in accepting the event with resignation—provided it does not come untimely: but there can be no virtue in being resigned to a condition of things by which not ten persons in a hundred, in the healthiest countries in the world, are permitted to reach the standard old age of seventy-five years, by which the death rate of the first year of infancy is swollen from one in twelve, as it is in some districts, to one in three, as it is in others. And the excess of deaths is but an imperfect measure of the aggregate influence which preventible diseases exert against the efficiency and happiness of a people. There remains an incalculable amount of physical suffering and disablement, of sorrow and anxiety, of thwarted effort and straitened means, not to speak of destitution and pauperism and their terrible effects upon the physical virtue and moral stamina of the rising generations: all to be traced directly or indirectly to easily preventible causes.

Foremost among the causes which affect the public health injuriously—causes not of local, but of general, almost universal, operation—the Medical Officer of the Privy Council finds most conspicuous these two "gigantic evils," which

claim the "earliest attention in the sanitary government of England," and equally, we may add, of every other civilized government, namely:

First, the omission (whether through neglect or want of skill) to make due removal of refuse matters, solid and liquid, from inhabited places; and secondly, the license which is permitted to cases of dangerous infectious diseases to scatter abroad the seeds of their infection.

Very frequently these two causes cooperate, doing immense injury to the public health, through the special facility which certain forms of local uncleanness provide for the spreading of certain specific infections: so that, on summing up the results of the extensive and very able investigations of sanitary conditions, made under his direction, Dr. Simon does not hesitate to say that, in total power, uncleanness must be reckoned as the deadliest of our present removable causes of disease. This, even when the term is restricted to such degrees of uncleanness as fall or ought to fall within the designation of filth, implying nastiness such as any average man or woman should be disgusted at. If the term were made to include all that it legitimately implies, as for example the foulness of air due to the non-removal of the volatile refuse of the human body, such as obtains in overcrowded and ill ventilated dwellings, a much stronger expression of its fatal influence would be justified.

That filth makes disease, meaning by filth putrescent refuse matter causing nuisance by its effluvia and soakage, must have been one of the earliest of social discoveries, for it is recognized in the oldest records which exist of legislation meant for masses of mankind: yet the more subtle and destructive effects of filth remained unsuspected almost until quite a recent period.

Filth kills in two ways. First, and most obviously, by a direct poisoning action, as when one succumbs to the concentrated fumes of organic decomposition from an old unventilated cesspool, or a long blocked sewer, or when the vigor of life is depressed by continuous breathing of a foul atmosphere in which the fetid gases have been largely diluted; second, with far greater and more subtle destructiveness, by means of the morbid ferments or contagia which it breeds or harbors. The chemical poisons of filth hurt by instant action, and in direct proportion to the palpable and ponderable dose: with contagia, on the other hand, indefinitely large ulterior effects are produced by, or by means of, doses which are indefinitely small.

The last named agents of disease and death consist, so far as known, in minute living organisms, indefinitely self-multiplying in their several spheres of operation. At least one sort, the ordinary septic ferments, seem always to be present where putrefactive changes are in progress; others, though not essential to putridity, are in different degrees apt, and some of them little less than certain, to be incidents of ordinary refuse. It is by these various agencies, essential and incidental, that filth produces the diseases classed by sanitarians as zymotic, and not by means of the usually accompanying stench. Hence, as Dr. Simon tersely observes, the question: What infecting powers are prevalent in given atmospheres? should never be regarded as a mere question of stink; and it is of the utmost practical importance to recognize, in regard to filth, that agents which destroy its odor may yet leave all its main powers of disease production undiminished. On the other hand, there may be prevalent fetid gases of the most sickening potency with an entire absence of septic ferment in the air.

Indeed filth ferments show no power of active diffusion in dry air. They may be passively wafted for short distances, but probably do not carry their vitality far if the air be freely open. Moisture is their normal medium. Currents of humid air, as from sewers and drains, lift them in full effectiveness; and if into houses or confined exterior spaces, the chances are that their morbid powers will be less preserved. Ill ventilated and low-lying localities, where refuse is allowed to lie, may especially be expected to have these ferments present in their common atmosphere, as well as teeming in their soil and ground water.

In the latter, too, as in the air, stench and palpable foulness afford no adequate test of zymotic malignity. Chemical demonstration of unstable nitrogenous compounds in water is a warning (and the disgust of healthy taste and smell equally so) which should never be disregarded: "but till chemistry shall have learnt to identify the morbid ferments themselves, its competency to declare them absent in any given case must evidently be judged incomplete, and waters which chemical analysis would probably not condemn may certainly be carrying in them very fatal seeds of infection."

Of the diseases distinctively due to filth, the most characteristic are those which, in respect to their leading symptoms, are called diarrhoeal. These are of two general types—common diarrhoeas, ascribed to the common septic ferments generated in all refuse, and specific diarrhoeal diseases, such as cholera and typhoid fever due to specific infection. It is in regard to the latter that the labors of the British Medical Board have been especially searching and successful.

In every one of the cases investigated, the relations of water supply and excremental deposits were horribly close in very many instances, as for example at Annesley, of which the inspector, Dr. Buchanan, reports, "arrangements for excrement disposal and water supply such that people must drink their own excrement!" Truly the chief medical officer may well say that it is difficult to conceive, in regard to any causation of disease in a civilized community, any physical picture more loathsome than the way in which enteric fever spreads its infection. Though sometimes making its way by covert processes, yet far oftener in the most glaring way, it apparently has its source in that which is of filth the filth-

est: "apparently its infection runs its course, as with successive inoculations from man to man, by instrumentality of molecules of excrement which man's filthiness lets mingle in his air and food and drink."

The distribution of an immense quantity of other diseases is traced to the same disgusting process. The argument which applies to the bowel discharges of enteric fever apply equally to cholera, and seems to extend, by extremely strong analogy, to every disease, whether nominally common or specific, in which the human intestinal canal is the seat of infected change.

But this does not limit the deadly influence of filth. The researches of Dr. Burden Sanderson and others have clearly shown that in the common septic ferment, so called, or in some ferment or ferments not hitherto to be separated from it, there reside powers of disease production as positive as those which reside in variolous or syphilitic contagia. By successive inoculations, it not only develops itself as one of the most tremendous of zymotic poisons, but becomes communicable from the sick to the healthy, producing diseases exactly corresponding to the fatal infections chiefly known under the names of erysipelas, pyæmia, septicæmia, and puerperal fever: infections sometimes arising in unquestionable dependence on filth, yet becoming, when arisen, the most communicable of diseases. And further, it seems most probable that the ferment which destroys life so quickly by septicæmia in its stronger actions can in slight actions start, in the infected body, chronic processes which will eventuate in general tubercular diseases. In this way the mischief done by filth in generating diseases like erysipelas or puerperal fever on the one hand, or tubercular diseases on the other, may be of a sort entailing possibilities of extension, by accidental contagion or by hereditary transmission, indefinitely beyond the original filthy neighborhood.

WHAT FILLS THE INTERSTELLAR SPACE?

That the interplanetary and interstellar space cannot be a perfect vacuum, or consist of absolutely nothing, is clear from the fact that light and heat are propagated through it; and whether we accept the old theory of Newton, that light is an emanation of fine particles, or the now generally accepted undulatory theory of Huyghens, that it is propagated by waves through an existing medium, we are driven in either case to the conclusion that there must be a something pervading the whole Universe (outside of the luminous and dark spheres which are suspended in it at various distances apart) to its furthest recesses. It has usually been agreed to call this something the celestial ether, and even different kinds of such ether have been supposed to exist: one to propagate light, one for heat, one for electricity, one for magnetic effects, and some philosophers have even suggested one to produce the phenomena of gravitation; and they have been respectively called the luminiferous ether, imponderable caloric fluid, electrical ether, magnetic fluid, etc., and even some of our foremost savants still indulge in the use of such hypothetical expressions.

It may be that this something which fills space is composed of a number of elements, in the same way as our atmosphere consists of nitrogen, oxygen, carbonic acid, and watery vapor; but it is also possible that it consists of a single substance, capable of transmitting various kinds of motions, as our atmosphere, without reference to its chemical constituents; it transmits waves of sound of various pitch and character, various pressures, currents of different velocities, etc. It is sufficiently well established that light, heat, and electricity are only modes of motion differing in character, being for instance progressive, circular, elliptical, to and fro, rotary, longitudinal waves, transverse waves, etc.; therefore it is possible that the same interstellar medium may transmit light, heat, attraction of gravitation, electricity, magnetism, and possibly other forces as yet unknown to man.

In the meantime, it forms an interesting subject of inquiry if this medium is absolutely without weight, and therefore of a nature different from what we call matter, of which weight is the first and fundamental property, or if it may be considered as very rarefied matter, so highly expanded that it is to our hydrogen as hydrogen is to platinum. The latter is, at the common atmospheric pressure, 250,000 times heavier than hydrogen, and we can easily reduce its density (by means of an air pump) to a one hundredth part, as is done in the Geissler tubes, which, when illuminated with an electric current, show the characteristic spectroscopic lines of hydrogen; and notwithstanding this still ponderable material has a density of only the twenty-five millionth part of that of platinum, it will, when condensed again, show all the characteristics of its nature, enter into chemical combinations, exert pressure, etc.

It is well known that our ancestors, a few centuries ago, had no conception of the gravity of gases in general, still less did they attribute weight to rarefied hydrogen, and even now, for the savage mind, such a thing has no existence; and it is a question whether even we, the enlightened and supposed to be well informed savants of the nineteenth century, do not stand in the same ignorance in regard to the gravity and other properties of the interstellar medium.

The modern theories of the conservation of forces and the transformation of heat into power, and vice versa, considered in connection with the velocity of the transmission of the solar rays and with the amount of heat poured out by the sun, which has been correctly measured (and which is the primary source of all motion and life on our planet, except the motion of the ocean tides), may give some light on this subject. As the heat of the sun is sufficient to melt half an inch of ice per hour, or 72 cubic inches for every square foot of surface, which is equivalent to  $\frac{1}{24}$  of a cubic foot, or nearly 2½ lbs., and as the melting of 1 lb. of ice con-