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ON THE CONSTRUCTION AND MANAGEMENT OF HUMAN HABITATIONS, CONSIDERED IN RELATION TO THE PUBLIC HEALTH.

By Dr. DRUITT. Read at the Ordinary General Meeting of the Royal Institute of British Architects,
February 20th, 1860.

I PROPOSE to bring before you this evening some considerations on the manner in which human life is affected by the construction and management of dwellings. And I do so with the belief that the demolition and reconstruction of a large part of the buildings which occupy the surface of this great city, and the better management of the remainder, are the means through which we may hope to be delivered from some of our common domestic pestilences. Besides, it is evident that when the Legislature confided to your Institute the duty of examining into the professional acquirements of district surveyors, it placed in your hands, likewise, the power of exacting a knowledge of the conditions under which houses are healthy or the reverse; so that whilst, on the one hand, the public would be secured against accidents arising from insufficient solidity, it may also be secured against those slow, and silent, but a thousand times more destructive, accidents which arise from want of sunlight and fresh air.

It is evident that your calling and mine meet at a certain line. I spend my life in the prevention and treatment of disease; you are the constituted heads of the profession employed in the construction of houses. I shall not apologise, therefore, for endeavouring to present a sketch of the natural history of such diseases as may be presumed to arise from misconstruction or mismanagement of houses; and I will not apologise for treating the question in its medical aspects; any practical inferences will be best supplied by yourselves.

Now, in seeking to display the facts of the case, it is evident how masked and complicated they often are, as they exist amongst ourselves, and how desirable it is to bring forward some experiments which shall show them in their simplest form. Such experiments are made whenever a body of men go and take possession of a country, and encamp in the open field, as in the common operations of warfare. Then certain consequences follow as a matter of certainty; and there is no campaign of which we have any record, from that of the Greeks before Troy, to that of our own troops in the Eastern campaign, or that of the Spaniards now in Morocco in which we do not find distinct evidences of them.

Let me, as a fair specimen, turn to the pages of Sir John Pringle, the historian of the medical events of the various campaigns in the reign of George II.; and I choose him because it delights me to give an incidental mark of respect to one of the earliest and most honest observers of these matters, whose opinions, if acted up to, would have rendered Miss Nightingale's labours unnecessary. Let us accompany 16,000 British troops, who in June, 1742, disembarked in Flanders. Their first autumn and winter were not very eventful. They were quartered in various towns in Flanders, and it was noticed that those who had barracks in high and dry situations were healthy, whilst those in low and damp ones, where their shoes and belts rotted, were unhealthy. Their diseases were: various fevers and dysentery, which lasted through the autumn, but ceased with the first frosts of November; and during the winter, colds, coughs, stitches, and rheumatisms. But there was one malady observed during this winter which attracted some attention; and this was a peculiarly malignant and fatal fever confined to the hospital, and seeming to have originated in the foul air of a ward, where lay a man with a mortified limb. So the winter passed; and in the spring the troops marched out, and on the 17th May, 1743, found themselves encamped in an open and healthy country, at Hoechst on the Main.

Then began a regular cycle. During the first three weeks various inflammatory diseases from cold prevailed; pleurisies, coughs, and the like. By the end of June the weather had become very hot; they fought the battle of Dettingen, on the 27th, and encamped on the spot, on wet ground, without straw, for two or three days afterwards. Then dysentery broke out, and Sir John Pringle takes the opportunity of demolishing the vulgar error, that this malady arises from eating fruit. It continued all July and August, and did not abate till the army marched onwards, leaving the foul filth-saturated spot of earth behind them. But mark this. The village of Feckenheim, a league from the camp, was taken up for an hospital, into which, besides the wounded, about 1,500 men were sent, sick with the dysentery. "By this means, the air was vitiated to such a degree that, not only the rest of the patients were infected, but also the nurses and apothecaries, and other attendants of the hospital, with most of the inhabitants of the village. To this acceded a still more formidable disease, namely, the hospital or malignant fever, an inseparable attendant of foul air from crowds, and animal corruption." These diseases combined caused a great mortality in the village, while, such as were seized with dysentery, and not removed from the camp, escaped this fever, and generally did well.

Now, with regard to the army, when they removed to fresh ground the dysentery ceased; but the intermittent and remittent fevers of the country broke out, and lasted till the first frost; when the men became healthy again, till, from increased severity of cold, again came round the winter crop of stitches, coughs and rheumatisms. But no such good fortune awaited the inmates of the hospital. There, no matter what the original malady, they caught the fever, which acquired all the characters of true plague, viz., spots, blotches, and abscesses of the parotid glands. Of the hospital attendants, all were sick, and a third died; of the patients, half died; and of the poor inhabitants of the village, between the fever and dysentery, almost all were destroyed. And now for the last phase. When the survivors from Feckenheim were removed, they were first taken to another hospital, which they infected with their own fever; and then were sent a tedious voyage down the river, in some country barges, to Ghent. There, it is said, and there seems to be no doubt of it, a parcel of old tents, used as bedding on the voyage, were put into the hands of a tradesman to be refitted; and that they conveyed infection to his workmen, seventeen out of twenty-three of whom died.

Here I must leave Sir John Pringle. But without following him in the Scottish campaign of 1745, I have drawn sufficiently from him to show how four classes of effects follow in definite sequence;—First, fevers arising from the condition of the surface of the earth, including intermittent and other malarious fevers; secondly, colds and rheumatisms, arising from insufficient protection; thirdly, diarrhoea and dysentery from insufficient drainage; and lastly, under certain conditions of filth and crowding, fevers of new type, destroying all within their reach, and invested with an intensity which enables them to spread amongst persons not within the original focus.

Now, it is these four classes of maladies, of which we have seen the origin in the definite experiment of a campaign, which in a greater or less degree affect *us*, and which it is the province of the scientific constructor of houses to guard us against specifically. In fact, there are these four questions which should be asked concerning every house:—Is it protected from malaria, or emanations from the soil? Is it adequate as a protection against cold, and does it supply such an amount of fresh air and sunlight as shall be a protection against scrofula and other diseases of decay? Is it so drained that the inmates shall not suffer from diarrhoea and other sewer diseases? And lastly, is it so arranged that it shall not be a breeding place for pestilence, nor yet a lurking place, if it happen to enter from without? I would more particularly urge the necessity of looking at these things always in their relation of cause and effect. If defective construction, and defective drainage, cause such and such evils, then where those evils exist let us look for the causes. If, for instance, a

fall of the thermometer be followed by a rise in the death rate from lung disease, let us consider whether the habitations of the people are such as to afford them adequate protection from cold.

These, then, are the four points to which I shall direct your attention, although it is the first and last only that time will allow me to notice at length. First, then, under the term "malaria" we may comprehend emanations from the earth generally. And in considering houses we should never forget the large, and in some countries, the increasing portion of the earth's surface, which is rendered unfit for human habitation by the emanations from the soil. Well does this fact bear out the Divine admonition to *subdue* the earth, as well as to replenish it; and the other Divine announcement, that bounds have been set to the habitations of tribes of men. But we cannot wonder at it if we think of the myriads of generations of which the earth's surface has been the graveyard; and, that, speak as we may of pure and virgin soils, the whole earth, down to the bare rocks, is full of organic debris, and that our valleys, meadows and marshes are little more than the elevated mud of rivers and estuaries. I will not dwell on the standard facts respecting malaria; that it affects white races in preference to black; that it is lost about 55 degrees north of the equator; that it is intense in proportion to the heat; that it requires moisture, and yet is destroyed by actual floods; and is most dangerous after long droughts, when land previously wetted is nearly dried; and that heat, and stagnant water undergoing evaporation above or under ground, are the efficient elements in its production.

Of the effects of malaria, the most specific in this climate is the intermittent or ague, which in hotter climates and more marshy soils passes by degrees into the pestiferous fever of Walcheren, the remittent of Spain, the Yellow Jack of the West Indies, and the fever which secures the annual apotheosis of an Anglican Bishop at Sierra Leone. Ague is now seldom fatal in London; the Registrar-General gives only 178 as the average mortality of all England from ague during the seven years 1848-54. In Sydenham's time, in the reign of Charles II., the case was different. He speaks of its doing fearful mischief in July and August 1661, whole families falling victims to it. He speaks of it, further, as raging in 1683. But the few cases of ague met with now, attract little attention; so that terrestrial emanations are virtually disregarded. Whether with perfect prudence is another question. For it must be remembered that ague, although the special, is not the only product of malaria. There is besides, in the first place, that brood of most painful illnesses, called rheumatic neuralgia, of which brow or face ague is the commonest type. This flourishes in aguish districts, and can be caught to perfection at Herne Bay (let me say, by way of parenthesis, that the myriad of small flies which infest this place is a sure sign of a swampy situation; and abundance of flies always indicate the presence of neglected decaying organic matter); but the brow ague is present every year in London; and in practice one knows that it affects certain houses or streets by preference. In the next place, it is a property of malaria that it produces the same class of illness which more usually arises from defective house-drainage. Witness the cholera, which broke out amongst our troops in the beautiful but pestilential valley of Aladyn, near Varna, and on board the ships of the Black Sea fleet, and amongst the Spaniards now, in their Moorish campaign. Witness, too, that love of a low level which is a constant feature in the cholera, and which seems to show its alliance with marsh miasma. Dr. Farr tells us that, taking the mean of the cholera epidemics of 1848 and 1854, in London, nearly 15 per 1,000 of those living under 10 feet of elevation died, and 1 per 1,000 of those at the highest elevation; and that, if London be divided into terraces of different degrees of elevation, the mortality from an epidemic of cholera is, in round numbers, inversely as to elevation. Another property of malaria is its power of producing fevers of the continued, or ardent type, like our typhus fever; and here let me observe that any one who reads the works of the physicians of classical antiquity, or even of our own Sydenham, may well be surprised and thankful at the accounts of constant epidemics, and as they were

called, stationary fevers, or fevers of the country, of which we have no practical knowledge in our happier times. Another point to be remarked in malaria is the remarkable way in which it enhances all diseases of degeneration. The tunbellies, crooked limbs, pale lips, and glandular swellings of the children, and the sickly wan appearance of the adults, at Walcheren, were remarkable.

Again, another point is the power it has of giving intensity to almost any disease, of which the following may serve for an example:—In the years 1805 and 1806, certain regiments which were quartered at Hythe, had an outbreak of ophthalmia, which they had previously contracted in Egypt. They were removed to Dover and other places, without getting rid of it; and on 9th May, 1806, were sent to Riding Street Barracks, twenty miles in the interior of Romney Marsh. Dr. Vetch, who wrote a description of the disease, calls attention to these emphatic facts. The ophthalmia was generated amongst the inhabitants of the marshy soil of Egypt; when brought home, it first appeared in any virulence at Hythe, at the edge of Romney Marsh; at Riding Street, in the centre of the marsh, it broke out with tenfold virulence; it assumed a remarkably mild form when the men were removed twenty-four miles, from Riding Street to Maidstone; and an equally remarkably severe form on the return to Riding Street, when the assizes compelled the men to remove from Maidstone. Now, if we consider these facts with regard to malaria, and remember that London, like ancient Rome, is, as the Registrar-General says, built upon low hills, in the midst of an imperfectly reclaimed swamp; that it was once severely scourged by it; that even now there are occasional indications of its presence; and that it contains in itself the essence of all such diseases as can be produced by putridity and damp, besides those which are special to itself, and that it aggravates all;—the practical question arises, is it not worth while to take even superfluous precaution to get rid of every trace of the evil, and to avoid everything which would tend to create it artificially.

Here it will be well worth asking, are there any present indications of the presence of malaria in London? I believe that it does exist, though generally in a masked form, and undistinguishable from other prevailing sources of illness. Let me give the following instance:—My attention was called to a small cluster of houses, inhabited by respectable tradespeople, and with no want of drainage or ventilation. In the first place, a healthy girl of eighteen years of age died of fever, at No. 12. Two cases of fever then occurred at No. 11. A year afterwards, another case of anomalous fever at No. 12. This year I saw some people from No. 10: the children suffering from diseases of degeneration; the mother told me that last year she had a regular tertian ague, though she had never been out of London. I have long known of these houses, that they stand on the side of a hill, on the very edge of a bank of clay, parallel with Piccadilly, which banks up the water in the gravel behind; and that the basements of these houses are always wet, sometimes flooded; and just the place where, theoretically, ague might be expected. A friend of mine lived at Kilburn for some years with nothing worse than occasional rheumatism, and never anything like fever or ague; moreover, ague was unknown, and fever very rare in the place till, in the winter of 1857-58, a railway was constructed, and an embankment, 25 feet high, made of clay from under Lord's Hill at Hampstead. The first effect was to cut off ventilation and render my friend's garden damp. But so soon as the hot sun acted on this bank, it produced emanations which poisoned every member of the family more or less. The eldest son had continued fever, preceded by great depression, sighing, and ocular spectra; two of the daughters had severe tertian ague; another mumps and slighter ague; the wife and servants were similarly affected; and several cases of ague in Kilburn. It must be remarked, too, that there are ague years, as 1661 and 1683; and in our time, 1827 and 1858, when it prevailed unusually in London. Moreover, there are many instances of the spread of disease which, in the absence of personal contagion, or other common source, we can scarcely help attributing to malaria; and there is no reason to doubt that organic emanations from an undrained soil are similar to those from sewers. Now, it seems phy-

sically certain that malaria may be removed by deep drainage. I do not mean merely the closed pipes and impervious channels by which house drainage and surface water are carried away; but the porous pipes employed by the scientific farmer. The philosophy of the thing is obvious. A constant descending capillary current of water, bringing into it the atmospheric air through a porous soil, provides for the oxidation of all noxious matters. But this oxidation is conditional on free access of air, which the displacement of absorbed water causes. If this were attended to, probably we should have less of the fever which prevails in new neighbourhoods in the outskirts of London, on a clay soil. But as things are, you may see houses erected on a clay soil, covered with stagnant water, which is just concealed by a little made ground. Last summer, too, I saw at Weymouth, a whole row of new houses standing in a swamp. Moreover, in many parts a fictitious elevation is often created by means of made earth and rubbish; itself charged with offensive organic matter. I can point to examples in Gloucester Place, Regent's Park, and Gloucester Road, South Kensington. I may conclude this part of my subject, by submitting to your judgment the opinion, that the preparation of the surface of the ground is a most important point, and the first point to be effected in the scientific construction of houses.

On the second and third divisions of my subject, namely, diseases which arise from imperfect protection, and want of house drainage, I have not time to treat; but whilst discussing malaria, let me say one word on the kindred subject of damp. I have many cases, collected from various parts of this parish, in which mere dampness by itself produced a most singular and uniform train of symptoms; consisting of extreme mental despondency, and accompanied with anæmia and bodily feebleness, and with a tendency to drink and to suicide.

Passing over these matters, I now wish to direct your attention to a matter in which none of us can help being personally interested: I allude to the origin and propagation of the common domestic pestilences, small-pox, scarlet-fever, and others of the group. Consider, in the first place, the number of them. There are small-pox, measles, scarlet fever with diphtherite, and whooping-cough, each of which is, so to say, the centre star of a host of satellites, in the guise of chicken-pox, eruptions on the skin, mumps, and others, which, being more frequent and less fatal, are not so much talked about, though they often cause most distressing illness. Now it is worth remarking, that the average annual mortality from these four diseases, in the seven years, 1848-54, was not less than 37,168. The total loss of our army in the Crimean War was under 22,000.

Considering the cause of these diseases, it is too often taught, both by members of my own profession, and by others, that they arise from what is called *specific contagion*, that is to say, that they never arise *de novo*, or *ab initio*, out of filth and crowding, but that they absolutely require, for their development, a germ derived from some preceding case. Of course it will be seen at a glance, that belief, in such a matter, has some very practical bearings. For, if a man believes that scarlet fever can only reach him by contagion from without, derived from some pre-existing case, he will carefully look to his front door; he will exclude suspicious visitors, and perhaps fumigate his letters, and the clothes which come from the laundress; and in doing so he will do well. But possibly he may neglect to see where the air of the house comes from by night, when his street door is closed, and every aperture, by which a clean current could enter, rendered as impervious as possible; and he may neither know nor care that the air of his bed-room enters through an ill-fitting door in the basement, where it has received contributions from a dust bin, from a cellar full of mouldering old hampers and straw, and from a damp coal cellar and servants' water-closet in the area.

Now, partly under the influence of this doctrine of specific contagion; and partly from the fact that these four maladies and their satellites for the most part attack us but once in our lives, the public mind has attained to a wonderful degree of apathy and acquiescence, insomuch that we are accustomed to look upon them as necessary and unavoidable evils, and to think that the annual loss

of 37,000 lives may be lamented, but cannot be helped. If I can succeed in dislodging this doctrine, and rendering it probable to you that they do arise from the same class of causes as did the malignant fever in the hospital at Feckenheim, I shall venture to hope that our time this evening will not have been quite wasted.

Now, in the first place, let me remark that the above four domestic pestilences are members of a very large family of zymotic diseases, some of which were likewise once regarded as specific; but which are now admitted on all hands to be capable of being created wherever the necessary conditions are combined. Take for example typhus, or continued fever, which destroys 17,844 persons on an average per annum. I was reading the other night an essay, by a venerable friend, describing an outbreak of it amongst troops in Jersey in 1806; and he says of the *causes* of fevers, that they are utterly unknown, and locked up in the bosom of the Deity. When, too, I received my medical education at King's College, the Professor of Medicine, known to us all as a most sagacious and benevolent physician, laid particular stress on the doctrine that fever must come by contagion, and that although dirt might create the soil it could not create the seed. But later research has resolved typhus into groups; in one we recognise a fever generated by the vapour of sewers; in another, the product of overcrowding, and so on; and no one doubts now, that, by putting the proper elements together, a fever poison could be bred, as certainly as prussic acid can be formed in the laboratory of the chemist. Let me, in the second place, allude to that group of zymotic diseases which are generated in hospitals; and I do so for the purpose, not merely of showing that these institutions in their degree serve amongst ourselves for laboratories of new diseases, as surely as did the hospitals of Feckenheim, but likewise of paying a passing tribute to yourself, Mr. President, whose papers on hospitals are not the least of your services to humanity. Begin, if you please, with the well-known story, a "Light for the Line," by the authoress of "Hedley Vicars." Thomas Ward, a young navigator, had his arm torn off, and suffered amputation at University College Hospital; and he lost his life because his blood was so poisoned by the hospital air, that it was unable to furnish material for healing the severed arteries. He was advised to leave in order to escape the hospital fever; and went home and bled to death in his cottage at Beckenham. The works of any military surgeon are full of instances of what is called the hæmorrhagic diathesis, generated in military hospitals; in plain English, the patients' wounds bleed to death unless they get out of the hospital air. Numerous, indeed, are the varieties of effect of hospital miasm; you may have erysipelas, you may have pyæmia, a condition in which a patient perishes with universal abscesses, or you may have low inflammation, or diffuse inflammation, all of which can be propagated artificially and reproduce either of the others, and this more particularly if the native miasm of the hospital be aided by a blast of sewer air. Some years ago I witnessed a remarkable operation in one of the leading metropolitan hospitals. The skill and coolness of the surgeon were remarkable. But the patient died of low inflammation. I heard one of the young men attached to the Hospital say, "That patient was in bed 19; every patient in that bed dies after an operation. It receives a blast from the watercloset. I entreated the surgeon not to put this one there; but he does not believe in sanitary measures." But even these hospital diseases sink into insignificance, in all other respects, when we consider the relation which they have to the death of women by puerperal fever, at the very time when they are most the objects of solicitude and affection. No one, not in the medical profession, can have an idea of the painful series of facts which have forced accoucheurs to guard women in childbirth from every source of putrid miasm; and which show that the putrid water-closet, or the ordinary cause of fever, or scarlet fever, may soon rob a house of the mother; and that, wherever generated, the fever may spread; nor how painfully our brethren have learned the necessity of absolutely guarding such patient from every source of contamination. Abundantly has it been

proved that any putrid poison whatever, whether from the diseased living, or from the dead, may originate this fearful scourge, and that, from whatever point putrescence has begun, it may be carried onwards to others.

Still more fully may the source of this domestic pestilence be found in that mistaken and unnatural institution, the Lying-in Hospital. For whole generations has it been known, that what is death to the wounded soldier in the military hospital, is equally death to the poor woman in the lying-in hospital. My friend, Dr. Robert Ferguson, for some years physician to the General Lying-in Hospital, and Professor of Midwifery at King's College, writing in 1839, says, "We have abundant evidence of the disease being most fatal in hospitals. Neither the skill, nursing, nor diet diminish the mortality to a level with that of the out-door population. In her own home the patient is generally better placed with regard to ventilation than in most hospitals, and in no malady is pure air, quickly changed, so requisite as in the puerperal state; it is, in fact, the chief prophylactic. A lying-in hospital should consist either of a series of cottages, or its spacious wards should contain very few patients. When fever prevails, the hospitals should be closed." So wrote Dr. Ferguson in 1838; but General Routine, the oldest commander in the British army, reigns omnipotent elsewhere; and in 1858 the medical periodicals were furnished with fresh accounts of the manufacture of puerperal fever at the General Lying-in Hospital. Dr. Rigby, senior physician to the hospital, showed that from January, 1837, to August, 1841, the mortality of women in child-bed was 76.05 per 1,000. Then a ventilating system was established, and, being obstinately misused by the nurses, whilst the old open windows were in abeyance, the death-rate during the twelve months next after the hospital was re-opened was at the rate of 90.90 per 1000. Then for a period of seven years of perfect ventilation the deaths were reduced to 4.81 per 1000. Again, in April, 1850, the committee determined to discontinue the ventilation, and from this time to May, 1855, thirty women died, or at the rate of 26.77 per 1,000. No evidence can be clearer than that the puerperal fever is an artificial disease, made out of putrid vapours, and that out of the cases in which it appears in private life, some, at least, received contagion from hospitals. I must not quit this disease without noticing that there is a now almost obsolete disease, the erysipelas of infants, which is generated wherever the mothers die of puerperal fever, and that one disease, lock-jaw of infants, is now scarcely met with, even in Ireland. To conclude the catalogue of hospital diseases, I must not omit hospital gangrene, a kind of mortification attended with exudation of a leathery putrescent material, which is constantly generated in crowded military hospitals, and occasionally visit the civil ones. There is a capital experiment recorded by Professor Brugmans, of Leyden. In 1798, hospital gangrene prevailed in a lower ward of a hospital in that city. A surgeon, in order to ventilate it, made an opening through the ceiling into the ward above, and in thirty hours the disease attacked the three patients in the upper ward who lay nearest the opening. Hospital gangrene of a wound, and diphtheria in the throat, present the closest analogies.

Next, glancing in passing at the diseases which emanate more emphatically, but not at all exclusively, from the sewer poison, that is the typhoid fever, diarrhoea, dysentery, cholera, and the severer cases of boil and carbuncle, all of which, if severe, are communicable, let me allude to the vast number of diseases of external surfaces which obey the same law as those under consideration—viz., that they may be engendered under certain conditions, and then spread to the healthy. Amongst such maladies are many known by us only by name, although vestiges of them are to be found in Ireland; such as the plica polonica, the button scurvy, sycosis menti, and the leprosy of the middle ages; amongst those, too, are those maladies which are the appointed scourge of incontinence, respecting which the late Army Surgeon, Wm. Fergusson, expresses his belief, that wherever foul and promiscuous immorality prevails, there they will spring up. But let me allude too, to the Egyptian ophthalmia, which

was the object of much dread and controversy in the last generation. Never absent from the debased peasantry who occupy the crowded huts in the towns on the marshy soil of Egypt, it was brought home from that country by our troops in 1806, and was propagated, and flourished wherever it met with a congenial habitat; it was often noticed to disappear during a march; to be aggravated by close, damp air; but always has been, and is now, certain to appear in Yorkshire schools, workhouses, and barracks, whenever the eyes are irritated and exposed to an atmosphere tainted with human exhalations. But nowhere was this more palpable than in the case of slave ships; and there is an absolute truth in the tale sometimes told by poets, of a ship rolling about at the mercy of winds and waves, because the unhappy captives and the ship's crew were blinded by contagious ophthalmia. Equally true is this with regard to the air passages. Let one or two persons, ill with common catarrh, shut themselves up, and create a vitiated atmosphere, their visitors will, to my knowledge, run the greatest risk of "catching cold."

Another disease, which at times creates an awful interest from its great fatality when communicated to man, is the glanders, a well-known disease of the horse. But, although the effects of the glander poison are as regular and *specific* as possible, yet veterinarians have always maintained that it can anywhere be generated, *ab initio*, under the combined influence of low condition and bad air. The constancy with which it breaks out when horses are sent long voyages is worth noticing.

Let me now remark upon some of the diseases of bygone days—the Hungarian fever, for example, which was said to have been introduced by troops in the reign of Queen Elizabeth, and to have ravaged England from one end to the other; and, still later, at the plague, of which Sir W. Petty, writing in 1683, declares that a visitation of it occurs once in twenty years, and that it carries off one-fifth of the population. Sydenham, treating of the causes of the plague, says they are "matters, like many others, upon which vain and arrogant philosophy speculates to no purpose," and proceeds to "thank the mercy and goodness of the supreme God," because He hath willed that the plague shall occur at distant intervals; and estimates that it visits the British Isles no oftener than once in thirty or forty years; "yet," says he, "when it has done so, its attack has been of more than ordinary severity, and with its full complement of terrors." Moreover, there is always a pestilential condition left for some few years after a great plague year, like the gleanings after harvest, so that all fevers take the plague character; just as in small-pox years, all fevers whatever take a small-pox character." I dare say that when Sydenham wrote, he would have thought it just as visionary to expect to be delivered from the plague, as some of us do from scarlet-fever or hooping-cough. But the editor of the "Collection of London Bills of Mortality," 1759, was able to say, "London has now been free from plague for 100 years. Was it, then, bred or imported?" If imported, why is it imported no longer? The great fire may have destroyed the breeding places, but could not have hindered importation. This is just the question which we ought to put with regard to our four domestic pestilences. Are they bred, or are they imported? And it surely comes within the scope of your profession to consider it; for if, as I hope to show, when they virulently break out in and spread in any house, it is not because they are imported, but generated out of surrounding conditions; then the prevention and eradication of these plagues rests with you. Mind, I do not deny that these pestilences can spread by contagion; quite the reverse. But what I affirm is, that they from time to time arise up here and there *de novo*, out of the malaria, or the defective house-drainage, or the want of ventilation of our own houses.

Now, let me give some instances of the scarlet-fever, or throat-group, including diphtheria, and the varieties of putrid sore-throat, which have convinced me that they are the products of putrid vapour, just as typhoid fever and cholera are. The difficulty of precisely fixing on the very site of an

outbreak in a large town is very great: not so in a remote country seaside village at the extremity of a peninsula, which is emphatically no thoroughfare. Such a village is Swanage, in Dorsetshire, where scarlet-fever broke out some years since amongst the patients of my friend, Mr. Willcox, who gave me the particulars. It began by simultaneously affecting thirteen members of a family, on whose premises a foul cesspool, unemptied for years, had burst. There was no other case for many miles around, till Mr. Willcox carried the infection unconsciously to a poor woman on the other side of a hill, from whence it spread, from one to another, till there were 170 patients and three deaths. When Mr. Willcox was laid up with it the infection ceased.

In Wareham, in 1859, Mr. Willcox distinctly traced an outbreak of scarlet-fever, in a row of small houses, to be emanations from a putrid ditch opposite, which received the sewage of the upper parts of the town. The Inspector of Nuisances of this parish, whilst superintending the opening of a cesspool in a house which had been infected with scarlet-fever, which was examined on that account, was smitten with the emanations, and went home ill with the fever, which began then and there. The first case of diphtherite I ever saw was on the 7th July, 1855, in the person of a lady staying at a private hotel in Dover-street. Her maid and son took the disease afterwards. All were exposed to vapours from a cabinet in their suite of apartments, which ought to have poisoned some one. Three deaths from diphtheria occurred in the winter of 1858-59, at No. 299, Oxford-street, and one in a contiguous and communicating house, No. 17, Hanover-place. Complaints were made that the air of these houses was nauseous in the extreme; and it was found that they stood over a putrid swamp, composed of their own sewage, which had had no means of escape for a generation. All the workmen employed in excavating this, were laid up with severe sore throat. Five deaths of children, and one severe illness of a woman occurred in one house, No. 15, Woodstock-street, in March and April, 1859. All these persons lived in the back of the house; none who lived in the front were ill. In the back kitchen it is reported that there was a current of sewer air of most offensive odour, from an untrapped sink. A remarkable point is, how scarlatina, diphtheria, putrid sore throat, and measles, herd together. If three or four persons die in one house, under different medical authorities; one will return his death as measles; another his as diphtheria; another his as putrid sore throat, and another his as scarlatina. My own conviction is, that each of these maladies, with their congeners, small-pox and hooping-cough are so many products of putrid earth, putrid water, and putrid air festering in the dwellings around us. Last month a party of benevolent gentlemen undertook a sanitary walk through some of the houses of the poor in St. George, Hanover-square. One soon was obliged to leave, the air of the houses made his throat sore. It is constantly observed by those who have to work the sanitary machinery of the Metropolitan Local Management Act, that all these diseases flourish and fade, side by side, and that the accumulating evidence of a common origin is invincible.

Even whilst I am writing this, a friend calls to tell me of the death from diphtheria of the child of a mutual friend, this 17th of February, 1860. I ask the question, is the house healthy? Oh dear no; there is no staircase window; the house is always stuffy, and never can be sweet; besides, the water-closets are within the house, and in some of the bedrooms. Has there been illness before, and if so, in any particular part of the house? Oh yes: amongst the children; they had cholera in 1856; and in April, 1858, there were such symptoms of poisoning amongst the nursemaids and children, that the father of the family sent some of the water to be analysed. No poison was found in the water; but it was found that a constant current of foul air ascended into the nursery, through an untrapped sink from the drain below. The children all look blanched and anæmic. All that professional skill, affection, nursing, and lavish nourishment could effect, was done for the poor child; but the question will occur to everyone, was she not poisoned by the air of the house? and yet the house is new, and the

rent not much under £300 a year. I am unable, from want of time, to adduce more of the evidence of which this is a specimen, in favour of the *ab initio* origin of scarlet fever and its allies; an opinion which has arisen independently in my own mind, and been, as I conceive, confirmed by the inexorable logic of facts. Evidence of the same kind, as there is for the independent origin of scarlet fever, exists also for that of small-pox and measles, although in lesser degree.

In the remarks which I have made, I have confined myself entirely to the medical side of the question, and have purposely abstained from entering into any details of construction or arrangement on which points I should come here to listen, and not to speak. But after full consideration, I determined to confine myself to the natural history of disease, being convinced that every study of nature, whether in her order or disorder, must lead to good results; and that when once it is stated emphatically that, good drainage, fresh air, sunlight, and space, are antidotes to all diseases arising from houses, it is only necessary to bring before you an ample store of medical facts, showing the intensity of the evils to be combated, and you will not fail to devise and apply the structural preventives and remedies. For if it be not known and believed, that hospital gangrene, puerperal fever, and scarlet fever arise out of certain conditions, how can the constructor be expected to take pains to avert them? If it be not known and believed that sunlight and air are necessary to protect children from scrofula, why should not the constructor build a low room with borrowed light for an infant school? and so of the rest. But I will conclude with offering four brief suggestions, arising out of the general view of the subject.

In the first place, your Institute will render an essential service to humanity, not merely if you insist on a knowledge of the conditions which render houses healthy or the reverse, from candidates who are entering your profession; but still more if such a state of professional ethics, or etiquette be cultivated, that designers of houses of every grade shall be deterred, both by conscience, and by a regard for professional opinion, from designing, and from sanctioning such designs of houses or such subsequent enlargement or alteration of houses, as shall render them unhealthy: such as putting five houses where there is room for four only, and so depriving one of air, as is the case of my friend's house, who lost his child from diphtherite. Your professional weight will be well employed in controlling the ignorance and cupidity of the owners of houses. Secondly, I would suggest the expediency of experiments in the construction of houses upon improved conditions. At present our experiments are irremediable, for when the house is built, it cannot be pulled down; but that which is wanted is power to erect experimental houses, such as that described in the Government Report on Warming and Ventilation. For instance, as chemical knowledge increases, we see the folly of sending a large portion of our fuel up our chimneys; and, as towns increase, the air of a wide area becomes daily more contaminated from a thousand causes, and it becomes most desirable to remove not merely the opaque, but the transparent products of combustion, especially the sulphurous acid. In fact, there would be no impossibility in conveying all the foul air out of a block of houses by one channel, and washing it from its impurities before it is allowed to mix with the atmosphere. But for these purposes experiments are needed, which your Institute may procure, but which would be hopeless for private individuals. In the third place, it appears absolutely necessary to utterly remove the old, dilapidated, dark, squalid, damp tenements which cover a large area of this metropolis. Practically speaking, they are perfectly incurable, and they serve only as a nursery of an enfeebled and sensual population. There are houses close by this from which disease is never absent; the soil is sodden with damp and riddled with drains and cesspools; the walls damp, and saturated with the exhalations of years; the wood, decayed and spongy, full of vermin, never looking clean, and, from its porosity, refusing to dry if washed. Such houses are utterly hopeless; and it is evident that it would be a boon

to humanity if the district where they prevail could be razed to the ground, the surface excavated, and then covered with dwellings which would admit the light and air and encourage cleanliness. Lastly, let me say, that looking to the number of the conveniences of life which society intervenes to procure for its poorer members—such as churches, clergy, schools, libraries, baths, washhouses, savings' banks, clubs, hospitals, and dispensaries; relief in destitution over and above the legal pittance; work for the unemployed; reformatories for the fallen; and even protection of the brute from cruelty—it were reasonable to extend the existing machinery for providing houses for the poor, and controlling them. At present we have associations which erect or repair model dwellings here and there, and all honor to them. But we really want bodies whose functions shall be conterminous with every parish, which shall take poor buildings whenever vacant, compete with the present sordid owners of house-property, take, cleanse, improve, and let, poor apartments at such a rate as shall just avoid loss, and find their profit in an improved public health.

This subject, however, must be developed elsewhere. Let me repeat, in conclusion, that the diphtherite, which will occasionally intrude into the best constructed house, if not developed there, is a sign of the existence of houses elsewhere, the sites of which I should be glad to see put into your hands to be covered with new buildings.

In the first place, your Institute will render an essential service to humanity, not merely if you base on a knowledge of the conditions which render houses healthy or the reverse, from candidates who are entering your profession; but still more if such a state of professional ethics, or etiquette be maintained, that every grade shall be honored, both by conscience, and by a regard to the interests of the community. Your Institute will render this service, and be getting the houses where there is room for four only, and so depriving one of air, as in the case of my friend's house, who lost his child from diphtherite. Your professional weight will be well employed in controlling the ignorance and cupidity of the owners of houses. Secondly, I would suggest the expediency of experiments in the construction of houses upon improved conditions. At present our experiments are inadmissible, for when the house is built, it cannot be pulled down; but that which is wanted is power to erect experimental houses, such as that described in the Government Report on *Warning and Ventilation*. For instance, as chemical knowledge increases, we see the folly of sending a large portion of our fuel up our chimneys; and, as towns increase, the air of a wide area becomes daily more contaminated from a thousand causes, and it becomes most desirable to remove not merely the opaque, but the transparent products of combustion, especially the sulphurous acid. In fact, there would be no impossibility in conveying all the foul air out of a block of houses by one channel, and washing it from its impurities before it is allowed to mix with the atmosphere. But for these purposes experiments are needed, which your Institute may procure, but which would be hopeless for private individuals. In the third place, it appears absolutely necessary to utterly remove the old dilapidated, dark, airy, damp tenements which cover a large area of this metropolis. Practically speaking, they are perfectly incurable, and they serve only as a nursery of an untold and sensual population. There are hopes close by this from which disease is never absent; the soil is sodden with damp and riddled with drains and cesspools; the walls damp, and saturated with the exhalations of years; the wood decayed and spongy, full of vermin, never looking clean, and, from its porosity, refusing to dry if washed. Such houses are utterly hopeless; and it is evident that it would be a boon

