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ORIGINAL ARTICLES.

HOSPITALS.

THEIR CONSTRUCTION, ORGANIZATION AND MANAGEMENT.

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Hospitals were not the offspring of Christianity, but were founded in India among the Buddhists several hundred years before Christ. Cut in the rocks can still be seen the edicts of Aosta, more than two thousand years old, concerning the hospitals.

The origin of our word "hospital" is derived from the name of the guest-rooms in ancient Rome—*hospitalia*. Our first hospitals originated from the spirit of charity taught by Christ, and were stimulated by the necessities of the pilgrims and the Eastern caravansaries.

The history of hospitals does not extend, like that of medicine, far back into antiquity. No information has come from the Greeks or Romans of buildings for hospital purposes only. The sick could obtain the advice of physicians in the antechambers of the Temple of Esculapius or upon the street, but not in special buildings. We only know that on one of the islands public buildings existed in which the women of Delos awaited the time of their confinement. Arrangements like the *Xenodochia*, *Nosokomia* and *Hospitalia* of the Greeks and Romans, were parts of the houses of small buildings in which guests were housed, and in which, when necessary, the sick were cared for. Later, in Rome, at the time of the Council of Nice, A. D. 325, the *taberna meritorum*, houses set apart for the afflicted, were in existence. These hospitals were spoken of in the Council of Nice as institutions well known and deserving support and encouragement.

In A. D. 300 several hospitals were established near Bethlehem by St. Jerome, who first used the term "hospital." To either St. Ephraim or St. Fabriolus (or perhaps Fabiola, a Roman lady who was a friend of St. Jerome) is due credit (A. D. 381) of founding infirmaries supported by charitable contributions for the exclusive treatment of the sick. About this same time (A. D. 370-380) hospitals are said to have been founded by Valens in Caesarea, and the saintly Basilios, Bishop of Cappadocia, erected the celebrated Basilios, a very extensive hospital. About that time John of Chrysostomus built a hospital in Constantinople, and later the enormous Orphanotropheion was erected by King Alexius and accommodated 10,000 indigent and sick of all kinds. The Hotel Dieu is perhaps the oldest hospital in Europe now in use, and was founded about A. D. 600 by St. Landry, Bishop of Paris, for all sick and destitute, of whatever age, sex or condition, and has for its motto, *Medicus et Hospes*. This huge hospital extended over and under the Seine and contained several thousand beds and from two to six

patients to each bed. It has been compared to a gigantic and ancient oak, rotten at the core, and even the present condition of many of its quarters shows it to be as fit a habitation for the sick as a rotting tree would be for a human being. It is thought, however, that the origin of our present hospitals must be looked for in the monastic arrangements for the care of the sick and indigent. Every monastery had its *infirmaria*, in which not only were sick and convalescents treated, but also the aged, the blind and the otherwise helpless were housed. (Liber ordinis Sancti Victoris Parisiensis, MS. Cap. xl. See Ducanges Glossary, s. v. "Infirmaria.")

About the earliest distinct record of a hospital in England is in the life of Lanfranc, Archbishop of Canterbury, who in 1080 founded two, one for leprosy and one for ordinary diseases. The establishments for the sick remained in the hands of the clergy until the Reformation, when some of the monasteries and church properties were appropriated and set apart for the use of the sick.

The earliest American hospital of any size was the Pennsylvania Hospital of Philadelphia, begun in 1555 under the auspices of Dr. Thomas Bond and Benjamin Franklin, and finished in 1805. Considerable attention has been paid to hospitals in America, especially since their importance was so roughly thrust upon the country's notice in the Civil War of 1861-4.

Leprosy, introduced during the Crusades, and later, the epidemics of cholera and smallpox necessitated special lazarettos. In 1456 the Grand Hospital of Milan opened, and is still in use, with a capacity of 2000 patients.

For centuries the Church of Rome was the only home and protection of Christian religion and the development of hospitals, until the sixteenth century, since when, up to very recently she has resisted all changes in hospitals. Her first idea was to make a hospital a church institution. Add to this idea that of economy and convenience of administration, and take the plan of the Grand Hospital of Milan as a model, and we have the source of our modern block plan and corridor hospitals. This hospital was not to any extent improved upon until science became an important factor in progress and civilization.

War began to influence the establishment of hospitals in the first part of the sixteenth century; but previous to the time of Ambroise Paré (1560) there is no evidence that the surgeon was considered as a necessity or as being of much consequence in military affairs. Italy was the first country to produce writers on military medicine, at the beginning of the thirteenth century. The first military hospital appeared in 1575 at the siege of Metz, through the influence of Ambroise Paré. Thus the spirit of humanity, without the aid of science, did not make proper provisions for sick or wounded soldiers.

Three hundred years later, when science had developed in such proportions as to divide the control of the world with religion itself, we find the experience afforded by the large number of sick and wounded incident to wars to be far the most important influence of all others in bringing about reforms in hospitals. Positive science was established only at the beginning of the eighteenth century, and the practical adaptation of science and inventions was only just fairly begun and curative medicine was hardly in advance of the times of Hippocrates. Sydenham did much in the latter part of this century to influence advances in medical science, and earlier, Hoffman, Beucres and Arbuthnot. The great movement in hospital building took place in the eighteenth century, and Dr. Steele's paper, "On the Mortality of Hospitals," Howard prize essay for 1876, gives a tabulated list of the chief institutions founded during that period.

In 1713 Cardinal de Polignac treated of ventilation, and made use of the laws of physics in giving plans for the construction of fireplaces, and to him is due credit for inventing the first machine for forcing ventilation. His method of heating air before it enters the room, by ducts and chambers behind the fireplaces, is most scientific and ingenious. Desagliers, in 1727, describes a ventilator by drawing out foul air or forcing in fresh, or both successively, without opening doors or windows, the current being established by a number of fans revolving in a circular case—the exact principle of the fan regulator of today, but with the yet common error of taking impure surface air. This was not altogether original with him, but was the application and improvement of the plan proposed by Cardinal de Polignac. It was applied to the House of Commons and used seventy-five years. The most useful hospitals are, and have been, general ones, built upon the pavilion plan, with ample acreage, with wise management, principally under medical officers' control, under whose roofs every medical man is a free, independent and responsible agent, enjoying equal rights with all, as far as consistent with wise general management.

Although hospitals have been intended as a blessing and benefit to the poor, they have too often proved the reverse, on account of the ignorance, on the part of the administrators, of the true principles of health. So much was this the case formerly that it was frequently debated whether hospitals are or are not gigantic evils. In the present state of our knowledge of hospital construction and building hygiene, it would be of no use to consider statistics of mortality, etc., of different times, as former conditions are hardly likely to be met with again. Most instructive lessons can be learned, nevertheless, from these statistics of former times, and it can be gathered that the mortality is pretty generally in the ratio of the size of the hospital, and the consequent aggregation of patients, the crowding together in the wards, the deficiency of ventilation, defective sewerage arrangements and want of constant attention to the details of cleanliness, which latter neglect has especially been a fertile source of hospital disease. Dr. B. W. Richardson has traced out in a very instructive way the remarkable immunity of the Jews from epidemic and other diseases, and has shown that their religious attention to the details of the periodic cleansing enjoined by the Mosaic law appears to be the main cause of this notable circumstance. In these times it may be urged with some

reason that, with correct hygienic construction and good management, there is no reason why a large hospital should not be kept in a healthy condition.

The broad general object for which hospitals have been established may be stated to be the gratuitous medical and surgical treatment of the indigent sick. Many abuses, however, creep in, and large numbers of persons yearly receive medical treatment gratuitously, who are quite able to pay for it. To obviate this evil the establishment of paying institutions has been much recommended. There is a large class above the very poor who are but ill able to afford skilled attendance and nursing at their homes. It is not desirable, nor is it always their own wish, that those persons should be objects of charity, and the establishment of hospitals and dispensaries at which they could contribute something toward the expense of their treatment and attendance meets this difficulty to some extent. However, if it is accomplished, it should be done with fairness to all concerned.

A second cardinal principle to be observed in such a hospital, is that it shall do as little harm as possible. The hygienic principles of the even ordinary construction, if employed, are sufficient to insure that no harm by spreading contagious disease is apt to occur; but there is another danger well known, connected with free hospitals and dispensaries, of quite a different kind, namely, the danger of promoting negligence, shiftlessness, laziness and vice by offering free relief from their consequences—the danger of pauperizing people. This is a danger connected with organization and management, and can be guarded against.

MODERN PRIVATE AND SPECIAL HOSPITALS.

It is said, and with reason, of many institutions, that they can show no claim to a separate existence. Some special hospitals there are whose existence is a necessity in the interests of society, and are primarily defensive; some which have come into being in the interest of individuals. Much can be said on both sides concerning the latter, but it is unfortunately a subject which can not be adequately discussed without trenching upon matters of a too personal nature.

CHILDREN'S HOSPITALS.

As regards children's hospitals as separate institutions, there is something to be said for and against. It is not good, it may be said, for children to be treated in the same wards with adult patients, on ethical grounds, because they might see or hear things they ought not, and on administrative grounds, because they can be better cared for if associated with other children only. On the other hand, there seems to be in most children's hospitals an inevitable tendency to the outbreak of infectious fevers, which does not exist when children are treated in the same wards with adults. One cause of this is probably to be traced to visiting days, and the impossibility of exercising any efficient control over the visitors. Another circumstance not remotely connected with the evil is the too close proximity of the out-patient department. In a children's hospital, more than any other, it is a necessity to have an out-patient department. This should be in a separate building. With proper precautions it is possible, if not to abolish entirely, at least to minimize these risks, and with this proviso it should be admitted that special hospitals for children are, if not absolutely necessary, at least eminently useful and beneficent institutions. It is not my purpose in this paper to go into the great subject of other

special hospitals, such as hospitals for military purposes, for railway systems, for consumption and chest diseases, chronic hospitals, institutions for incurables, cancer, paralysis, insanity, lying-in, convalescent, mineral-water, throat, ear and eye, hospitals for diseases of women, stone and fistula, diseases of the skin, etc.

HOSPITALS FOR INFECTIOUS DISEASES.

The primary defensive hospitals deserve serious consideration from all medical men and sanitarians. The fulfillment of the duty of providing suitable hospital accommodations for infectious diseases is a task apparently very little to the taste of sanitary authorities and council health committees, as a rule, particularly when not in any immediate demand; and as a consequence the provision for such hospital accommodation gets shelved from time to time, until an epidemic occurs, when a frantic effort is made to put up a temporary hospital in a few days to cope with the emergency of the moment. Wooden huts or perhaps tents are put up, the epidemic runs its course and dies out, and the town or district returns to its normal health condition. The question of a permanent hospital is then quietly shelved, to reappear only with a recurring outbreak of disease. The great value of a permanent and transportable isolation hospital is that it provides the means of isolating at once the earliest cases of disease, and of thus preventing the epidemic, instead of leaving it to be battled with when it has gotten full sway. This fact is very strongly brought out by Dr. Thorne's "Report on the Use and Influence of Hospitals for Infectious Diseases," which forms the supplement to the "Tenth Annual Report of the Local Government Board of London," 1862. "I could occupy you for hours," says Dr. Thorne of the evidence he has collected, "in telling you instances in which epidemics have evidently been prevented by the isolation of first cases of infectious diseases." On the other hand, of the hastily extemporized hospital put up to meet the demands of a sudden outbreak, Dr. Thorne says: "It is often not ready for occupation until the immediate cause of its erection has passed by; it provides accommodation of a very indifferent sort; it fails, almost without exception, to meet the permanent requirements of the infected district, even when in amount it turns out to be more than the district needs; and thus the object of the hospital as a part of the sanitary defences of that district is often attained in a very imperfect manner and at a needlessly large cost."

The necessity of isolation hospitals for smallpox, cholera and yellow fever is therefore exceedingly clear, and if clear in the case of provincial towns and country places, how much more so must it be in the case of the metropolis! Our health laws do not usually empower the sanitary department to provide hospital accommodation for such persons as, not being paupers, could not be isolated in their own homes without danger to their neighbors. Little children and lodgers, for instance, or tenants of large blocks and hotels would come within this category. The "mother's cottage" plan for diphtheria cases, involving no expense to a city, but which is usually defeated by municipal aldermanic councils, seeks to obviate just this lack of power on the part of the health authorities. In 1871-72, in London, attention was drawn to the behavior of smallpox in the immediate neighborhood of Hamstead Hospital. Following upon this

came reports of similar observations with regard to other smallpox hospitals. In 1882 appeared Mr. Poweis' report on the Fulham Smallpox Hospital in the surrounding neighborhood, and in the same year the Royal Commission on Hospitals for Infectious Diseases was appointed. The result of all this inquiry and discussion was an almost general agreement among those most able to judge, that something like a *prima facie* case had been made out in favor of the view that a smallpox hospital of more than 100 cases was usually a menace to its neighbors within a radius proportionate to the strictness of the local quarantine regulations.

The Ducker or Doecker, improved by Strohmeier of Konstanz, or Strohmeier's canvas barracks hospital, if kept on hand by State or municipal authorities, could be put up on very short notice wherever needed, and would seem to solve the problem of hospital needs in unexpected epidemics. They served the purpose admirably in the cholera epidemic at Hamburg in 1892.

The most perfect permanent isolating ward is in the Johns Hopkins Hospital. The essential feature is that the central corridor is freely open to the external air at either end, and rises through the building in a clerestory to the top, the sides of the clerestory being fitted with movable glass louver windows. The walls of this corridor are practically double, and it is necessary to pass through two doors to get from the corridor into one of the patient's rooms. Each room has a fireplace with a separate chimney-flue, and in the wall is a small closet, in which is a commode containing a chamber utensil, which can be removed from the outside through an opening in the wall without the necessity of entering the patient's room for that purpose. This closet is lined with galvanized iron and has a separate flue exit, in which is an accelerating steam-coil. The door of this closet does not come quite to the floor, and the exit of foul air takes place mainly through the closet and up its special flue, which is of iron. The whole of this closet with its exit flue can be readily cleansed with flame. This arrangement isolates each patient from others and other parts of the hospital.

Perforated floors for heating and ventilation up to four to eight cubic feet per second per bed are employed here, the object also being to have the air pass constantly upward, so that no portion of this air should be rebreathed or come a second time in contact with the patient, thus placing him in the condition of being out of doors in a very gentle current of air.

PLANNING OF PAVILION, BLOCK, CORRIDOR, AND IRREGULAR CONGLOMERATE AND MILITARY HOSPITALS.

This is exhaustively discussed in Burdett's colossal work, "The Hospitals and Asylums of the World." Modern scientific construction can be fully enough indicated by a description of a modern surgical hospital such as many cities have recently been favored with. Doctors have often taken a deep interest in the erection of such a building, and as some of them are often the most famous in their city, and an ordinance or term of gift provides that the plan shall be approved by them, a plan adopted should give a good idea of the present progress in hospital construction, and such a hospital should be interesting as one of the few erected with the design of subserving all the interests of modern scientific achievements, as well as the interests of patients and physicians. It will be

evident that the controlling idea, unhampered by any misapplied notions of benevolence or necessity of economy, was the practical application of sanitary science in treating the sick, well knowing that absurd and mistaken economy has hitherto rendered pious labor and expense in a great measure not only useless, but even fatal and destructive to the very aim and end of the intended purpose. With all these advantages and a clear field, to those unacquainted with the subject in question it may appear a very extraordinary assertion, that there is probably not at present in this country a single hospital constructed throughout upon proper medical principles, excepting perhaps the Johns Hopkins Hospital at Baltimore, which will be memorable for the care and study bestowed upon the consideration of its plans. If we inquire into the cause of such absurdities, they are easily traced to those sources of darkness and ignorance from which most of our civil abuses have originated, but how they should be continued, to disgrace the improvements of more enlightened times, can only be resolved by reflecting on the pride, obstinacy and self-interest which are too generally annexed to ancient errors and ignorance of the subject of hospital construction. The writer has seen interior plans favored *in toto* from a study of a fine black-and-white sketch of a front elevation alone. A hospital built in these days should have fewer objections to its plan than any hospital hitherto constructed, by avoidance of objects of convenience, by avoidance of objects of cheapness or ornament, even though the physicians and architect have generally two very opposite and incompatible views on many points.

CONSIDERATIONS IN PLANNING AND MAKING SPECIFICATIONS FOR A SCIENTIFIC HOSPITAL.

So-called thoroughly fireproof construction is not necessary in hospitals of two stories. The semi-fireproof or slow-burning construction, with solid oak pillars for supports and fireproof stairs and corridors, is, for such buildings, equally safe, as far as danger from fire is concerned, and is much more economic and better adapted to the double system of ventilation, which has proven to be a decided success.

Site.—In selection of a site the following should be considered: Aspect and conformation of ground; nature of soil; area in relation to number of beds; convenience of access for patients, physicians and students; and cost.

The first three questions are of hygiene and the last two of economy. The tendency to subordinate health conditions to those of economy is too often in the ascendant. The healthiness or unhealthiness of a soil is affected by its power of retaining heat and by the level of the ground water, as well as by the actual composition of the ground itself. A high water-level is unhealthy, because it keeps the soil and the air above moist and damp. This can be cured by drainage. Interspaces in the soil above the water-level are filled with air. T. W. Hime shows that the quantity in even very compact gravel amounts to one-third of its bulk. This air is not stationary, but is more or less in constant motion and subject to influence of atmospheric pressure, and unless proper precautions are adopted, is liable to be drawn up into a house by the current induced by the warmer air of the house. Such air is impregnated largely with decaying organic matter when the ground water-level is low, and would be saturated with moisture when it is high; both of

which conditions are highly antagonistic to health. A system of soil drainage independent of the sewerage system should be employed to insure suitable dryness of hospital grounds. Even elevated sites must be so drained if the grounds are uneven. (Johns Hopkins Reports, p. 54.)

The soil.—In cities, the soil often consists of the accumulations of refuse of all kinds, many places having been filled in with the contents of dust-bins, garbage carts, etc. Such a soil is obviously an improper one on which to build unless the earth is covered with an impervious stratum of concrete, asphalt or some other equally efficacious pavement. As this precaution is necessary in the purest possible soils in order to prevent the air from the ground being drawn into the house, it becomes an absolute necessity in all sites. This becomes all the more important when we consider the lack of area in relation to the number of beds.

Foundations.—Foundations should have a solid concrete base with lines of drain tiles laid around them. In all buildings having cellars or half basements the outer surface of walls beneath the ground should be sheathed with overlying slates and have horizontal layers of slate the width of the wall at grade or ground level, above which the walls are to be hollow with a two-inch air space, nine inches from the inner surface; this is closed in by two or three courses of brick at the top.

Precautions necessary for a stable foundation belong to the science of building, but it is of equal importance to prevent the moisture in the soil from being drawn up into the walls by capillary attraction. The method of preventing this evil, is as just stated, to interpose between the level of the ground and the lowest floor a layer of asphalt, slates or other impervious substance continuously along the whole length and width of the foundation wall.

Walls.—The proper function of walls is usually assumed to be, in addition to their duties of support, to keep out the air. A wall built in the ordinary way of brick and stone and plaster internally performs this function to a certain extent. The porosity of brick is very great, 3 to 22 per cent., stone less, varying according to the kind. The porosity of plaster is, as is well known, very great.

By covering a brick with wax or enclosing a portion of a brick wall in an air-tight box, Pettenkofer has shown that the force of the breath will drive air through the brick, and will blow out a candle on the other side, if the current of air be collected in a small channel. Most walls therefore act as a filter by intercepting the organic particles carried on the air currents. In a hospital it would seem that the internal linings of the walls, if of a porous nature, must become saturated with the matter floating in the air, and such matter will, in the parts occupied by patients, be very largely composed of organic particles, epithelia, pus-cells, dried sputa and the like.

In the French Academy of Medicine a case was reported in which analysis had been made of the plaster of a hospital wall, and 46 per cent. of organic matter was found (Galton on "Healthy Dwellings"). This being the case it would seem that the most perfect form of wall for hospital wards is one that presents an absolutely impervious surface, capable of being washed down and thoroughly cleansed without its impermeability being affected. Such a wall as this, if it could be obtained, would have the effect

of condensing on its surface the moisture of the air and of so lowering the temperature of the ward. To remedy this a larger supply of air would be necessary than would be the case with walls of ordinary construction in a building of ordinary ventilation.

Glazed bricks and tiles are perfectly impervious, but do not make a satisfactory wall surface on account of the numerous joints which have to be made of some more or less absorbable cement. Whatever wall surface is adopted, it is of equal necessity to avoid all angles where the air is liable to stagnate. For this reason it is usual to pitch the ceiling toward the center and then to round the angles forward at the junction of wall with ceiling and wall with floor and the vertical angles of the walls. This also has the advantage of facilitating the process of cleansing. The tint of the finishing internal coat, if paint, or whatever material may be used, should be selected with special reference to its effects upon the eyes; and in selecting the window curtains the same considerations should determine their color.

Wall paint.—"Ripolin," made in Holland by the firm of Lindenberg, Jun & Co., also furnished in Berlin from No. 235 Friedrich Str., is recommended by the Berlin authorities and used by the Das Neue Krankenhaus der Stadt Berlin am Urban, built in 1893. Its advantage over oil paints is that it is neither affected by acid or alkaline fluids, is perfectly waterproof and is not brittle or tearable (*rissig*). It dries in ten to twelve hours after applying. It was also tried on the iron work, beds, etc., with good results. It is dearer than oil paint, but more durable and stronger.

Floors.—Floors of the wards, operating rooms, etc., should be a solid and fireproof surface. Infinitely superior to floor boards of even teak or oak, is a floor of solid oak or teak—that muscle of nature as it is called in Burmah—parquet, laid on the surface of cement or concrete. Such a floor, if properly laid and of well-seasoned wood, forms, when wax-polished or paraffined, a practically impervious, solid and fireproof surface. Paraffin in the solid state is melted and painted over the wood, forced into the pores with a hot iron and then polished with a stiff brush. It is very easily kept clean, and needs to be occasionally brightened up with a moist cloth. Next to such a floor is to be preferred the marmor-terrazzo, now in much general use abroad, and recently in this country. The only disadvantage of terrazzo is a tendency to cracks, which must be repaired with cement. Examinations for bacteria in the dust found in these crevices were negative, all having been killed or rendered inert by the antiseptic solutions used in flushing; but one staphylococcus colony was found. This should, for purposes of cleanliness, wear, appearance and cost, be used for kitchen, laundry, morgue and generally in all floor spaces where the objectionable and disagreeable asphalt often creeps in. In all floors, of whatsoever material, the angle between the floor and the wall should be rounded to a radius of not less than two inches. Where walls are of glazed brick this can be best effected by means of a specially-made, hollow molded brick; where of oak or other wood, a hollowed fillet of the wood answers best, and where marble, cement, terrazzo or asphalt joins a plastered wall, the rounding is best formed in the material of which the floor is made. It should be a fixed and essential rule that in all details of joiner's work, no mouldings involving sunken recesses or grooves

should be permitted, and that all angles in which dirt can lodge should be abolished. Every opportunity for the lodgment of dirt means so much added danger of septic poisoning, and no consideration of ornament or even beauty should be suffered to weigh for a moment against this imperative rule.

Windows.—In the construction of windows in exposed situations the value of double glazing must be sufficiently recognized. Two sheets of a thinner glass than would ordinarily be used, with an air space of perhaps three-quarters of an inch between them, makes a most effectual non-conducting surface by incurring a slightly increased cost. In such sashes the space must be made perfectly air-tight.

Doors.—In the construction of doors and the linings and architraves pertaining thereto, the same rule should apply as to minor details. All doorways into wards, or bedrooms, or bathrooms, should be made sufficiently wide, forty-two inches, to allow of a bed being wheeled through, and that these doorways should be without thresholds goes without saying. The linen room should above all things be spacious, provided with abundant air and light from an outside window, together with ample ventilation and artificial heat, and have washable walls. Light, it has been said, is the greatest enemy of hygienic crimes.

Ventilation and warming.—In approaching this great subject, one of the first things to be considered after the bacteriology of the air, is floor space, which should be 100 square feet per bed. A distance of less than eight feet between centers of beds is undesirable; and the second thing is that with 100 square feet of floor space, and the ceiling about 12 feet high, over 1000 cubic feet per bed is secured.

Cubic space supplied vertically has no advantage to the patient, but a minimum of 100 square feet floor space is necessary. Little or nothing is to be gained by raising the ceiling; it has been found that 12 feet is practically enough. The experiments of Drs. Cowles and Wood of Boston (see Report of State Board of Health of Massachusetts, 1879) show that above 12 feet there is little or no movement of air except toward the outlet ventilator, and that the space above is of little value as ventilation space. This teaches that whatever be the height of wards, the windows should reach to the ceiling, whether the ventilators are in the ceiling or top of side walls or not.

This subject of ventilation is one in regard to which much has been written, but about which there is apparently little chance of any general agreement being reached.

Warming is a subject so closely connected with artificial ventilation that it forms indeed an integral part and can not be considered separately. It is of the direct or indirect varieties, of which the indirect seems preferable. Whatever system used should have the automatic heat-regulating apparatus. The ancient idea of floor heating, which can be seen today in the Baths of Caracalla, is carried out to perfection in the great Hamburg Eppendorf Hospital. Technic description in Curschmann's or Ruppel's monographs.

The authorities, nevertheless, are practically agreed upon the fundamental principles which should determine the quantity and quality of air to be supplied, the temperature it is to be supplied at, and the rate at which the air is to be changed, almost as much as they are upon the necessity for ventilation itself. Ventilation resolves itself into two systems: 1, natural, i. e., unaided by mechanic contrivances; 2, arti-

ficial or forced ventilation. The natural system depends then upon the ordinary means of windows, aided by smoke flues from grates, etc.

Artificial or forced ventilation is arranged in two ways: 1, either air is forced into the ward, or, 2, vitiated air can be drawn out. The first system is known as ventilation by propulsion, and the second as ventilation by extraction. These two artificial systems were established at the Lariboisière, Paris, one side of the hospital being ventilated by propulsion, the other side by extraction, the air in both instances being taken as far as possible from the ground by means of tall shafts. The terms of this comparative experiment provided for a mean temperature of 16 to 18 degrees C. (61 to 64.5 F.), and that the air-supply per bed should be at the rate of 50 cubic meters (2119 feet) per hour. In one system steam-fan power was used; in the other hot water coils in the exit shaft. Result of comparison was greatly in favor of propulsion, because it supplied 3178 feet per bed per hour, while by extraction it was but 1059 feet. A comparison of cost, however, showed the former almost three times more expensive than the latter, and this, when run in connection with the modern automatic heat regulator, which must be kept constantly in motion winter and summer, about doubles the expense again.

Johns Hopkins system.—This ventilating and heating arrangement, which should be understood by all, is by a double system of outlets, one in the floor and one in the ceiling, and the object is that the floor outlets may be used in winter or cold weather for the purpose of economizing heat, while in summer both sets may be fully opened. In the Johns Hopkins system, which has proved to be a perfect success, it has been found that in winter the accelerating coils in the main exit shaft are not usually needed, but it is found that whenever the temperature of the external air is 60 degrees F. or higher, especially if there is little or no wind going, these coils are useful. All pipes, wires, etc., for heating, lighting and drainage, are in tunnels, always open to inspection.

Foul-air flues placed in the outer walls of hospitals of two or more stories, often prove unsatisfactory in cold weather, when they are most needed, because the current in these flues is checked by the chilling of their walls.

One cubic foot of fresh air per second per person by this system is easily obtained, with the possibility of doubling this supply for a short time in flushing out the ward.

In wards designed for cases giving rise to offensive odors, or in which a large amount of organic matter is thrown off, or in which for other reasons a large amount of air is desirable, the air-supply is fixed at 2 cubic feet per second per head. Finally, a few rooms in the isolating ward are arranged with perforated floors for an air-supply of 4 cubic feet per second per head, with a capacity for doubling this if desired. All registers and flues for fresh air are of such sizes as to permit the passage of the requisite amount of air with a velocity not exceeding $1\frac{1}{2}$ feet per second under ordinary circumstances. Air-currents of this velocity of from 70 to 75 degrees F. are barely perceptible to the hand and create no discomfort.

In the isolation wards perforated floors are employed for heating and ventilating, and supply from 4 to 6 cubic feet of air per second per bed, the object being also to have the air pass constantly upward, so that no portion of this air shall be rebreathed or come

a second time in contact with the patient. This places him in the condition of being out of doors in a very gentle current of air.

Sewage disposal and house drainage.—At the Johns Hopkins Hospital all soil pipe was delivered on the grounds as it came from the foundry, without being tarred or painted. It was then tested by passing through each length or section a swab dipped in a mixture of linseed oil and red lead. The slightest defect in the casting was indicated by the appearance of an oily stain on the external surface of the pipe. After passing this test the pipes were painted with red lead. All pipes are so placed as to be readily accessible and freely exposed to view. Where the sewage does not drain into large bodies of water, it should be temporarily led to wells of from 70 to 80 feet in depth if possible, until a system of sewerage is established.

Water-closets must be disconnected from wards by intervening lobbies and be perfectly ventilated. The mechanism for supplying water must be as simple in construction, as strong, and as nearly self-acting as possible. A three-gallon flush should be the minimum at a minimum height of six feet above the basin, and a pipe of $1\frac{1}{2}$ inches internal diameter will fulfill the required conditions. It would be better to have the flushing apparatus entirely automatic, if the mechanism was not as a rule too complicated to stand the rough usage of hospital wear. It remains therefore to put it out of the power of the user of the closet to modify the amount of the flush, and this can only be done by so regulating the apparatus, if not automatic, that by one pull of the lever or chain that works the valve the whole of the contents of the flushing cistern are discharged. Basin and trap should be of the simplest form and entirely of white enamel, and the traps properly ventilated through the roof. Those forms which have the trap immediately under the basin are preferable to those in which there is a double bond, because in the latter the water has double work to do, and its force therefore is reduced one-half. In number, the water-closets are reckoned usually as one to every ten or twelve beds, but this is not a hard and fast rule. In close proximity to the closets should be a separate space enclosed for the slop sink, with provision for keeping bed-pans, brooms, etc., and here also should be a cupboard, ventilated to the whole extent of its external or wall side into the outer air, in which to keep feces, etc., required for examination by the medical staff. This hospital slop sink requires special care. The operation of emptying and cleaning bed-pans is one involving no light risk to the nurse, and necessitates most scrupulous care on her part. This risk is a positive danger when typhoid excreta have to be dealt with. The ordinary form is a large glazed porcelain receptacle into which pans are placed and water turned into them from a tap above, and it is practically impossible to prevent splashing. This is obviated by the "McHardy sink," King's College, London; a modification of which was invented independently by the writer, and is easily adapted to an ordinary deep, rim-flush sink.

Baths and lavatories.—Although, for convenience and economy of plumbing details, baths and lavatories are frequently placed with closets, there is no necessity, as in the case of closets, of interposing a disconnecting lobby between a bathroom and a ward. Bathtubs themselves should be placed in the center of the room, or away from the walls, and not enclosed

in any way, and surrounded by movable floor slats or lattice wooden standing boards, to prevent the attendant's feet from becoming wet while administering a bath.

Lighting.—The electric system involves no demand on the oxygen of the air to support combustion, nor does it contribute in the slightest to the vitiation of the air, on the other hand gas does both these things, and then again, electric lighting is infinitely more convenient, safer and less trying to the eyes.

Water-supply.—The importance of the purity and abundance of the water-supply is so well understood, that filters should be put in whenever there is the slightest suspicion of the quality of the water. Large filters of the Loomis patent, which are iron cylinders 6 feet high and 2 feet in diameter nearly filled with clean sand, were in use at the Johns Hopkins Hospital, and the straining effect of these filters is shown by bacteriologic examinations of the water. Before filtration the water contained an average of 39 micro-organisms per cubic centimeter; after filtration the average number found was 5 per cubic centimeter. At intervals of about twenty-four hours, the direction of the current is reversed and the accumulated impurities are washed out into the street. These filters permit the passage of an ample supply of water for ordinary use but greatly obstruct a free supply which would be requisite in case of a fire, hence a by-pass around them is arranged, so that in case of necessity the steam pump can draw directly from the main. This steam pump is connected to force water into large tanks placed in the attic of the largest building. These tanks are intended both to contain a reserve supply for use in case of temporary interruption of the supply from the street main, owing to breakage, etc., and to give additional head or force when the pressure in the street mains is lowered from any cause.

Operation house.—Post-operation wound-infection, not the fault of the operator and assistants, is now understood to be an extremely rare occurrence. The status of surgery to-day rests upon aseptic technic as much as upon the skill and judgment of the surgeon, and a rigid scrutiny of the technic employed in an operation followed by septic infection will almost always show the error of omission or commission to account for it.

There should be three operating rooms: one for a surgeon's dressing room, one for instruments and sterilizations, and one for preparation of patients. If not in a separate house, they should be placed as far as possible from aerial contact with wards or other parts of the hospital. Thirty by forty feet is not found to be any too large for an operating room. All the angles should be rounded, and the window frames flush with the inner surface of walls. Fixed furniture, pipes, tops of sinks and other fittings should clear the wall by at least one inch. The whole of the room and all its contents should be of material that can be freely washed with water and hence must be constructed from aseptic patterns. Lavatory and sink tops should be of glass, also all shelving for dressing, instruments, etc. When a part of the hospital building, there should be a lobby between ward corridors and operating room, which should have double swinging doors so far apart that one set must be let go before the other can be opened. Every detail in the operating room is to be devised with a special view to its aseptic necessities. Everything of an absorbent nature is to be eliminated; this should be easy of accomplishment

and simple enough where the room is intended for operation only. The floor should be finished with a slight fall to a point near the wall where an iron pipe passes through the floor and is connected to a lead pipe on the outside, which in its turn discharges over an open trap. This iron pipe is to be enameled white inside, with a gun-metal plug made flush with the opening in the floor and connecting pipe. Around the walls at the floor line is a marble or glass skirting hollowed out to a radius of $2\frac{3}{4}$ inches; above this the walls are lined with marble or glass to a height of five feet above the marble or glass, and flush with it.

The wall should be finished with impermeable cement and the walls and ceilings made in the form of a vault with pitched glass roof and horizontal glass ceiling, leaving an intermediate space through which a ventilator leads out from the ceiling into the open air.

A north window should furnish the principal light and be formed of one sheet of plate glass, 10 or 12 feet by 8 feet, fitted in a wrought iron frame, flush with marble or glass and wall. Other windows should be constructed in a similar manner, but made to open for purposes of ventilation.

Doors should be made of two leaves of white enameled sheet iron in a wrought iron frame, and on the inside flush with the walls. Ventilation at floor surface for winter use. Light, electricity.

The important end to be kept in view is that every part shall be impervious, readily cleaned and easily seen.

The ideal practical operation room—Besides incorporating the above features it would be better if the large window with the north light extended four feet from the floor to the ceiling; as large a skylight as possible, and a marmor-terrazzo, or better, a teak parquetry floor. The room should have two 100-candle-power electric lights, with an arrangement allowing of any angle of reflection, and also two portable incandescent lamps with flexible connections so they can be brought close to any part of the operating tables. Electric connections should be furnished to one or two sides of the room for wires for galvanic-caustic instruments, electrolytic work and ordinary galvanic and faradic currents.

Operating table and floor should not be in any way connected with the general drainage system of the building, if there is the slightest doubt of its perfection; the bowls and sinks should then discharge into vessels which can be removed. One fixed operating table should be provided with steam heat. There should be an apparatus for a large, constant supply of sterilized water, first filtered through diatome cylinders, which is piped to the wash basins, the operating table and irrigators, the water in the wash bowls to be turned on by the foot on a pedal, through a gooseneck vent or spray. This supply of water is to be furnished at a constant temperature of about 130 degrees F., and the entire mechanism of filtering, boiling each drop, carrying it to the germ-proof reservoir, where it is maintained at the uniform temperature desired, to be entirely automatic and self-regulating. Such an apparatus is practical, and is even already realized through the inventive genius of a hospital surgeon.

The furniture of the room, as well as the parts of the hospital devoted to patients, is best described by what is known as aseptic hospital furniture, and is made of white enameled wrought iron and glass. This ideal room should have anterooms, with lavatories and baths for patients and surgeons.

It is thought that a few attractive tablets containing bacteriologically exact instructions for cleansing instruments, surgeons' and nurses' hands and the patient himself, as well as everything to be used in an operation, might not be out of place as proper articles of furniture in such an operation room, such as complete instructions in short separate chapters on:

1. Preparation of patient.
2. Preparation of surgeon, assistants and nurses.
3. Preparation of instruments.
4. Preparation of ligatures, sponges, towels, sheets and dressings.
5. Preparation of operating room.
6. The anesthetist.

The tablets should be printed and posted in a conspicuous place in the preparation room at least, and it would then remain necessary to have in the operating room itself, in quite brilliant characters, perhaps emblazoned on the walls, the two following summary operation room laws:

After the hands to the elbow are prepared in the manner prescribed they should never touch anything except the instruments or ligatures, the sponges or the wound, or the cleansing must be repeated.

From the time everything is in readiness until the wound is dressed, nothing is to be disturbed in the room, and any instrument, sponge or suture which has touched anything not protected by aseptic towels is discarded for the entire operation.

The detention house.—This department is mentioned merely to insist that it is an absolute necessity in all hospitals of any size. The need of properly built strong rooms for the care of violent and maniacal patients is too well known to require any argument in its favor. Windows must be built far above the reach of patients, and the floor-and-wall system of heating used.

Disinfecting room or house.—Of paramount necessity in all hospitals is a large, general disinfecting apparatus of some kind, both for the purpose of destroying vermin in clothes, and for disinfecting bedding, etc., after cases of infectious disease. Present knowledge of the subject is that the only trustworthy process, aside from destruction by fire, is the application of steam under pressure, aided and supplemented by dry hot air or formol gas. The great value of steam under pressure is its penetrative power, and the failure of dry heat disinfectors was due to their want of this property.

The fundamental doctrines established by R. Koch and Wolfhügel (*Mitth. a. d. Kais. Ges.-Amte*. Bd. i, 1881) have conclusively proved that dry air is an almost useless disinfection method; because a three-hours exposure to 140 degrees C. is necessary to kill all the known germs, and at that temperature nearly every material subjected to such ordeal is severely damaged. Far more thorough than dry hot air in its influence upon germs is the hot steam. The conclusive and final researches of R. Koch, Gaffky and Loeffler have proven that in the low pressure 100 degrees C. steam is the most convenient and most easily applied disinfectant, which for certainty of result is not to be compared with any method that we have yet learned.

The most imperishable disease germs with which we are acquainted are the spores of anthrax bacillus, as Esmarch has shown (*Zeitschr. Hyg.*, 1888), which have greater or lesser resistance according to the surrounding material, or material in which they

are imbedded. The most persistent of these anthrax bacilli spores, according to numerous experiments by Esmarch, survive an exposure of twelve minutes to steam of 100 degrees C.; the majority of the spores perish in five minutes. In the steam current we have therefore, for all practical purposes, a sufficiently absolutely reliable method of disinfection (Carl Günther). In all permanent hospitals steam is usually available at any time.

The difference between the two heat agents may be best illustrated by two examples taken from Dr. Parson's "Report on Disinfection by Heat." (Fourteenth Annual Report Local Government Board for 1884, *Sanitary Record and Local Government Review*, London, Sept. 29, 1894.) Spores of bacillus anthracis required for destruction four hours' exposure to dry heat at 220 F., but were destroyed by five minutes' exposure to a heat of 212 F. in steam or boiling water. Bacteria not containing spores are destroyed by dry heat in about two hours at a temperature of 212 F., and three hours at 212 F. are required to destroy the fertility of their spores. In any case it is not desirable to exceed a temperature of 240 or 250 degrees, as this is too high for woolen fabrics.

Moist heat, like hot water, is the best germicide. The thermal death-point of surgical bacteria, which practically means pyogenic cocci, and which are not spore-bearing, and the bacillus of tuberculosis and their spores is correspondingly low, when they are exposed to moist heat. The pyogenic cocci are all killed inside of ten minutes at 150 F., while the tubercle bacilli and their spores are destroyed in five minutes at a temperature of 212 F. Boiling for five minutes at a temperature of 212 F. seems, therefore, sufficient for all practical purposes. Steam acts like hot water of the same temperature, and when disinfection on a large scale is desired, it can be used where hot water is not practicable. The germicidal property of steam depends upon its moisture and on the expulsion of air contained in the articles to be sterilized. It is used at a boiling temperature or even greater. All known pathogenic bacteria and their spores are destroyed in low steam at 212 F. maintained for five minutes. No spores are capable of germination if a high-pressure steam temperature of 230 F. is reached. (Red potato bacillus, Globig, *Zeitschrift f. Hygiene*, Bd. iii, 1887.) An efficient apparatus should provide means for subjecting the articles to be disinfected to actual contact with an overhead streaming steam, which expels every particle of air from top to bottom, while the apparatus is getting heated; and then the removal of vapor by a new filling of the disinfector with air from below upward before the steam can condense sufficiently to injure the articles disinfected. Such an apparatus should be provided with means of automatically shutting off steam if the temperature should exceed a certain point. Whatever form of apparatus be adopted, it should always be provided with two doors, one for ingress in one room, the other for egress in another room; the rooms being divided by a solid wall. The test of the large Reck apparatus built upon these principles, as well as the smaller Boeckmann sterilizer, show them to be scientifically perfect and efficient. (A. B. Reck, Copenhagen, Denmark; Edward Boeckmann, St. Paul, Minn.)

Disinfection by formaldehyde gas is the most recent method, and probably one of the most efficacious and economic known. The following letter indi-

cates sufficiently the manner of applying this agent for hospital purposes:

BARNES HOSPITAL, U. S. SOLDIERS' HOME,
WASHINGTON, D. C., Nov. 3, 1898.

To the Surgeon-General, U. S. Army, Washington, D. C. :

Sir:—In compliance with your instructions I have the honor to submit the following account of the methods and appliances used at the field hospital, Camp Wikoff, for sterilizing articles of bedding, clothing, etc., with formol or formaldehyde gas. The generator used was obtained from Kny-Schreier Co., and is designated as High "C" Formol Gas Generator No. 2. Wood spirit was used for the lamp, and gas generated from a mixture of formalin (40 per cent.) 1,000, calcium chlorid 200, and water 400 parts, with which the cylinder is to be charged.

A convenient wooden structure was erected, 10 x 12 feet, ten feet to the plate. The frame was scantling, 2 x 4 inches. This was first covered, floor, sides and roof, with tongue-and-grooved boards, and over this was placed a layer of tar paper and another layer of tongue-and-grooved boards at right angles with the first. No window is needed. The batten door was made double, and lined like the sides. It must be carefully fitted and hung to open outward. This tightly constructed room was provided with hooks and cords for the suspension of articles to be sterilized. A room, 10 x 12 feet, is large enough for use of a hospital with 100 beds or more. Adjoining this sterilizer chamber was a small chamber, 5 x 6 feet, to contain the generator and chemic materials, as shown in the accompanying ground plan and side elevation. The gas was introduced through two small perforations in the wall of the sterilizing chamber, into which the tubes from the generator were inserted. One charge of 128 ounces is sufficient for a room of the size above mentioned. The soiled articles are sent at once to this room, and when a sufficient number has accumulated, the generator is to be started and the gas turned on. A few hours is sufficient. It is convenient to sterilize at night, filling the room with gas in the evening and leaving it closed until morning.

Very respectfully, your obedient servant,

(Signed) W. H. FORWOOD,
Col., Asst. Surg.-Gen. U. S. A.

Necropsy, laboratories and museum.—In these times no hospital would be complete without facilities for the scientific study of, and experimentation in, disease. These necessary departments should be together in a separate building and include a crematory. In large hospitals a chapel for religious exercises can also be incorporated in this building.

The technic of building and fitting up these departments is so exhaustively set forth in Ruppel's great work that it is only necessary to refer to its pages.

Kitchen, laundry, boiler and bath house.—This paper has long since outgrown its proposed length, but strange as it may seem, it is necessary to mention these departments, to insist that they be incorporated in a building or buildings entirely separate from the hospital proper. It is not within the province of this article to describe these parts of the economy of a hospital in detail, but it can not be dismissed without enumerating at least the necessary contents of the culinary department:

1, a gas roasting-oven; 2, a gas hot plate fitted with grill for grilling; 3, a steaming-closet for potatoes and fish; 4, steam-jacketed coppers for beef tea and broth and for broiling meat; 5, a steam-heated "hot closet;" 6, a steam-heated carving table; 7, a steam-heated cylinder for boiling water; 8, a scalding apparatus for milk and scullery purposes; 9, two or three sinks for washing vegetables and crockery (one of porcelain for green vegetables), all provided with hot and cold water, and so arranged that the water can be kept constantly running when the sink is full. It must be possible to empty each sink rapidly and completely. Flooring should be of marmor-terrazzo, or of some impervious material.

Hospital furniture.—This subject can be briefly disposed of here by merely mentioning the modern aseptic hospital furniture made entirely of white enameled iron and glass. Hall floors and stairs should be covered by rubber matting, one meter in width, in long strips, with reinforced corners. This makes the hospital practically noiseless, there is no dust, and the matting can be cleansed and disinfected by water and antiseptic solutions.

Shutes or flues for dirty linen are things to be avoided; they rapidly become foul and serve as shafts for conveyance of polluted air from one part of the building to another. For bed or body linen that is fouled there should always be in every ward a basket or light box with handles, lined with iron or zinc, to convey linen to the laundry; the receptacle to be properly cleaned and disinfected before being sent back to the ward.

Management.—More than nine-tenths of all that can be found written on hospitals in this article, as well as all others, is mainly about their construction, and most writings have appeared since Miss Nightingale's "Notes on Hospitals" and "Notes on Nursing" (1858), results of her labors in hospitals during the Crimean War. Many times the results of carelessness and of unwise and fraudulent management, poor or untrained nurses, etc., seen in hospitalism or hospital diseases, have no doubt been unjustly attributed to faulty construction. Those who have served on the staffs of large pauper hospitals have had excellent opportunities of observing bad effects of poor nursing in newly-constructed wards, and vice versa, the good effects of good nursing in defectively-constructed and equipped wards. A well-managed, poorly-constructed hospital will give a far better result than a finely-constructed hospital with bad management. Badly constructed and managed hospitals will be built, and the causes of diseases will continue to create preventable diseases just so long as doctors leave these matters to business men, politicians and their architects, especially when the latter happen to be amateur ventilators and sanitarians. Such institutions are always liable to cause hospital diseases and become centers of infection; thus defeating the very object they are intended to promote.

PROBLEM OF THE MUNICIPAL GENERAL HOSPITAL OF THE FUTURE.

The future, centrally-located general city hospital, built upon the ground area limited by the great property values of such locations, should engage the attention and study of physicians and the modern scientific and hygienic builders. With our present knowledge of fireproof (from the inside) construction, of relative purity of air strata, diffusion of gases, ventilation and warming, together with interior finish to the remotest detail in what is called hospital construction, and with aseptic furniture, why should we not advocate the erection of double-floored, fire-proofed hospitals of an indefinite number of stories. Such a hospital could harbor every class of sick, and it could be argued that the higher the floor the more hygienic the conditions. Isolation of departments could be perfected by the properly arranged system of elevators and outside stairs and the economy of the building and its various departments could by the same means, as well as special diet kitchens, be aerially disconnected from the wards proper and from each other. Safety from external

fire could be secured by sufficient space about the building, and quiet is assured in the noisiest neighborhood by properly constructed walls and elevation.

This proposition is suggestive only, but there is no good reason why it could not be worked out. The essence of the plan is in the isolation of the wards from the rest of the hospital and from each other. The extreme limit of isolation can be reached here as in some modern foreign hospitals where connecting corridors are abolished altogether and the pavilions are confined to one story. The special form of plan for such a hospital would be determined entirely by the area, conformation and shape of the site.

BIBLIOGRAPHY.

- The Hospitals and Asylums of the World, Burdett.
 Johns Hopkins Hospital, John S. Billings.
 Johns Hopkins Hospital, five essays on.
 Mittheilungen über das neue allgemeine Krankenhaus zu Hamburg-Eppendorf, Dr. H. Curschmann.
 Deutsche Medicinische Wochenschrift, No. 36, 1895.
 Policlinico zu Rom.
 Zeitschrift für Hygiene.
 Galton on Healthy Dwellings.
 Einführung in das Studium der Bacteriologie. Carl Günther.
 Reports of Local Government Board, London, September, 1893.
 Third and Fourth Annual Proceedings of the Association of Military Surgeons of the United States.
 Medical and Surgical History of the War of the Rebellion.
 Anlage u. Bau der Krankenhäuser, nach hygienisch-technischen Grundsätzen, von F. Ruppel, Baainspector in Hamburg.
 Das neue Krankenhaus Der Stadt Berlin am Urban, 1893.
 Hospitals, Their History, Organization and Construction—Prize Essay, W. Gill Wylie, M.D., 1876.
 Hospitals and Asylums of the World, Dr. John Jones, New York, 1875.
 Hygienische Rundschau, Carl Frankel ü Erwin von Esmarch.

GONORRHEA IN WOMEN.

Read before the Mississippi Valley Medical Association,
 at Nashville, Tenn., Oct. 11-16, 1898.

BY JOSEPH RILUS EASTMAN, M.D.

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There is no malady to which womankind is liable that should engage more consideration than gonorrhea. Strewed in the train of its ubiquitous and wily germ are pathologic ravages of surpassing import in their clinical and moral consequences, yet hardly recognized or understood. Sinclair, a decade ago, observed a strange indifference toward differential diagnosis of gonorrhea in the female, and even now, when, in the light of recent bacteriology, it is easily possible to demonstrate the gonococcus in the act of pathologic mischief, there exists a notable, if not notorious, tendency on the part of the most general practitioners, and some specialists, to disregard discriminating diagnosis in doubtful cases.

The diagnosis of acute gonorrhea in women is comparatively easy, even without the microscope. What with a history of impure coitus, free purulent secretion from vulva, vagina and urethra, intertrigo, burning on micturition, and vesical tenesmus, the diagnosis is not far to seek. Upon inspection one usually detects a discharge of tenacious pus; or greenish or yellowish streaks upon the linen may alone be in evidence. Erosion may be present upon the skin, upon the labia majora or in the inguinal and gluteal folds. The labia minora, the clitoris and its prepuce, and the hymen, if present, are red and swollen. The meatus urinarius is found to be congested and ectropic, its normal pink color being changed to a deep red. The mouths of the ducts of the Bartholinian vulvovaginal glands are deeper in color, gaping and tender. They discharge, instead of their normal glycerin-like secretion, pus-laden mucus. A small area of mucosa immediately about these openings exhibits a purplish-red tint. The surface of the vagina proper presents no great changes, the adult vaginal mucosa being practically uninfluenced

by the presence of the gonococcus; not for the reason generally presented, viz., that the germ can not exist upon flat epithelium, but more probably because, as Doederlein has pointed out, of an acid environment and the presence of the vaginal bacillus.

It is certain beyond cavil that the gonococcus can grow fat upon flat epithelium. Rosinski reported five cases of gonorrhea of the mucous membrane in the mouth in the new-born; and specific vaginitis of children is by no means rare. It occurs so often in plural instances among the children of the same household in Germany that the term *glückliche familie* has obtained currency as a technic expression of the craft. The so-called "happy family" is one in which the father, mother and all the children are simultaneously ill with clap. It may, moreover, be adduced as proof that the gonococcus is able to penetrate flat epithelium that pieces of vaginal mucosa removed by the curette have been repeatedly discovered to contain gonococci. As a rule, however, the only gross pathologic lesions detectable in the vagina are minute angry red spots emitting a drab-colored secretion. These are the follicles. If the discharge from the uterus has been great, the stagnant secretions behind the hymen irritate the vagina perhaps, to the extent that it becomes reddened, or loses its epithelium and becomes eroded. Upon introducing the speculum we may discover that the portio vaginalis is reddened and secreting pus, which, collecting posteriorly in the vaginal vault, produces erosion.

After a time—usually about a week—the inflammation spreads to the uterus and is here announced by symptoms of pain and marked tenderness in that organ, with fever and a purulent discharge from the cavum uteri. Having rested for a time upon the comfortably arranged rugæ of the cervix, the gonococci, if unapprehended, wander about into the tubes, ovaries and parametria. There may appear in women the symptoms of cystitis, ureteritis, blenorragic rheumatism and endocarditis, but to dwell upon these complications would be to drift beyond the limitations of a short paper.

The relative value of the microscope in diagnosing gonorrhea in females is uncertain. Saenger and Broese ascribe to it very small worth, since in many cases the gonococci are not to be found, and since on the other hand observation of the clinical symptoms often establishes the diagnosis without bacteriologic examination. Contrary to the views of these men are the *ex cathedra dicta* of Neisser, which declare the proof of the presence of the gonococcus by the three classic tests of Koch to be absolutely essential. Certainly in doubtful cases the microscope offers substantial aid. When once the gonococcus is isolated on the slide, the examiner is certain of his ground. It is not necessary to postpone treatment until the diagnosis is complete. Therapy may at once be aimed at gonorrhea, and if one errs it will be upon the side of safety.

A comprehensive examination of the discharge is not complete until the secretions of the urethra, Skene's lacunæ, the glands of Bartholin, the vagina and the cervix have been searched through; and in chronic cases several preparations should be made from each of these. It may appear that this would consume much time, but it may be said with truth that the reliability of the diagnosis *cæteris paribus* will bear a direct ratio to the amount of time and patience invested. The culture of the gonococcus