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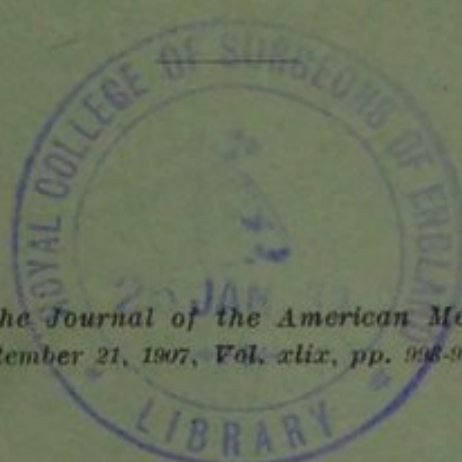
Modern Hospital Construction.

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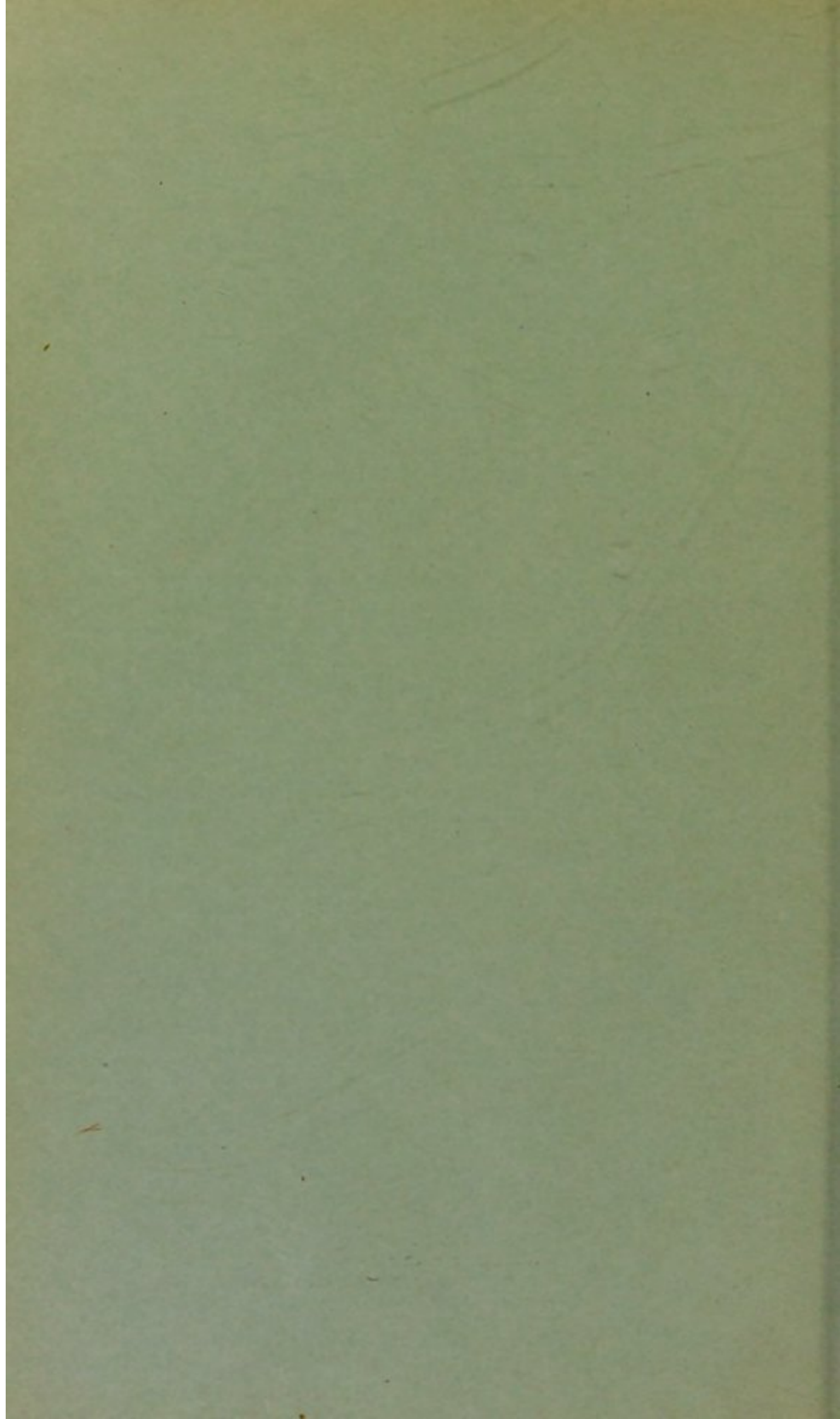
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MODERN HOSPITAL CONSTRUCTION.*

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NEW YORK CITY.

The modern idea of the construction of the general hospital building is that the building itself should bear a definite relationship to treatment, that it is more than a mere convenient form of lodging house for the sick, and that environment is a potent factor in the control of disease, often more powerful than the giving of pills and potions. One reason among many for this position is the lesson taught by tuberculosis, namely, that fresh air is not a specific for that disease alone, but acts through increasing the resisting power of the organism. If this be true of tuberculosis, why is it not also true of many other diseases? Hence hospitals are built with almost as much ward space outside as inside the retaining walls, with wide verandas opening off every ward, and broad flat roofs for exercise, fresh air and sunlight.

Another reason is a demand for the intelligent classification of cases according to their special hygienic instead of mere medicinal requirements. Yet another reason is the widespread tendency to give fewer drugs and to employ more extensively the general non-medicinal aids to treatment, such as hydrotherapy, thermotherapy, etc.

The earlier view of hospital construction, which dominates most of the existing hospitals of this country, was that the hospital building is little more than a dormitory where a number of sick persons, having every conceivable malady, are placed in a series of long large wards, like a lot of sheep corrals, all of similar size and shape, and where they are gathered without the slightest regard to their individual peculiarities or different re-

* Read in the Section on Hygiene and Sanitary Science of the American Medical Association, at the Fifty-eighth Annual Session, held at Atlantic City, June, 1907.

quirements of treatment, varied needs as to air, temperature, sunlight, quiet, etc. Could any arrangement be more irrational or, in fact, more uncomfortable than this?

Let me picture briefly from experience the inmates of such a ward: The pneumonia patient, with a temperature of 105 F., sorely in need of fresh, cool air, lies in the next bed to the uremic patient with a subnormal temperature and high tension pulse, who needs warm air and a hot pack! The typhoid fever patient, with a racking headache and photophobia, lies facing a glare of sunlight, which is doubtless beneficial to the man with pernicious anemia in the next bed, because the trained nurses think the ward looks better with the shades all at the same height. The neurasthenic with insomnia lies next to the patient with alcoholic cirrhosis and delirium tremens, who keeps the entire ward awake most of the night. The convalescent patient has nowhere to go during the day for a change of air and scene, and the poor old woman with a little chronic cough, who needs to rest in an easy chair toasting her feet at a heater, sits gazing wistfully and pathetically at a hole in the wall near the ceiling, where some architect (who never built a hospital before) has seen fit to place a hot-air register. The patient with fetid diarrhea and sixteen stools a day destroys the appetite of the patient with chlorosis in the next bed, and the patient with a neurotic tachycardia is cheered by the stertorous groaning of the moribund hemiplegic.

This sort of thing may be housing the sick, or boarding them, but it certainly is not treating them. I am not even certain that in the long run it is economical. It may appear so, to place as many patients as possible in a long large ward, because fewer nurses are required to watch them, and certain routine things like handing out wash-hand basins in the morning can be done more quickly than in smaller classified wards, but suppose it to be proved, as it often has been proved, that patients do not recover so promptly under such conditions as they do where they can have change of air and scene on roof-gardens, balconies, or in day rooms, sun-parlors, etc., or where they can sleep better and eat better if segregated from the depressing influences of the ward? Protracted convalescence of any patient is a serious economic disadvantage. Convalescents have no business

in a mixed general hospital ward at any time, but when they are kept there, as they are in most of our hospitals, it costs as much per capita per diem to maintain them as when they are seriously ill, for the fact that they require less service is offset by the fact that their board is more expensive.

That these suggestions are not visionary but eminently practical is proved by what has been already accomplished in this country, and much may be done by the readjustment of old buildings. At the Presbyterian Hospital in New York City, for example, a model open-roof ward has been constructed on the flat roof by Dr. W. P. Northrup. It is capable of accommodating at least fifty patients, many of whom are kept there in the open air all night. A kitchen and lavatories on the roof make this practicable. A similar alteration is planned for St. Luke's Hospital in New York City, although the building was only completed a few years ago. In an admirable article on "Environment in Therapeutics" by Walter James,¹ which everyone interested in this topic should read, he explains what he has accomplished in two hospitals, the Roosevelt and Presbyterian, in New York City (both built many years ago) by such means as a liberal use of ward screens, tinting the walls and adapting shutters to make certain wards more reposeful for the very ill, securing different temperatures at opposite ends of a ward, etc. He says: "Thus, without the expenditure of any money and with no structural changes whatever, I was able to secure in one ward three different kinds of environment and kept the patients distributed in accordance with the nature and progress of their complaints."

The new Bellevue Hospital is being constructed with large verandas opening off of each ward, designed for the continuous treatment of certain classes of patients in their beds in the open air.

I spent last summer in Continental Europe studying hospital construction and found that a veritable hospital renaissance is everywhere in progress, especially in Germany, but also in Italy and France, where it has developed during the past decade. It is no exaggeration to state that many of these modern hospitals are structurally a generation ahead of any at present existing in this country.

1. Amer. Jour. Med. Sci., November, 1906.

THE POLICLINICO OF ROME.

For example, the Policlinico Umberto Primo in Rome (Figs. 1 and 2), which is one of the finest hospitals in the world, possesses forty-four separate pavilions, covering forty-five acres of ground within a short drive of the Colosseum (Fig. 1). The capacity is 1,000 beds and the buildings, which are of a light stucco, and are connected by open corridors, are most attractive in design (Fig. 2). The two-story ward pavilions open on to the extensive grounds, which are planted with pines, oleanders and palms. There is a large separate building for hydrotherapy, and another for the pathologic department, fitted up with laboratories, animal rooms, etc. There is a separate building for each of the important special services, such as gynecology, diseases of the eye, etc. A well-lighted subway conveys the water and heating pipes and a track on which delivery cars carry the food from the central kitchen to the wards.

VIRCHOW HOSPITAL.

In Berlin three of the finest hospitals, all within the city limits, cover collectively 124 acres of ground. The largest of these, the Virchow Hospital (Figs. 3, 4 and 5), which was opened last year, was ten years in building, and so much forethought was exercised that rows of trees were first planted to form avenues between the ward pavilions (Fig. 4), which now, by the time the buildings are opened, afford massive shade. The hospital comprises fifty-three separate buildings, laid out on broad avenues which are further adorned with shrubbery, flowers and fountains, and supplied with benches, arbors and shelters for the patients. The total capacity of the hospital is 1,650 beds for patients and 550 more for the staff, nurses and attendants, 2,200 beds in all.

In addition to the one and two-story pavilions for the sick there is a separate building for each of the following purposes: A lay-director's house, two medical directors' houses, administration building, nurses' home, kitchen, laundry, workshop, pathologic department, animal experiment house, wagon house, disinfection building, gymnasium, chapel, icehouse, water tower, filtration plant, crematory, bathhouse and power-house. All these buildings constitute practically a small village, and the instructions given regarding them to the architect by the trustees state that "The buildings should be of

simple rather than ornate construction, but should be designed to make a pleasing impression in form and color on the inmates for whom a cheerful environment is an important consideration." The motto suggested for the entrance archway might well be placed over many another hospital: "While treating the disease do not omit to treat the man."

The cost of this most complete institution was only \$2,250 per bed, which, with due allowance for cheaper building in Germany, compares favorably with the \$2,500 or \$3,000 rate which is common in this country. The wards have arched ceilings, a favorite modern type for the one-story pavilion, which is not only attractive, but favors ventilation by giving varied direction to air currents. The windows are of casement type, with transoms at the top, an arrangement which admits of directing the air currents at will, and has other advantages



Fig. 1.—General view of the Policlinico, Rome; contains 1,000 beds, consists of 44 separate buildings and covers 45 acres.

over the cumbersome heavy sash type of window which prevails in this country, and which latter is often too heavy for the nurses to lift unaided. The ward floors are of terrazzo. The heating pipes are placed in front of certain of the windows, and each ward has its independent steam disinfection apparatus for clothing and excreta. There are many small rooms for delirious or other patients who need isolation, either for their own good or that of the other patients. Attractive day rooms are used during inclement weather by such patients as are able to be out of bed, while in fair weather they have easy access at all times to the pleasant grounds.

The wards are built on the desirable "unit" plan which permits indefinite extension (Fig. 5), i. e., each pavilion consists of two one-story wards, joined by a two-story service group of rooms, containing the ward lavatories, diet kitchen, linen closets, disinfection apparatus, bathrooms, and rooms for a member of the house staff,

and also for several nurses. In the four largest pavilions are separate clinical laboratories. Each ward unit, moreover, has a room for storage of such appliances as water beds, portable bathtubs, splints, etc., as well as ward-cleaning utensils (which in this country is apt to be remembered after the hospital is built).

The bathhouse in this, as in other foreign hospitals, is a model of completeness, and forms a striking contrast to the arrangement in our own hospitals, which is likely to consist of a single tub for a ward, usually placed in a water-closet (!) and constituting a feature as unhygienic as it is unesthetic. The Virchow Hospital bathhouse is completely fitted not only for purposes of cleanliness but for scientific treatment. It contains Roman, Turkish, hot-air and electric light baths, sand baths, baking appliances, carbonic acid baths, showers and douches of all kinds, with proper adjustments for regulating water pressure and temperature, besides a large plunge bath and massage rooms. There are also inhalation rooms for treatment of respiratory diseases, and an extensive electric department for the Roentgen-ray, Finsen light, etc. In many American hospitals the patient with chronic rheumatism, who is so unfortunate as to be in a hospital, is put to bed and given potassium iodid, perhaps, whereas what he really needs is a proper system of douches, sweatings or "baking," combined with skilful massage, and regulated exercises.

This applies to a very large number of ordinary ward cases of varied type, such as chronic rheumatism and gout, arthritis deformans, neurasthenia, anemias, chlorosis, tuberculous joint cases, gonorrheal and other forms of chronic sepsis, many forms of digestive disorders, many diseases of the nerves and muscles, such as ataxia, myasthenia, etc., and many varieties of chronic surgical conditions. To keep such patients in bed or confined to the depressing influences of a large general ward, without change of air temperature day and night, without change of scene, without access to a heater if they need it, or to an open window if they need that, without any opportunity for exercise, either active or passive, in fact without any treatment other than the necessary food and lodging and medicine (which latter they often do not need), to keep them thus is the common practice in many of our hospitals, but it is a long way removed from accomplishing scientific treatment through a max-

imum use of intelligently adapted hygiene and environment.

THE MOABIT HOSPITAL.

In the Moabit Hospital in Berlin are many illustrations of the extreme thoroughness with which structural details are carried out in Germany. Perhaps, it may be said, such details are unnecessary, and in some instances they seem to us almost absurd, but they do no harm and are at least preferable to the careless and even ignorant way in which hospitals are still sometimes being built in this country, with impossible Mansard roofs, entire lack of balconies or any place where patients

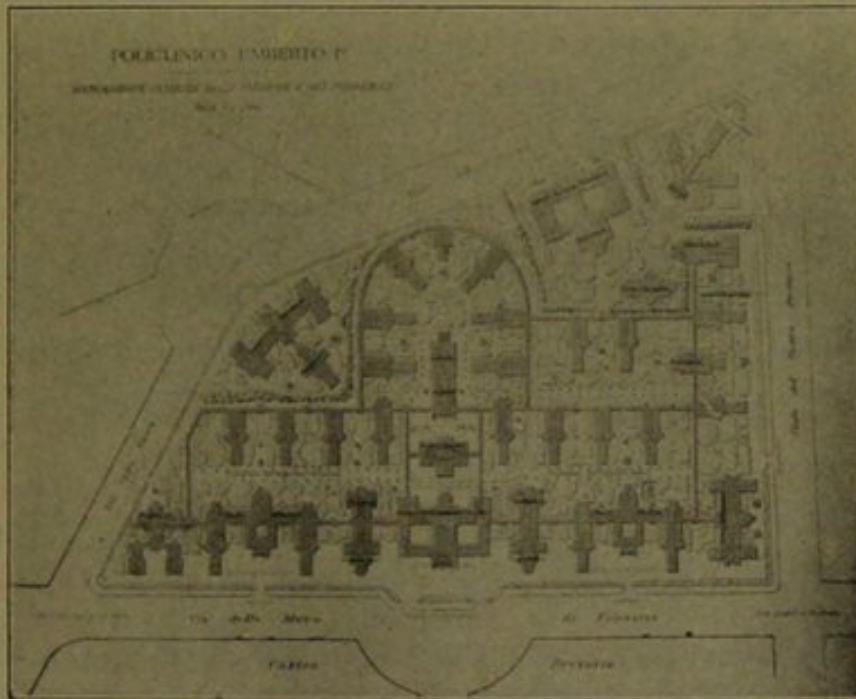


Fig. 2.—Ground plan of the Policlinico, Rome, showing pavilions, subways and connecting corridors. Front, center, administration. Front, right and left; medical, surgical and specialist services. Rear, left; gynecology and obstetrics. Rear, extreme right; isolation wards and, left of them, pathology. Center; power house, kitchen and bath house.

can obtain fresh air or exercise, and with that most pernicious of so-called "closed ventilation" systems, whereby air, cooked or roasted to 400 degrees Fahrenheit over superheated steam coils in the basement is supplied day and night at the uniform temperature of 70 degrees to the languishing patients in the wards above, where the windows are kept tightly closed from October to May, while the trained nurses are given theoretical lectures on "how to ventilate the sickroom!"

I have instanced the Moabit Hospital as illustrating amusing details. I saw there, for example, a large tank in the kitchen, where fish were kept alive to have them fresh for the patients; in the laundry was a separate rotary washing drum for almost every kind of article, the towels being washed together in one, the nightgowns in another, etc., and to each was attached a clock and automatic bell which rang to call attention when the clothing had been washed long enough. Adjoining the kitchen-maids' dormitory was a peculiar arrangement of plumbing in their lavatory, consisting of special traps to catch the loose hair when they washed their heads and prevent it from clogging the pipes, which was surely better than having it fall into the soup! There were also electric heaters for their curling irons. This hospital cures its own hams, and there were more than a ton on hand in cold storage. The hospital has a large therapeutic gymnasium, and in a schoolroom off the childrens' wards classes are held three times a week. The Moabit, which comprises forty-five separate buildings for all purposes, covers twenty-three acres, and was built for about \$2,500 per bed. The maintenance cost is only 80 cents per capita per diem.

PARIS HOSPITALS.

In Paris similar progress is being made in hospital construction, and hospital buildings are being erected from the standpoint of treatment. It is true that many of the older hospitals in Paris are both shabby and dirty, but the Assistance Publique has voted, within the past two years, \$9,000,000 for reconstruction,* and many new pavilions of admirable design are in process of erection. The Boucicaut (Figs. 6 and 7), a modern hospital of 250 beds, is built with one-story pavilions with arched ceilings and a solarium at the end of each ward. An underground passage is used for the service of all food and ward supplies from the central kitchen and store-rooms. The grounds are attractively laid out with inner courts adorned with trees and shrubs, and arbors with lounges and easy chairs accommodate many patients. This is one of the best types of modern hospital structure on the continent, and the administration cost is \$1.00 per capita per diem. Another example of advanced hospital construction in Paris is the Hôpital d'Enfants Trousseau with a bed capacity of 234 and covering nearly five acres.

Throughout this country there is at the present time extraordinary activity in hospital construction. A glance at the *National Hospital Record* for two consecutive months of the present year showed references to the projected erection of fifty-five hospitals, or large additions to existing hospitals, in all parts of the country. How important it is that these buildings should conform to the advanced practice of therapeutics and applied hygiene, which is the dominating idea in modern medicine, and yet how few of them do. There are notable exceptions, instance the new municipal hospital in Cincinnati, but in New York a large hospital was opened

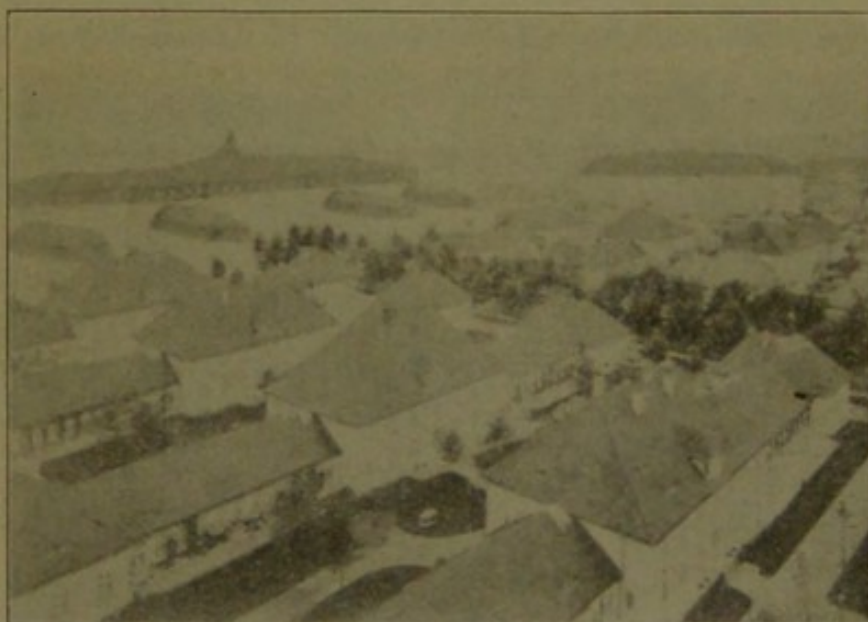


Fig. 3.—General view of the Virchow Hospital, Berlin, which was opened in 1906. Consists of 53 separate buildings, contains 1,650 beds and covers 68 acres. Showing the one-story pavilion connected by two-story service buildings. Large building in background with cupola, administration building.

within a year which, from the point of view under discussion, was fully thirty years old the day it was born.

I can not here enter into a full discussion of the relative merits of the many-storied single building, versus the low pavilion multiple unit type, which was the type of our cheap barrack hospitals in the war of the Secession and in the Cuban war, and which, curiously enough, gives rise to-day in Europe to the description of the prevailing type of pavilion structure as "the American type." The only valid arguments for the many-storied building or "sky-scraper" hospital are in the cheapness of ground cost and alleged facility of administration.

A few such hospitals of moderate size, say 200 beds, may be required in the heart of a densely populated city for the reception of emergency accident cases and such very acute diseases as pneumonia or cases of medical hemorrhage which do not bear transportation well. It is no doubt easier for the superintendent to step on an elevator and inspect a ward on the seventh floor than to walk to a distant pavilion and it will take him less time, but with a properly arranged unit system each one- or two-story pavilion is made so far independent that only a few of the higher hospital officials who are not duplicated in a hospital are inconvenienced.

The cheaper ground cost of the "sky-scraper" is offset by the much cheaper construction of the low pavilion,

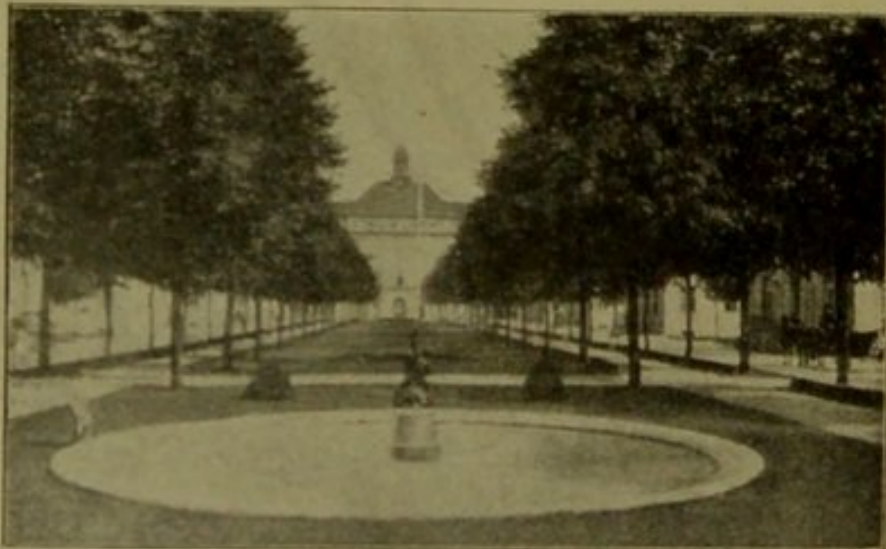


Fig. 4.—Central avenue of the Virchow Hospital, Berlin, showing trees planted before buildings were begun. Administration building in center.

which needs no heavy foundations, fewer iron girders and elevators, and much less complicated machinery to run it. The superiority of the multiple pavilion plan is the very great advantage that the units need not be all constructed at once, and that they can be changed in form to meet advances in medical treatment. New units may be added whenever the population increase demands them: they have only to be connected to the central power house by a subway and with the administration building by a corridor. Pavilions temporarily not needed may be closed or placed out of circuit. Hence the initial cheaper building cost of the pavilion may be made to offset their greater ground cost, and if the pavilions be placed where they should be—near the out-

skirts of a city, where good air and light and quiet are obtainable—the land need not be too costly.

It is most unscientific to plan the location of modern hospitals in large cities on the basis of population density solely, i. e., to place large hospitals where the crowding is greatest. A few ambulance emergency stations of a half dozen beds, a few moderate sized hospitals (not above 200 beds) to receive emergency cases in the center of the city, and then a large pavilion hospital for treatment in the suburbs, with perhaps a convalescent home hard by—this should be the broad scheme for hospital development in large cities. The unique advantages which the pavilion unit type of buildings offers are difficult if not impossible to secure in the multistory type, where ground area must be greatly

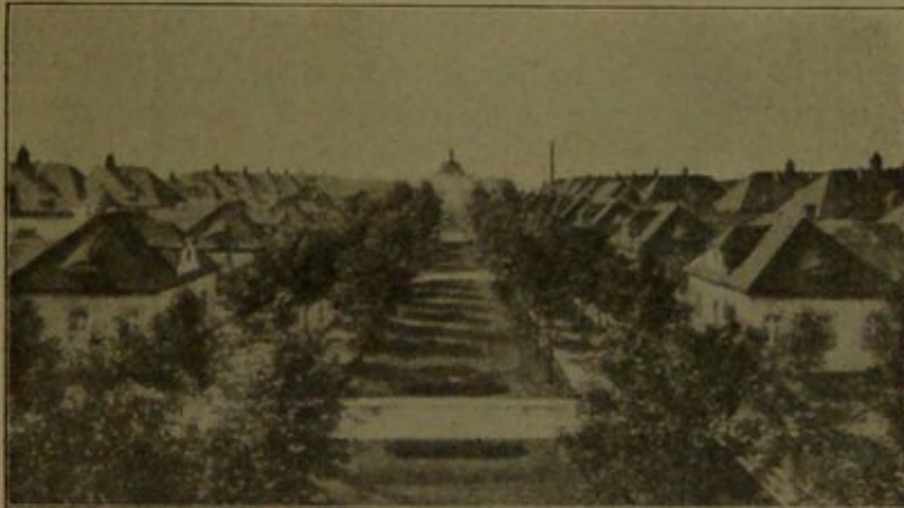


Fig. 5.—Virchow Hospital, Berlin. Central avenue leading to administration building and flanked by pairs of one-story pavilions, each pair joined by a two-story ward service structure.

restricted. Such are: The numerous small wards, day rooms, ease of access to the hospital grounds, and unrestricted space for the various hygienic accessories described above.

Following are the conclusions formulated to emphasize the dictum that the modern hospital should be adapted in structure throughout as an all-important factor in the *treatment* of the patients.

1. *Small Wards*.—In addition to the ordinary wards of medium size there should be numerous rooms to hold from one to four patients, to admit classification, according to their special needs as to air, light, temperature, quiet, etc.

2. *Day Rooms.*—These should be furnished for all such patients as are able to be out of bed, where they may obtain change, diversion, receive their visitors, and while themselves removed from the depressing influences of constant association with the very ill or dying, leave the latter in greater quiet and with better air to breathe. The three important therapeutic influences of repose or quiet, regulated exercise, and change of scene and air, are usually ignored in our general hospitals and regarded as luxuries of the rich to whom they are constantly recommended. It is taught that typhoid fever and pneumonia patients should be left in absolute quiet, but the common practice is to place them in a ward with twenty-four other patients facing a glare of white light, with nurses constantly passing to and fro, and then during visiting hours to admit an average of two visitors to each patient, or fifty outsiders in all, who talk and move about and pollute the air. In a ward with twenty visitors sitting for an hour, with four nurses and two doctors in addition, I found through analyses made for me by Dr. C. G. L. Wolf that the carbon dioxid contents of the air rose to 5.13 parts per 10,000 as against a normal of 4.06 parts in the fresh air outside. Why not let the convalescents step into a day room outside and receive their friends?

3. *Flat Roofs.*—Flat roofs fitted with a ward kitchen and lavatories, with wind shelters, are very important. As Walter B. James¹ says, the "hospital roof should hereafter be defined as 'the floor of the top story'." This is perhaps less important for the pavilion type of hospital and may be incompatible with arched ward ceilings, but it is an absolute essential for the many-story building, and the mansard roof should be forbidden absolutely. In winter especially there are many days when the roof can be cleared of snow, or when after a rain it will be much dryer and warmer than the ground and afford a suitable place for exercise, and in summer it catches breezes that may not be felt on the ground. With proper shelters or "lean-tos" and awnings the roof should be occupied by many patients every day in the year except in actual blizzards, as it now is at the Presbyterian Hospital and the Hospital for Ruptured and Crippled in New York, for example.

4. *Porches.*—Verandas accessible to every ward should be regarded as important as the wards themselves. They

do not darken the wards, if properly constructed, as proved at Bellevue Hospital, and, if necessary, a segment of glass flooring may be let in over the windows of the wards below. The communicating door sills should be low and the doors wide, so that the patients' beds may be wheeled out easily. The balconies, like the roof, should be furnished with screens and awnings and placed with due regard to sun and with wind exposure, so that they may be in use the year round. I have kept pneumonia patients out on such balconies at Bellevue Hospital when the weather was so cold that

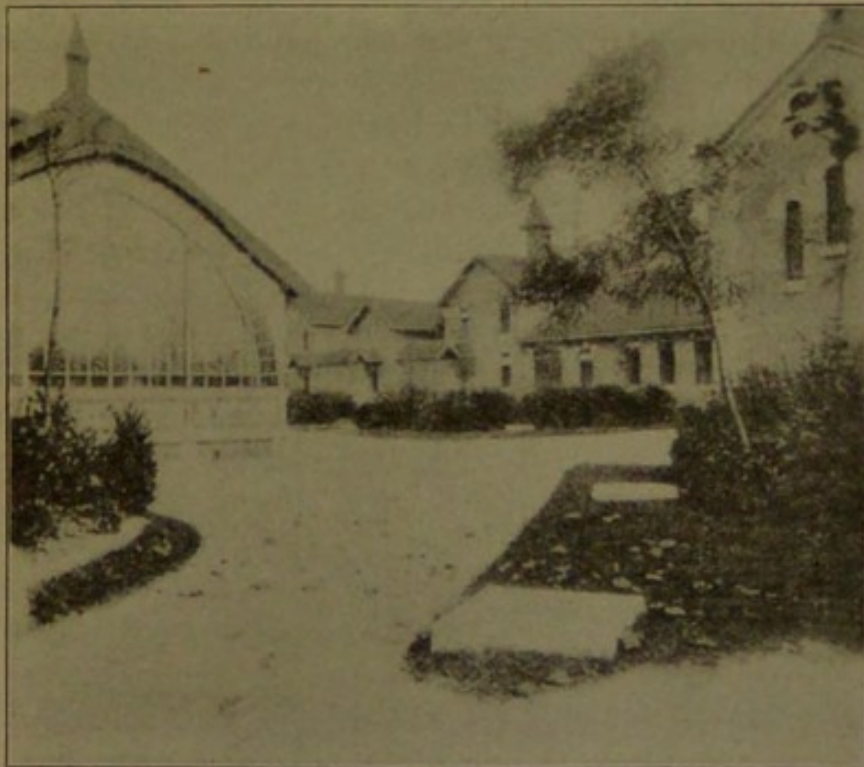


Fig. 6.—Bouicaut Hospital. Paris, showing one-story pavillons with two-story service buildings. To left, glass solarium at end of ward. Erected 1898, covers 6 acres, contains 250 beds. Pavillons are connected by a service subway.

their sputum froze in the cups, and it is always interesting to see how the fresh outdoor air lessens delirium, dyspnea and cyanosis in such cases and promotes sleep. It is the constant testimony of the nurses that delirious patients of every sort when placed in the open air require much less "nursing," for they become so much quieter and more comfortable than they are in the wards, where every breath of air they inhale has surely been at least once, if not a dozen times, in the lungs of some one else.

5. *The Compass*.—The first thing to do in locating a new hospital is to study the points of the compass.

The building is usually placed square with the lot in this country, whereas it should be placed with reference to the incidence of the sun's rays during the longest and shortest days, and also with regard to the prevailing winds, in order that the wards as well as the balconies may be correctly situated. I recently saw plans for a large suburban hospital on which the architect had not even placed the points of the compass, although the building was to stand in a lot of several acres.

6. *Ward Ventilation*.—Unquestionably the best type of ward window is the French casement opening outward, with a horizontal transom above. This type of window, which prevails in all the modern foreign hospitals, presents the following advantages: Either half may be opened, according to the direction of the wind, and when partially open there is less draft than from the sash window; the upper transom admits of additional air control, especially at night. The casement is less heavy to handle and easier to adjust than the sash, and it may be cut down to the floor in certain places to give exit to the balconies, the patients' beds being lifted by means of a special low truck. I have seen patients thus moved outdoors without awakening them. The ward windows should be planned with special reference to these needs, rather than exclusively for their appearance from the outside, as is usually the case, and it is by no means necessary that they should all be of identical size and shape.

7. *Light*.—All windows should be furnished with dark green shades, so that when needed the very ill may have the restfulness of tempered light, rather than the staring white glare to which all are usually subjected, irrespective of their condition. Similarly the wards should be tinted of an agreeable shade of green or blue, which is more restful to the eyes of those who have nothing else to gaze on all day. This has been recently done in several of the New York hospitals with marked improvement over the previous glaring white, and it is common in the foreign hospitals.

8. *Heating*.—The best method of ward heating in the changing American climates is by steam or hot water radiators in the wards, placed near certain of the windows. All hot air systems are open to the serious objection that in order to deliver the air through long conduits to the wards hot enough it has inevitably been

previously superheated, often to 300 or 400 degrees Fahrenheit. Roasted air has lost some mysterious property which, for lack of better term, is called "vitality." Cooked air will sustain life, and so will sterilized milk and canned foods, but, as Walter James has said, "there is nothing uplifting about it," and it certainly will not cure anemia. This is not mere theory, but is borne out by extensive practical experience in various hospital wards. Whatever heating system be adopted there should always be at least one accessible heater for each ward, preferably an open fire, where in exceptional

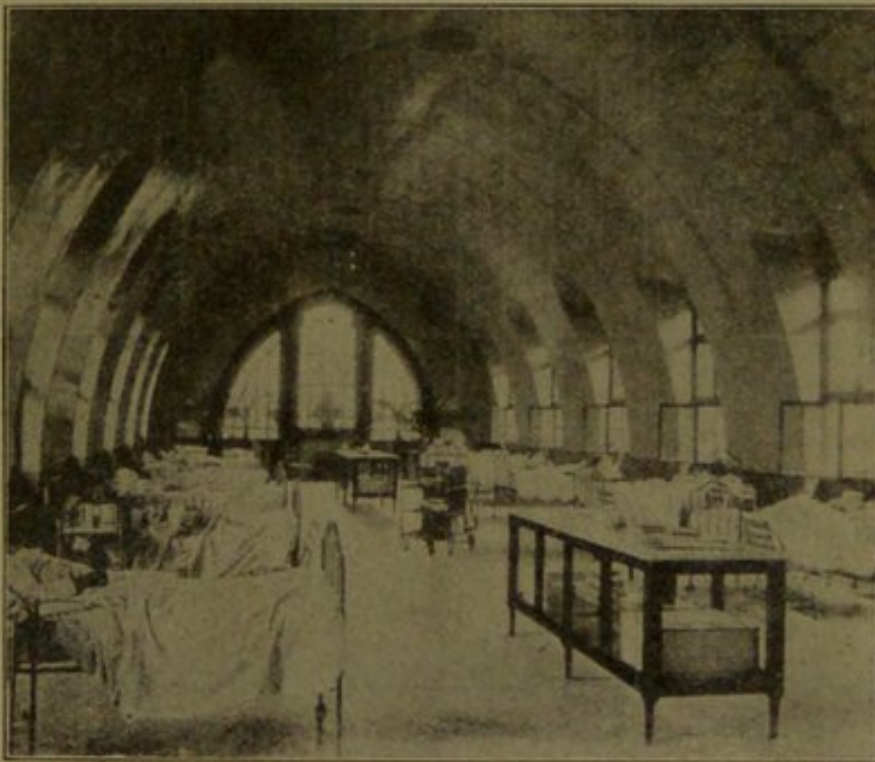


Fig. 7.—Interior of one-story pavilion ward at the Boucicaut Hospital, showing arched ceiling, casement windows, solarium, etc.

weather the feeble may secure the comfort of direct heat radiation.

9. Rooms for hydrotherapy, thermotherapy and mechanical appliances for exercise should be provided, like those described above as existing in the foreign hospitals. There are many patients in a general hospital service who can inadequately be treated, if improved at all, by medicines alone. Such, for example, are cases of chronic gout and rheumatism, muscular rheumatism, neurasthenia, all manner of chronic joint diseases, many diseases of the nerves and muscles, paralyses, insomnia, certain surgical conditions, digestive disorders, etc., but

such cases may be benefited greatly by non-medicinal treatment, for which adequate provision should be made in the structure of the hospital buildings.

Inhalation rooms should be provided for the treatment of a variety of respiratory system diseases, such as laryngitis, chronic or acute bronchitis, asthma, etc., which are slow to improve in the general ward air, without any form of local treatment.

SUMMARY.

Modern hospital buildings should be adapted as essential factors in the *treatment* of the patients, which can no longer be conducted to the best advantage in large wards alone, but which implies the use of many accessories, and especially the adaptation of environment, so that "in treating the disease" one may "not omit to treat the man."

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