cannot but be detrimental to that fluid; and here it seems reasonable to believe that advantage should accrue from stimulating the sluggish excretory organs, the skin and kidneys to increased functional activity.

I believe however that, though we may certainly in a large number of these cases prevent danger by anticipating it, and relieve symptoms and complications when they arise, and thus benefit our patients most importantly and save life, we as certainly do not possess the power of cutting short or curing these diseases. Some of them, glanders and hydrophobia, never have been recovered from under any kind of treatment. Some of them, such as whooping-cough, always have a lengthened career; others, such as mumps, a very short one, whatever the remedial measures which may have been employed to combat them. And as regards the other affections belonging to this class, there is no doubt that in the large majority of cases they run their course, as to duration and stages, quite unembarrassed by the obstacles which our puny efforts endeavour to put in their way.

[To be concluded.]

ON

A NEW MODE OF HOSPITAL CONSTRUCTION.*

By HENRY GREENWAY, M.R.C.S., Plymouth.

MANY will remember the able address "On the Construction of Hospitals", delivered by Captain Galton at our annual meeting at Leeds, in 1869, and the interesting discussion thereon. Having myself been present on that occasion—and I am thankful I was, for more than one reason, as I had the good fortune to be introduced to distinguished men who have since passed away (I refer to Sir James Y. Simpson and Mr. Nunneley)—I was much impressed with the subject, and was led to devise a plan whereby I hoped to secure the advantages of a large hospital without its dangers, and the safety of the hut system without its inconveniences. In the *Medical Times and Gazette*, September 24th, 1870, I gave a short description of my design, which has since been variously criticised. Among those outside the profession who have favoured me with their comments, I have the honour to include Miss Nightingale, who has bestowed much time and thought on the subject of hospital construction, and to whom I would here beg to express my indebtedness. I have now the pleasure of bringing my plan before your notice in an improved form, and trust that it may meet with your approval.

The portion of the hospital allotted to patients consists of one or more substantial plain masonry buildings, not more than two stories high, and of any required length, according to the number of beds. The floor of each flat or story is to be waterproof. I first proposed glass and iron as suitable materials; and I would now also suggest glazed tiles, or wood covered with best Vieille Montagne zinc, or with sheet-lead, if there were no objections against the use of that metal, as it would also afford a very dead sound when walked on. Within each story, and extending nearly from end to end, is a block of compartments made of glass, fixed in iron framework. The block is divided longitudinally by a central glass partition, thus forming two rows of compartments, placed back to back, each compartment being 10 feet square, 12 feet high in front, and 17 feet at the back (the central partition), thus causing its ceiling to be on an incline. The space on each side of the flat, between the fronts of these compartments and the main wall, forms a corridor, 7 feet wide, its ceiling being likewise of glass. Into these corridors the compartments open. Each compartment receives its supply of air from a large tube which passes through the masonry wall, then across and underneath the corridor and the compartment; the air issuing from the floor of the latter through a long iron grating, which may run either transversely or from before backwards. This tube will be furnished with a valve to prevent excessive draught from high winds. The tops of the double row of compartments unite to form a flat ridge, two feet wide. From this ridge, over each transverse pair of compartments, rises a flue, made of metal or of glass, in iron framework, which leads from the interior of the compartments to the outside of the roof. To prevent the possibility of foul air passing from the top of one compartment into the other, the flue is divided longitudinally by a partition, so as to form two flues; the area of each (beneath the roof) being 4 feet by 9 inches, the partition being continuous with the back wall of the compartments. Through these flues the outlet of foul air takes place. In order to insure an upward draught from the floors of the compartments, the air within the flues will be heated by a hot-water appliance in one of two ways: 1. By

placing around the flue, a short distance above the ridge of the compartments, a "jacket" (part of a system which would extend underneath the roof over all the compartments); or 2. By passing a pipe, having an oval bore, through the flues, dividing the partition horizontally, the pipe itself thus forming a part of the partition, as seen in Fig. 1. The latter plan is more simple, and would prove more efficient. In the main wall there is a large sash-window opposite each compartment, which gives light to the corridor and compartment. Outside each window is a small balcony for conducting window-gardening. On each side of the door of the compartment is fixed a pleasing transparency, such as a landscape. The corridors can be subdivided by a series of self-closing glass doors, so as to form ante-rooms to the compartments. A proper temperature will be maintained by means of hot-water pipes; the water being heated by a gas-furnace, or by asbestos rendered incandescent in a gas-furnace, thus insuring a constant supply of heat, easily regulated. The compartments will be illuminated at night by transmitted light from the corridors. At each end of the flat are placed the usual "ward-offices", and they are separated from the patients' compartments by a transverse corridor, which unites the side corridors. Doors furnished with springs are placed in the passages leading to the bath-rooms, etc., to prevent effluvia entering the corridors. The nurses' rooms are so placed that the nurse may be able to see the patients through either row of transparent compartments; and if a patient on any emergency require the nurse's attendance, by pulling a string he would ring a bell and at the same time cause a signal to project from the front of the compartment, thus directing the nurse to the proper quarter. As the "ward-offices" extend not only across the ends of the flats, but project on each side of the building, the ground-plan of this portion of the hospital would somewhat resemble the letter I. The roof of the building to be of the ordinary kind, but furnished with skylights. The expense of such a building of one story for twenty beds has been estimated by an able Plymouth architect (Mr. James Hine, F.R.I.B.A.) at about £3,000, or £150 a bed.

In the opinion of our best authorities, one-story hospitals are the most desirable, and no hospital should be more than two stories high. I have made no allusion to administrative buildings, as they may be carried out according to taste. I have also abstained from entering into certain matters of detail.

The drawings here exhibited are from the office of Mr. Hine (the engravings are reduced copies). The first is that of a transverse section of a one-story building, or of the upper of two stories; the second is a plan of a story with twenty compartments (ten in each row), and offices at each end. The corridor on one side is shown subdivided into ante-rooms, the folding-doors being shut. If a building were constructed for a much longer block of compartments on one flat, then the block should be intersected by a cross passage, for the sake of convenience. The plan represents the building as isolated; but it would be connected with the administrative, and, if necessary, other detached portions of the hospital, by means of corridors or covered bridges.

The following are some of the advantages gained by the above plan, and they have been considered unattainable by any other at present in existence. Each patient has the enjoyment of his own special supply of atmospheric air, uncontaminated by exhalations from his neighbour; the supply is also being constantly renewed; the compartments being made of glass, no absorption of morbid product, or of emanations which may eventually become injurious (I refer to those particles which produce the well-known odour peculiar even to our best surgical wards)—no absorption, I say, can take place in their walls, and, by occasionally washing them with water, they will for ever retain their purity. There will be no danger on the score of fire. As the patient lies in his bed, he sees not only the transparencies, but can look through his glass door and across the corridor at the little garden outside the window. He has also the advantage of an apartment to himself, thus avoiding the unpleasantness often felt in associating with strangers, whose company may possibly be deemed undesirable; also, he would not be so shocked by deaths occurring around him. Although thus isolated, he would not feel lonely, as he would see those around him, and, with a moderate amount of voice, could, if he were inclined, converse with his neighbour. The patient, although plentifully supplied with air, is not exposed to a draught, as the under surface of the bed acts as a screen. Patients not confined to their beds, and having no infection, may be allowed to associate and take their meals in the corridors during the day. The medical attendant or nurse, before entering the compartment of an infected patient, would see that the doors in that portion of the corridor immediately adjoining were closed. Any escape of infected air would then pass out through the open sash-window, and not be distributed through the whole corridor. If occasion required, as in the event of a patient fainting, an extra supply of air could be gained by throwing open the compartment door and the sash-window, the corridor

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Fig. 1.—Transverse Section.

Fig. 1 represents a transverse section of a one-story building through the middle of a pair of compartments.—A, A. Compartments, separated by a central partition, forming their back. The lower dotted portions of the upright lines forming the fronts of the compartments, signify doors. B, C. Side corridors. d, d. Inlet ventilating tubes, having a square bore. One of them joins at right angles the side of a trough, which is covered by a grating, e, in the floor of the compartment. The other tube is longer, and has no upper side, underneath the grating, f, in the floor of the compartment. g. Outlet ventilating flues, with hot-water pipe in the partition. h, h. Windows, with balconies projecting outside.

Fig. 2.—Plan of a story containing a block of twenty compartments, with offices at each end. n, n. Side corridor; the two rows of projecting points signifying door-jambs, the doors not being shown. c, c. Side corridor, subdivided by folding-doors (the dotted lines), so as to form ante-rooms to com-

partments. The dotted portions of the lines, forming the fronts of the compartments in the side corridors, signify doors. T, T. Transverse or end corridors, uniting the two side corridors. e, f. Gratings in the floors of the compartments, for the admission of air. i, i. Balconies and windows. k, k. Beds. [Similar letters in the two engravings refer to corresponding parts.]

doors remaining closed. Rules would be laid down as to the subdivision of the corridors during certain parts of the day.

It has been considered by Inspector-General Smart and other medical officers of large hospitals, that my plan of placing the compartments is far superior to the grouping them on the two sides of the area, leaving a central corridor. With a corridor between the fronts of the compartments and the main wall, the compartments are not exposed to extreme heat or cold, and those patients who are permitted to leave their beds have the advantage of a cheerful promenade or lounge. The greater portion of the glass to be used in the construction of the compartment will not be stouter than ordinary window-glass, and need not be transparent; but transparent glass, of good quality, should be employed in a small portion of their sides to enable the nurse to see through the range more distinctly. It has been said "that it is as difficult, *ceteris paribus*, to ventilate a cell with four angular corners as to ventilate a ward 100 feet long". This is true as regards side ventilation; but the same assertion would not hold good in my plan, where the height of the compartment far exceeds its area, the compartment itself becoming a kind of flue, the current of air passing from the floor to the ceiling. I acknowledge that every cubic foot of space is not in the line of draught, nor do I think it necessary; but I believe the air will be more or less in motion in every part of the compartment, as the ceiling is made to slope, the outlet flue being placed at the summit of the incline. The great hindrance to perfect up-draught ventilation is the horizontal ceiling. Supposing, however, that a current or draught of air were required in every part of a ward or cell, I think I could provide for such condition in the following manner. I should construct my room in the form of a circle, the wall and ceiling having much the appearance of a cylinder supporting an inverted funnel; the entire floor to be perforated for the admission of fresh air; and the neck of the funnel, above the room, to be furnished with a hot-water appliance. I fear the patients would complain of the excessive supply. At our meeting at Leeds, before referred to, there was a general feeling amongst the profession then present that, in the matter of ventilation, especially across a bed, it is possible to kill our patients with kindness, by producing pulmonary and other complaints.

As regards the oversight of the patients by the nurses, I should say that I propose, in addition to the means already mentioned, employing patrols, who would keep watch in the corridors during a stated period and then be relieved by others. The patients would also, to a certain extent, watch each other when awake. In cases of extreme illness, I have no doubt you would consider the constant presence of a nurse or friend at the bedside of the utmost importance, whether the patient be lodged in a hospital of the kind just described, or in an open ward, or in his own private dwelling.

Although the building just described is intended for the reception of all kinds of cases, I would venture to suggest the advisability of making additions of this character to existing hospitals, for the reception of infectious cases from the general wards, thus locating without intensifying infection—a condition which does not obtain in our fever hospitals. I would also advise the erection of such buildings for the upper and middle classes of society, so that infectious cases may be removed thither from private residences, and thus probably prevent the spread of infection in families—the patients to be treated by their own private medical attendants, and to be charged moderately for board and lodging, nurse, etc.

Various alterations or modifications of my plan might be suggested. If complete isolation were not required, a door might be placed in the back partition of each compartment, or this partition might be dispensed with altogether, thus converting the two rows of compartments into one row. Each section of the row would then accommodate two patients, and, if necessary, could be also ventilated from the window, the corridor door being closed. With this alteration, one corridor might possibly suffice. Instead of using water to convey heat through the building, a sort of paraffin oil might be heated and circulated through small pipes (J. A. Coffey's patent apparatus). By this means, high temperature can be gained with a small amount of fuel. Instead of the foul air being conveyed into the external air, the outlet-flues might be made to open into a tube which would lead to a fire or a highly heated flue, as carried out, I am informed, in some of our steamships. Not only would ventilation be thus insured, but infection be destroyed by heat. The position of the inlet ventilating tube might be altered, that the air may issue from each side of a compartment where the skirting would usually be placed. The side walls, or even the entire

building, with the exception of the roof, might be made of glass and iron framework, the portions substituted for masonry being of such colour as would prevent the admission of too much light.

I trust I have now said enough to show that my aim has been to prevent patients who are living under one roof becoming a source of injury and annoyance to each other, to benefit and please each individual, and to render the building itself as little a pest-house as possible.

In conclusion, I would beg to express the great pleasure it has afforded me in addressing the meeting now assembled, and presided over by a gentleman so distinguished for his labours in the department of public medicine.

A CASE OF MALIGNANT SMALL-POX: THE DIAGNOSIS MASKED BY REPORTED INJURY.

By G. G. GASCOYEN, F.R.C.S.,

Surgeon to St. Mary's and to the Lock Hospitals, etc.

THE following case is one of great interest. The symptoms presented by the patient are not only instructive as being those of malignant small-pox; but with the history of an accident to the loins from which the first urgent symptom dated, and which might possibly have accounted for at least some of the prominent symptoms which developed themselves, the case was rendered of rare interest from the further difficulty of diagnosis.

J. M., aged 23, a bricklayer's labourer, was admitted into St. Mary's Hospital, on Tuesday, April 9th. On the previous Saturday, whilst carrying a heavy bag of cement down some steps, he slipped, and was suddenly seized with severe pain in the loins, which compelled him to discontinue work. In the afternoon, however, he had recovered sufficiently to travel by railway to Harrow station, whence he walked to the town, a distance of one and a half miles. The next day he felt very unwell, and still had pain in the back, which was much increased by movement. On the 8th, being too ill to return to his work, he was brought to London in a cab. After reaching his home at Notting Hill, he experienced difficulty in passing urine, and noticed that it was scanty and coloured with blood; he passed a restless night, having a good deal of pain, and on Tuesday afternoon came to the hospital, walking part of the way. On admission, his chief complaint was of a very severe aching across the loins, and of pain over the lower part of the abdomen; but, except that he flinched on pressure, examination failed to detect anything abnormal in these regions. His aspect was anxious and expressive of suffering; his tongue was rather furred, and his pulse somewhat accelerated; his bowels had acted on the previous day, but he had not passed urine since the previous night. A catheter was introduced without difficulty, but no urine was found in the bladder. He was sent to bed, and hot fomentations applied to the loins. During the evening, he walked the length of the ward to the water-closet without assistance; he thought he passed a little urine there, but was not sure.

April 10th.—Although he did not sleep much, he had a quiet night, being nearly free from pain so long as he lay still, but the least movement brought it on again. He complained of pain when pressure was made over the loins. A catheter drew off a few drops of urine, which were tinged with blood. Pulse 82; temperature 101.4; tongue rather white. He took food fairly, eating some mutton for dinner. As the fomentations appeared to afford relief, they were continued; and a purge was ordered but not given, as the bowels acted four or five times violently in the evening.

April 11th.—During the early part of the night, he was uneasy and rather delirious, but became quieter towards the morning, although he slept little. His eyes were red and watery, his aspect heavy, and he seemed drowsy, but was easily roused. On examination, a number of small petechial spots were seen over the chest and abdomen; the forehead also presented signs of a coming eruption. About ten o'clock, blood suddenly spurted from his nose, and a severe attack of epistaxis lasted for half an hour or more, when it subsided into an oozing from the nostrils, and he continued to spit blood from the mouth. Temperature 101.6; pulse 94, feeble and small. In the afternoon, the patient was seen by me; and, finding him in a moribund condition from some very active disease unconnected with his asserted injury, I called in the assistance of Dr. Cheadle. At this time (2 P.M.), there was an eruption of minute red puncta on the forehead, which could just be felt with the finger; the eyelids were drooping, and the conjunctivæ suffused; the expression was dull and lethargic. Blood

was flowing slowly from the nostrils, and he was constantly spitting out the blood which evidently trickled backwards from the nose into the pharynx. There was no cough or vomiting. Pulse 94, very small and weak; temperature 101.6. Over the chest and abdomen were a number of small dark-red spots, distinctly purpuric in character, not raised above the level of the skin; a few were scattered also over the forearms and legs. On the left arm was one fair vaccination-mark of the size of a threepenny-piece—distinct, but not very perfectly marked—of old date. He was throwing his right arm about, and frequently rolling his head from side to side, muttering to himself; but, when spoken to, he became quiet and answered questions connectedly, giving an accurate account of his supposed injury and of what had occurred since; he soon tired, however, and began to wander, but after a little rest he again talked coherently. Although he had not passed urine since the night of the 8th, the bladder could not be felt, and the catheter brought away three or four drops only of blood-stained urine. He did not complain of pain in the back, and he had no vomiting or shivering. The stomach was distended with gas, but the abdomen was soft and compressible; he flinched a little when pressed between the umbilicus and pubes, but nothing abnormal could be detected here or elsewhere in the abdomen by hand or ear. There was a distinct mitral systolic *bruit*; the breath-sounds were marked by the gurgling of air through the blood in the pharynx, but they appeared to be natural. Dr. Cheadle expressed his opinion that the case was one of malignant specific fever, either hæmorrhagic small-pox or typhus, but most probably the former. As the patient was too ill to be removed from the hospital, he was placed in a separate room far away from the other wards. He was ordered ice to suck, brandy, and full doses of tincture of iron, if he could take them; but he was unable to swallow anything, and very rapidly became worse.

April 12th.—Insensibility set in during the early part of the evening, and he lost the use of his left side completely, but there was no paralysis of the facial muscles; he passed several bloody stools beneath him during the night. The bleeding from the nose and mouth had continued, though less copiously; and a small wound over the dorsum of the left great toe had been bleeding rather freely. The spots on the face had become hæmorrhagic, but were very small—not larger than a pin's head—and could only just be discerned with the finger. Those on the body were distinctly purpuric, and slightly larger, but not elevated. The pulse was very rapid, and scarcely to be felt; the extremities were cold. No change occurred in the symptoms; he remained in a comatose condition, and died at five in the afternoon.

To-day, it was ascertained from his mother that, although the man lived at Notting Hill, he was working at Limehouse, where small-pox was very prevalent; that he complained of aching in his back and did not seem well on April 4th, but that he took his breakfast and appeared to be better on April 6th, the day on which he believed he injured his back. He had not been vaccinated since infancy. None of his family, and, so far as she knew, none of the neighbours at Notting Hill, had had small-pox recently. He had always been a temperate man.

POST-MORTEM EXAMINATION, sixteen hours after death.—Rigor mortis was well established. The face was thickly studded with minute hæmorrhagic spots, which were less plentiful over the body, arms, and legs. When the body was opened, thin dark blood flowed freely, resembling bloody serum rather than blood; it also bubbled in quantity from the nose and mouth when the body was moved. Under the microscope, a careful examination of three specimens of the blood failed to discover a single white corpuscle; but the red did not seem to be altered, except that they were perhaps more transparent and less numerous than usual. Beneath both the visceral and parietal layers of the pleura, pericardium, and peritoneum, numerous small petechial patches were scattered. The heart contained thin, dark, fluid blood, but in each ventricle was a small white fibrinous clot. The mitral valve was thickened and contracted, as were the chordæ tendineæ and aortic valves; on the anterior flap of the mitral was an ulceration about the size of a threepenny piece, evidently of old standing, though still showing signs of increase, and perforated by two or three small holes. There was a considerable extravasation of blood in the posterior interventricular sulcus, beneath the pericardium. Over the lower part of both lungs were old pleuritic adhesions. The right lower lobe was in a state of consolidation, breaking down under firm digital pressure; the left was also solidified, but to a less extent; both upper lobes were much congested, though crepitant. The liver weighed four pounds and seven ounces; there was a thin film of recent lymph on the surface, in which were small specks of blood; its structure was paler and softer than usual, breaking down when firmly pressed by the fingers. The spleen contained large patches of blood, which rendered its substance so soft as to be indefinable. The kidneys were very large, weighing