SOME OBSERVATIONS

ON AN EPIDEMIC OF SMALLPOX.

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by

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ON AN EPIDEMIC OF SMALLPOX.

In the winter and spring of 1903-1904 there was in Greenock an Epidemic of Smallpox which smouldered in the heart of the town till the 9th of February 1904, when it suddenly took up the most alarming activity, testing and straining to the utmost the Hospital accomodation, the Medical Officer of Health, Sanitary Inspector, his office staff and the members of the Health Committee, only sinking to comparative mildness about the end of April, and not leaving the community till the 15th of July, when the last case was dismissed from Hospital and the building closed.

It is on this epidemic, and my experiences in it that I base the observations and remarks which follow.

I propose to give at first a very short sketch of the history of the epidemic, showing in chart form at what period the wave was greatest, and what steps were taken to treat those affected, and safeguard the unaffected. Then I shall describe the Smallpox Hospital at Craigieknowes, both the old and permanent

buildings and the new or temporary erections, mentioning their good and bad features, and what amount and kind of accommodation seemed to me to be required in a Smallpox Hospital. How cases were admitted; how their clothes were dealt with; how their friends were acquainted with their progress and the method of dismissal and of burial, will each be dealt with in their sequence. Coming then to the nature of the actual cases, the questions which will present themselves and be handled will be such as the social conditions of those affected, the probable source of infection, the nature of the onset or sickening, the number of says between the onset and the appearance of the eruption, and where the eruption made its first appearance. As points of less importance, but of some interest, I shall give statistics on how long cases remained at home, amongst their people after the appearance of the rash; and on the time taken by medical practitioners to make their diagnosis, counting the number of days either from the date of the appearance of the rash, where the medical attendant had been in attendance before its appearance, or from the date of his first seeing the case after the appearance of the eruption. I shall then go into the matter of the general characters of the eruptions I saw during my residence in the Hospital, their course, and method of "drying" and "cleaning"; into

our methods of treatment; into the question of the temperature in smallpox, complications and such like subjects. Notes on a few cases showing initial rashes will follow these. The question of splenic enlargement is one on which I made frequent and careful observations, and of these I shall give my finding. The discussion of unvaccinated cases, vaccinated cases, concurrent vaccination and variola, cases which had suffered from a previous attack of the smallpox, and of fatal cases, will next be taken up. After that I purpose giving some notes of peculiar and interesting cases, and in that way to bring to a close this thesis, which is written entirely on what I have personally seen, investigated, experienced, thought and done in the few months during which I acted as House Physician to the Greenock Smallpox Hospital, at Craigieknowes, under the late Dr James Wallace, who was at that time the Medical Officer of Health to the Burgh.

HISTORY OF THE EPIDEMIC.

The outbreak at present under consideration commenced on December 20th 1903, when the first case was notified to the authorities. The case occurred at a house in 21 Bearhope Street, where there were several lodgers, and the circumstances were these.

The first centre:

Joseph Gallachar, a man 22 years of age and a steeplejack by trade, had, in the course of his employment to work in Govan, Glasgow for a while. While there he lived in a common lodging house, and so mixed most intimately with a large number of the poor of that part of the city. Coming back to Greenock, he returned to his lodgings at 21 Bearhope Street, where he lived in a three-apartment house with four other adults and a child. In less than a fortnight after being in Govan he fell ill, suffering from sickness and vomiting and a pain in the back on December 15th. He was seen by a doctor who said he was suffering from measles and continued attending him for five days. In the meantime the child in the house - a baby, took a similar trouble, was concealed from the practitioner then visiting, and died. On the 6th day from the onset of Gallachar's illness,

the friends not being quite satisfied with the diagnosis of measles, called in another medical man, who at once suspected what was the true nature of the disease with which he had to deal, and sent for the Medical Officer of Health to see the case in consultation. His diagnosis was confirmed, the case notified to the Sanitary Officer, and removed that day - the 20th of December - to the Hospital in the extreme east end of Greenock at Craigieknowes.

This, then, was the first centre of infection in the Burgh, and an error in diagnosis was destined to kindle a conflagration, which, finding much susceptible and unprotected fuel, smouldered for a time and then blazed up and raged in the surrounding streets, spreading out gradually to the East end of the town, in its course disfiguring some and destroying a number.

All precautions were at once taken with this first case, the inmates removed to the Reception House in Crawford Street, and the house at 21 Bearhope Street cleaned and disinfected.

But the seed had been sown in another lodger in that house, a girl of 19 years, Lizzie McLauchlan by name, who developed the symptoms and signs of smallpox and was admitted to Hospital 13 days after the first case, on the 1st January 1904, and was kept

there although only a mild case, for a month, so anxious were the authorities to prevent any possibility of further spread.

The first case, Joseph Gallachar, was never vaccinated, and he was a confluent and very severe case, remaining in hospital till February 15th 1904, when, though suffering from that rough, warty condition of the nose and cheeks, so common a result in very severe cases, he was considered non-infectious and dismissed.

Lizzie McLauchlan, on the other hand, the second case admitted, was a very mild case, and showed two good primary vaccination marks on her right arm. She had been revaccinated at the time of the first notification, but it was unsuccessful.

Another centre:

A fortnight after the admission of the second case to hospital, another centre of danger in the town was discovered and reported to the Local Sanitary Authority on the 14th of January. In this instance a man, John White, a bank porter, aged 31, and his three little children, aged 4, 5 and 7 years, all living in a house of 3 apartments in which lived four adults and the three children, at 50 Cathcart Street, were removed to the hospital. This man and his family had been visiting in Glasgow on Christmas

Day, calling on some of their relations and friends and spending a night in the city. On the 6th of January some few spots came out on Rita, the little girl of 5 years; on the 10th the father found some spots upon himself, and on the next day, the 11th the other two children each presented a few spots of eruption. All cases were very mild, but there was no doubt as to the disease from which they were suffering. All of them had been vaccinated, and the father showed a slight revaccination mark which he said he had received fifteen years before.

A third centre:

Still another centre was established, and in this case too the infection was got in Glasgow. On January 18th Robert Riddick, 17 years of age, an apprentice plasterer, living at 81 Dempster Street, was reported to the Sanitary Office suffering from smallpox. Twelve days before notification he had been in Glasgow, and eight days thereafter he sickened, the eruption appearing on his face on the 17th - the third day after the onset. He was removed to hospital on the 19th. The house accommodation at home was good, there being two apartments for the three adults. He showed an indistinct vaccination mark on the right arm. He was covered with an

abundant eruption of large vesicles on admission, was a very severe case, and was detained in hospital for 42 days.

From these three centres the infection radiated, and, with probably occasional influxes of fresh infection from the city of Glasgow, spread first to the relations, friends and neighbours, then to the neighbouring streets till the epidemic assumed the most alarming character.

A couple of nurses had been engaged on the opening of the Hospital in December 1903, the one for day duty and the other for night. These continued to do the work of the hospital through January 1904, during which month the number of patients resident in hospital rose from 2 to 6 on the 14th, to 7 on the 19th and to 10 on the 26th, at which number it remained till the 8th of February, with the exception of one day, the 29th of January, when the number in hospital was 14. On the 8th of February the number of patients rose to 11, on the 9th to 17, on the 10th to 30, the 11th to 40, and to 53 on the 12th. On that day a third nurse was put on duty, and a House Physician advertised for. To this post I was appointed on the 13th and reaching Greenock late that night began duty in the wards the next morning, Sunday, the 14th of February. On that morning there

were 57 cases in the wards and many of them most seriously ill. There were only one day, and two night nurses, no temperature charts, no notes or records of patients, next to no ward instruments, emergency drugs, furniture or utensils - nothing, in fact but what had done for the one or two cases received in January; and the work to be done was more than twice what the staff could have got through. And still the cases poured in on us, while we had to arrange to accomodate them, provide for possible further increase in numbers, attend to the large numbers already on our hands, and collect some records of the cases admitted earlier. In a week, from being a couple of small wards with 11 patients, it had grown to a hospital of 69 patients, and in a fortnight we had to deal with 84 patients, with a daily large admission. It seemed as if we had been called upon to equip a fully organised hospital for the treatment of infectious disease, supplying beds and bedding, ward clothes, dishes, food, attendance, etc. etc. and at the same time to carry on the full routine of an established institution!

The staff was increased by another nurse on the 15th of February, when the numbers stood at 60, and by a fifth on the 18th when our numbers were 77. The Health Committee willingly supplied nurses as they were asked for; but on our side was the great

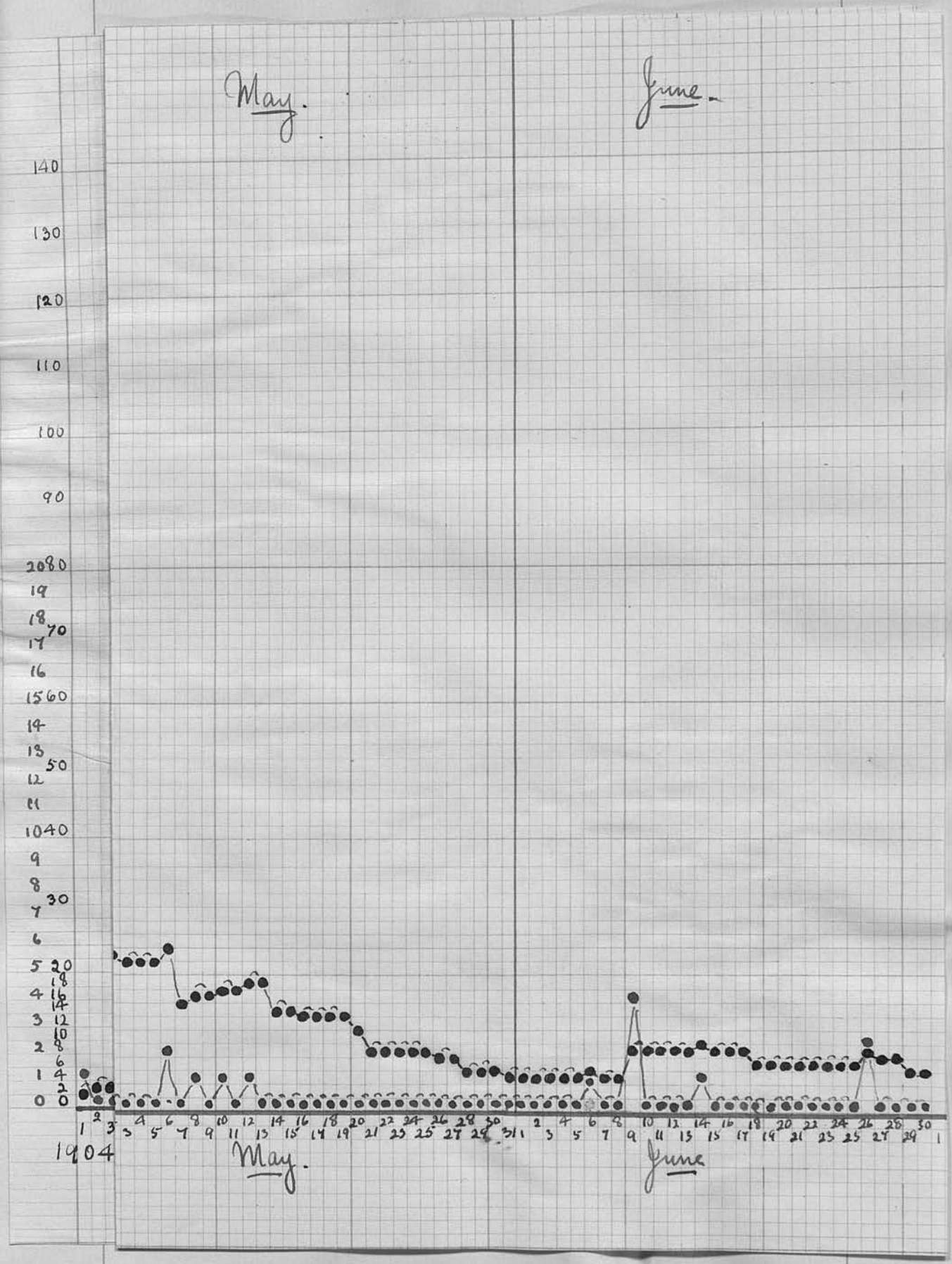
difficulty of providing accomodation even of the most meagre sort for the nurses we had. Eventually accomodation was got, and on March 1st, when the number of patients was 99, two other nurses were added to the staff, making it 7 in number. The total nursing staff was raised to 9 by the addition of one on March 13th and another on March 24th. This number I found sufficient for the Hospital, for, though it is true that for the last three weeks of March the number in residence varied between 120 and 130 and even above, it must not be forgotten that a large number of these were mild and convalescent cases, not only able to attend to themselves, but willing and anxious to assist in the ward work.

The accompanying chart gives in a graphic and striking form the rise and fall of the epidemic wave, as far as that was indicated by the number of cases resident in Hospital each night. This total number is indicated on the chart by black dots; and the sudden, great, and persistent rise beginning on the 9th of February and reaching its maximum of 136 on March 24th is well shown.

The red spots indicate the total number of the admissions per day, but in order to show more definitely and more strikingly the sudden increase of such admissions in February, and the continued activity

throughout February and March, becoming quieter in April, I have made the spacing per case wider, as in the scale to the left.

The greatest number of admissions on one day was 14, and this occurred on the 15th of March. On two days we admitted 13 per day, and on four days from 10 to 12. On the six days from February 8th to 13th inclusive, we received 47 cases, and the same number during the six days from February 27th to March 3rd inclusive - an average of almost 8.


May.
June.
140
130
120
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1904
May.
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New buildings.

In addition to increasing the staff and the number of beds etc. in the buildings already at our disposal, whose capacity was soon tried to the utmost, we had to quickly find more buildings to receive the overflow.

The convalescent ward.

The first building at hand which could be converted into a ward, thus saving time and expense, was the laundry connected with the building, which was soon converted into two small wards to be used for the convalescent patients. This building was ready to receive patients on February 15th and was quickly filled. (Ward D. on the Plan).

The first pavilion.

But even while it was being adapted it was seen that further and more ample accomodation must be provided at once, and that new temporary buildings would need to be put up. The recommendation that such a new structure be raised was passed by the Committee on the afternoon of February 12th. Immediately all the available machinery of the Office of Public Works was put in motion and that night the plans and specifications for a suitable building were in the hands of local contractors. The next day

their contracts were received and at eleven o'clock that night ground was broken for the first new pavilion, a plan and description of which will be given later on. By the morning of the 15th the ground was ready and the foundations laid by a gang of corporation labourers who had worked on through two nights and the intervening day, some of them being actually voluntarily on duty the whole time. The contracting builder, therefore, took up the work at 6 o'clock in the morning of February 15th and the building was occupied by patients on the night of March the 1st.

The second pavilion.

When this pavilion was finished the accomodation was found to be just sufficient, and therefore, seeing the epidemic was still growing, and no one could foresee to what it would grow, another one was planned and contracted for, as before, the building commencing on March 5th and coming to a completion on March 22nd.

The care of the unaffected.

While all this was being done for the treatment and accomodation of the affected, measures were being adopted outside to safeguard the unaffected. These do not come within the scope of my present paper, written as it is from the point of view of the House

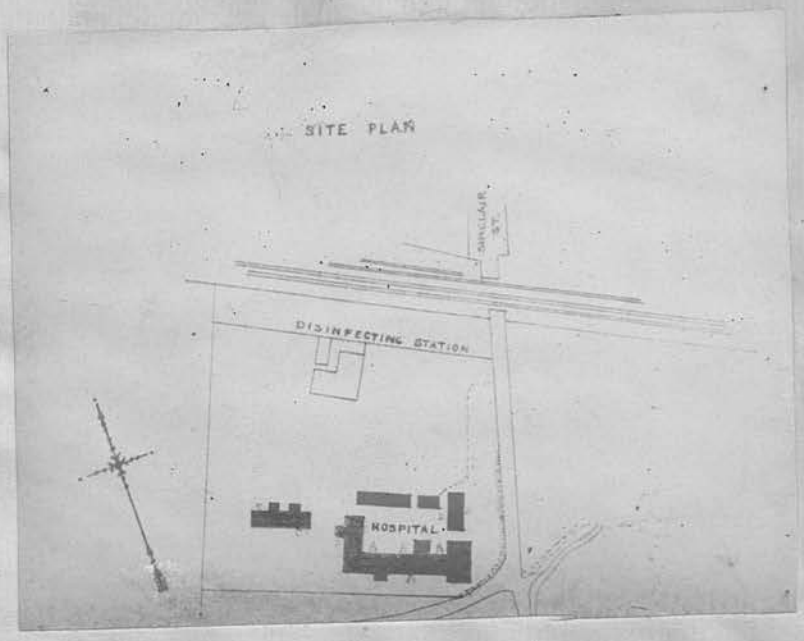
Physician, and not from that of the Medical Officer of Health, therefore I do no more than mention them. The sanitary staff was much increased. New assistant inspectors were appointed and all "contacts" carefully supervised and if necessary removed to the Reception House. More labourers on the sanitary staff were employed to carry out the flushing of closes and areas, the whitewashing of stairs, and disinfection of houses. Free vaccination and re-vaccination were offered to the public, advertised and urged by posters and newspaper notices, and that nothing might stand in the way of those requiring vaccination, an arrangement was made to make all medical practitioners for the time-being public vaccinators, the burgh paying for such vaccination at the rate of 1/6d per head.

On the 22nd of March Dr Geo. Robertson was appointed Assistant to the Medical Officer of Health, and it was part of his duty to still further urge vaccination by calling at public Works and other places, and arranging to vaccinate the employees at times most convenient to them. As the epidemic grew in March, the populace seemed to get scared, and before it reached its height, they were getting vaccinated in hundreds. It was after the public conscience

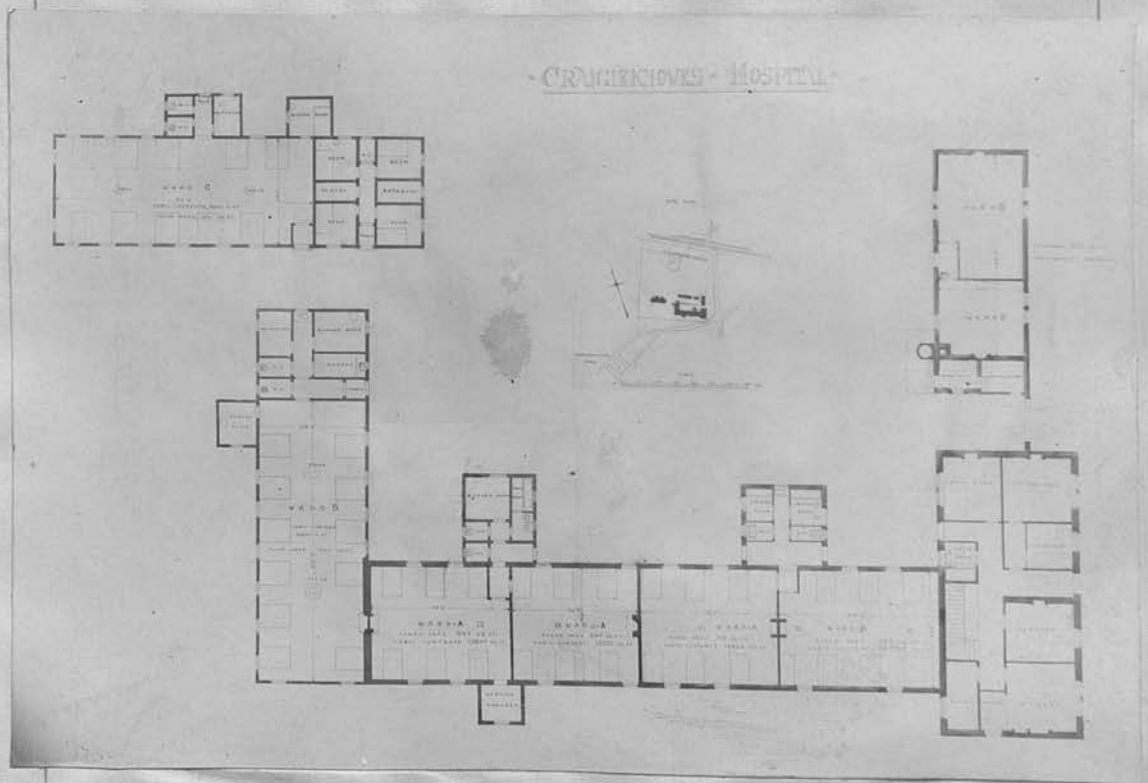
in relation to vaccination and revaccination had been thus roused, and responded to by this great burst of vaccination (whether post or propter hoc) that the decided decline in the incidence of the disease set in.

The hospital.

The hospital used to accomodate the victims of this epidemic was an old structure built during a Cholera epidemic about 33 years ago. It is situated in the far east of the burgh of Greenock in a very sparsely populated part, on a slight eminence to the south of, but near the Caledonian Railway line to Gourock, and between that and the same Company's line to Wemyss Bay, and the Glasgow and South Western Railway line to Greenock, both these latter lines being to the south of the hospital, but much further from it than the Gourock line which skirted the grounds.



(The plan above shows the true relations of the hospital buildings; that below does not.)



The buildings, before any alterations or construction were done, consisted of:-

1. A long simple story, brick-work building running in a direction from north-west to south-west, divided into four small wards (marked A in the plan).

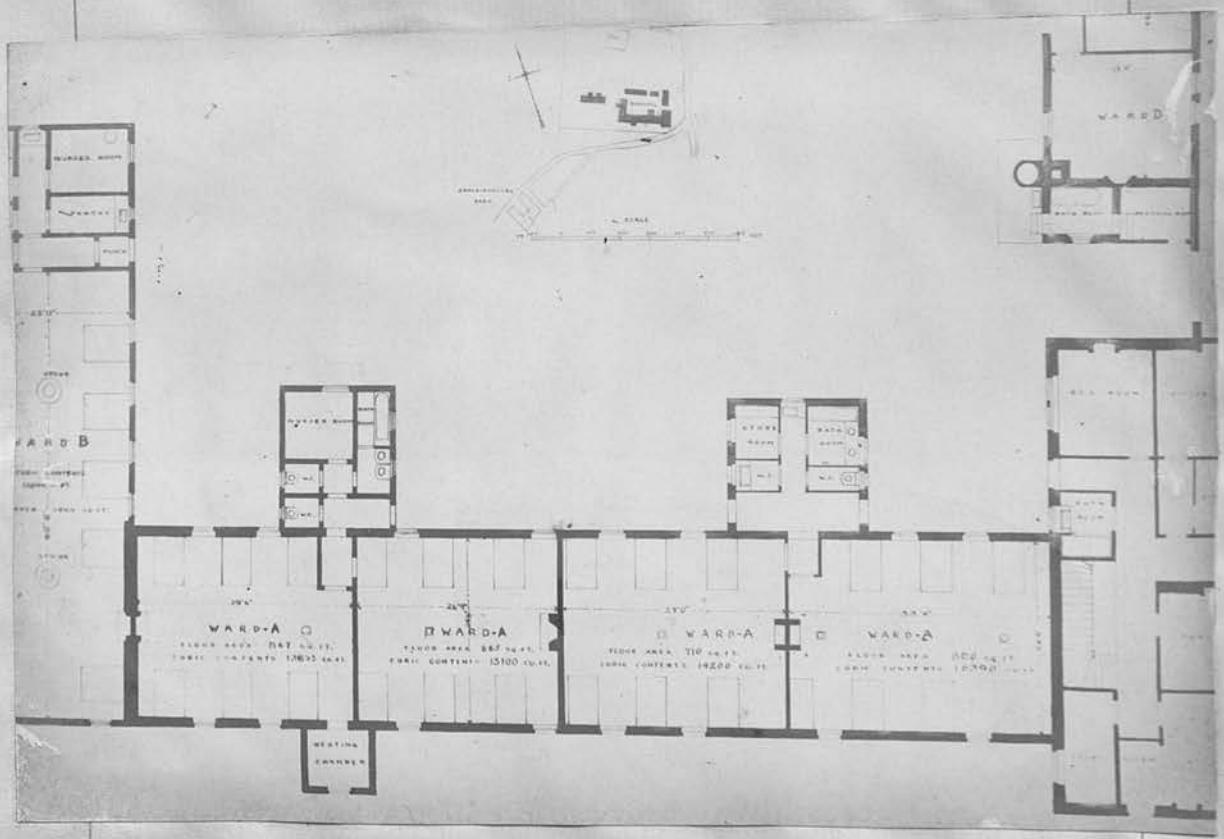
2. At the south-east end of this stood the house which had been originally built for an Administrative Block, but of which only a very small part was available for such purposes. This house was also built of brick and was a couple of stories in height. These two buildings formed the south-west boundaries of the court-yard of the hospital.

3. To the north-east the court was bounded by the Mortuary and Storehouses, wooden erections, of longstanding, and now condemned as unfit for use. There was no building to the north-west of this court at that time, but to the south-east there were:-

4. The laundry (the building which was converted into the convalescent ward) and between that and the Administration Block, the gateway.

Thus there was a court-yard unbounded by any building on the north-west side, so it was on this side naturally that the first new pavilion was built, (ward B. in the plan), a space being left between it and the mortuary buildings, sufficient to permit of

carts or wagons passing through. When the second pavilion came to be built, there was no site suitable except what was still further to the north-west behind the first, and approached by the passage-way described as left between the first pavilion and the mortuary.



The old buildings.

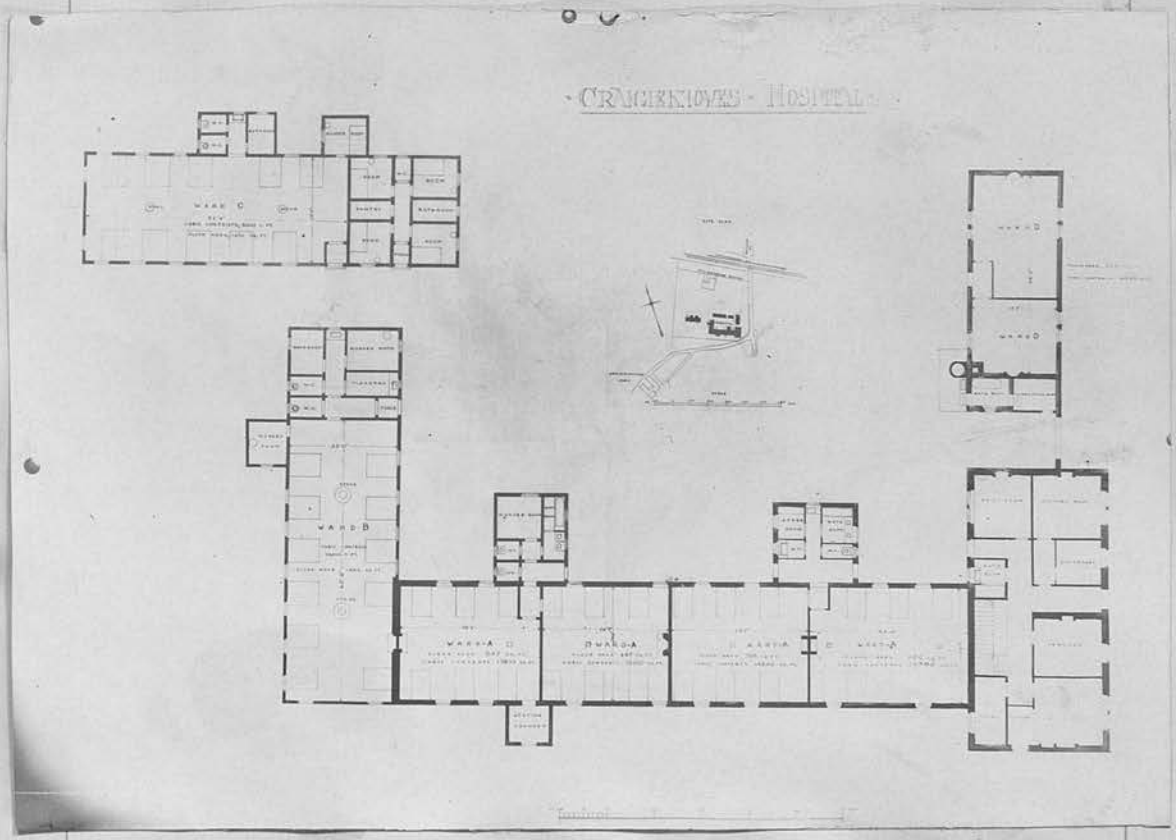
The four wards in the permanent block (A) were well built, capacious and easily ventilated by ventilators in the roof, which could be opened to any

degree required by an arrangement of ropes and pulleys worked from within. They were heated by low-pressure hot water pipes, and by open fires. The roof was high and arched so that the cubic content as compared with the floor area was large. The walls were about 18 to 19 feet in height. It was difficult to heat this great mass of air, and still more difficult to regulate the temperature. In fact this was a serious fault in these older buildings. It must be remembered that it is usually in the late winter months, and early months of spring that smallpox wards get congested, and every bed occupied. When a ward is thus taxed to its fullest there are bound to be many severe cases amongst its occupants. At one stage, the confluent and serious cases are very foul smelling, sending forth a sickening odour which is revolting even to the patients in the next beds, who though pretty ill, may not be just^so seriously affected. This requires that the air of the ward be frequently changed, and that at a time of the year when the temperature of the external air is very low. This fresh air must not be supplied in "draughts" to chill the skin surface of people suffering from a disease in which already the functions of the skin are^much embarrassed, and it must be quickly raised to the temperature of a sickroom where

delirious and restive sufferers are apt to cast the bedclothes from them and lie exposed to such changes of atmospheric temperature. In other words, the ventilation openings should as far as my experience goes, be small and numerous, so that the entering air is not admitted in one or two voluminous, cold and rapid rivers, but in many small and slow-flowing streams. This was done with conspicuous success in the buildings erected later on, and I had much greater comfort and pleasure in dealing with serious cases there. One case died of pneumonia and another of pulmonary gangrene, and a third of empyaema of the left pleura, all of these cases being in these older wards, and I had then, and have still an uncomfortable feeling that this difficulty in keeping the wards free from draughts and at an even temperature was partly to blame for these complications. So much did this feeling impress me that in each and every severe case after that, I took the precaution of having the chest protected, back and front at an early date in the course of the illness with a thick "Pneumonia Jacket" made of Gamgee Tissue.

I have said that these wards were heated from two sources, low pressure hot water pipes round the walls, and open fireplaces at one end of each ward. Both of these methods I feel I must condemn. My

objection to the hot water pipes is only occasioned by the way we used them and by the situation of the heating chamber; but the very same conditions are as likely to attend their use elsewhere, and while there are easier and more efficient methods, it is unnecessary to defend this.



As is shown in the plan the heating chamber was situated round on the south face of the permanent building, and was evidently primarily intended to be entered through a door from the most north-westerly

of the wards. Seemingly a subsequent alteration had been made, this communication with the ward was cut off and an outside door made in the north-west wall of the chamber itself. Thus it was only accessible to those in the wards if they left the ward by the ward-door which opens on to the court-yard and walked entirely round the first new pavilion, thus reaching the back of the old hospital. During the day this was no difficulty for the fireman at the Disinfecting Station, which is in the same grounds with the hospital, attended to the furnace at regular intervals. But this man stopped work at about six o'clock in the evening, and we had no night porter. Now, no matter how full the furnace was filled and how damped down to burn slowly and last long, it invariably spent itself by two or three in the morning, and in an hour or two the four old fireplaces in the wards were quite unable to furnish the heat required for 57,585 cubic feet of air, in the chill of a winter morning. When I learned of this, I made it a practice to stoke up this furnace myself to its fullest, as the last thing I did before going to bed. Even this did not always suffice to keep the fire alight till the morning, it being quite customary for the attendant to require to kindle it again with wood on

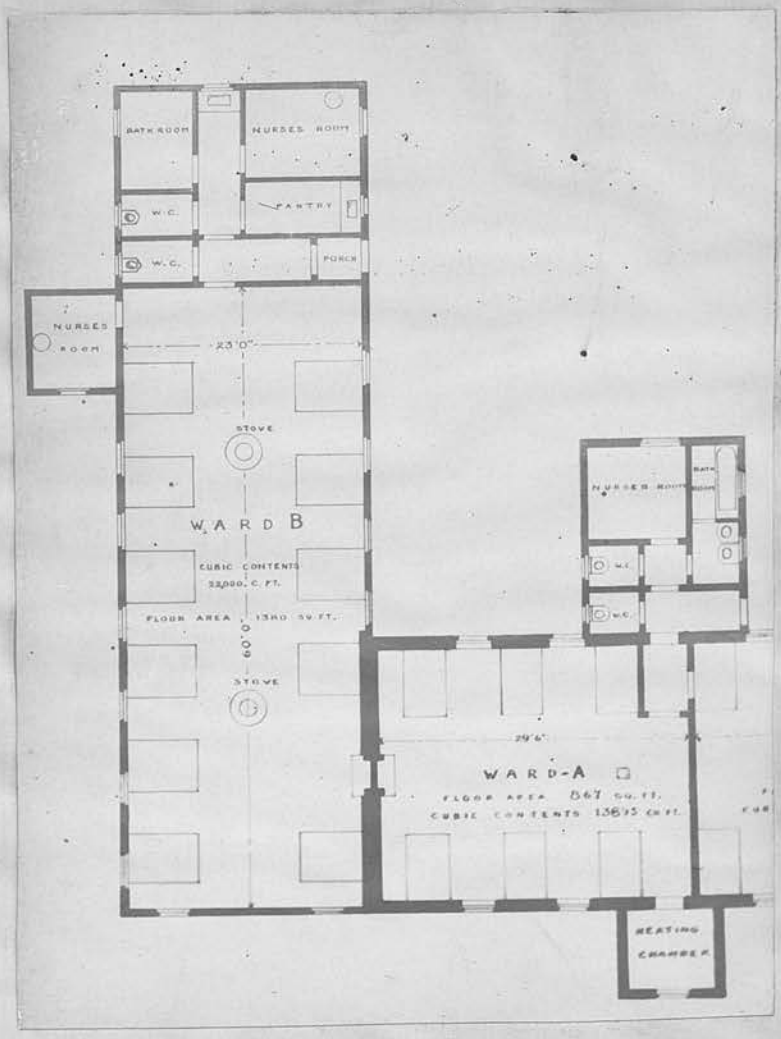
arriving at the hospital to begin his day's work. Even if they could have got over their fear to go round in the middle of a dark night to the back and lonely parts of a hospital situated practically in the country, it was obviously inadvisable to ask the nurses to leave wards, where delirious and serious cases were lying, and absent themselves for 10 to 15 minutes in attending to a furnace. Thus unless it can be attended to both night and day at regular intervals, the low pressure hot-water-pipe system of heating the wards is condemned.

The fires in the wards were objectionable for these reasons. They were old fashioned, consumed a lot of coal and radiated only a small fraction of their heat into the ward. They were too few in number and again were placed only at one end of each ward, and were built into the wall. Thus they gave off heat only from one aspect, radiating none from their backs or sides, and what benefits they did bestow were showered on the fortunate few who happened to lie at that end of the ward, and seldom dispersed to the less fortunate occupants of the beds at the further end.

A much more economical, more efficient and easier heating arrangement was made in the new build-

ings, where slow combustion heating stoves were introduced. I shall refer to these later on.

Another weak point about our older buildings was the fact that we had only one isolation room and this was so situated that the isolation was only nominal. It was the room marked "Nurses Room" in the plan, and situated in the north-west corner of the small building projecting into the court from the wall of the permanent building opposite to that to which the Heating Chamber is affixed. It will be at once seen on looking at this plan how nominal is the isolation, seeing that the occupant must use the same bathroom and W.C. with the smallpox patients, must meet them in the passages, and breathe the infection laden air coming from the door of the ward. To carry out efficient isolation and observation, such small wards should be built quite apart in the grounds and have their own bathroom and water closet system. We found it very frequently necessary to isolate doubtful cases or cases showing only an initial rash, until they should undoubtedly declare themselves. The facilities for this were much too small in the old buildings, and in the new buildings were quite unsuitable as I shall explain later.



The new pavilions:

(Ward B.)

New Pavilion No.I. was affixed to the gable of the permanent Hospital at the other end from the Administration Block, and bounded the Hospital court-yard on its north-west side. It was a wooden structure built on a foundation of brick piers and cement. The whole ground area beneath the building was covered with a layer of cement and stones below, and tar and stones above. This, no doubt, made an

excellent damp-proof foundation, but the risk to the helpless patients laying over it in case of fire was immense.

The walls were built of a frame work of thick wooden uprights and these were covered with three layers of material. To the outside of both walls and roof was galvanised iron. To the inside was common plank lining, covered with a layer of varnish, again a danger in case of fire. Between these two layers there hung a curtain of felt which was carried beneath the floor and over the roof. The ward was lighted during the day by frequent windows and at night by gas. The temperature was regulated by two slow-combustion stoves in the centre of the ward and by small gas stoves in the small rooms. These slow-combustion stoves stood in wide iron trays on the wooden floor, yet never gave cause for any anxiety as to fire, as any live coal falling out was immediately received by the surrounding tray. These stoves are fed from the top and the smoke and hot gases are not permitted to escape at once into the chimney and so to the outside air, but are made to circulate through passages and chambers between the central fire-chamber and the outer wall of the stone. Again they can be easily regulated. Close the top and open the bottom and the air must traverse the whole coal surface on

its way to the chimney; close the bottom and open the top, and the entering air but licks the surface of the hot fuel reducing the amount of combustion to a minimum. They were a great improvement upon the open fireplaces in the walls of the old buildings, and those patients,who had been transferred from these old wards to the new,greatly appreciated the uniformity of temperature.

The ward was ventilated by a small opening above every window, each of which could be opened or partially closed to any degree by a sliding shutter. This method we found sufficient, and there were now no complaints of draughts, and we had a great deal less anxiety and much more comfort in treating cases dangerously ill.

There is a wall fireplace shown in the plan of this ward and there are central stoves shown in the plan of the old wards; these were planned by the architects, but never carried out by the builders.

Entering from the main ward will be seen in the plan a small room marked "Nurses Room", and this we found a very useful apartment. In such a room can be placed a patient who, though affected with the common disease, lives in a social plane so much above those in the ward as to make it most painful to them to require to occupy one of the ward beds, and be ex-

posed to the publicity of ordinary ward life. Those who have charge of smallpox wards will find that such rooms are wanted, and we could have done with more such accomodation than we had. The advantages of this room were that it opened off the common ward, permitting of the patient being easily attended to by the nurse, and of his being able to call her through the open door, besides allowing him to hear the life and frolic of the other patients, thus lessening his feeling of isolation and monotony. While these were advantages for such a patient, they were obviously great disadvantages in a case where the diagnosis was doubtful and an effort was being made at complete isolation.

The remainder of this building was made up of accomodation for water closets, bathroom, pantry, scullery, nurses room and entrance lobby. I regret that I must continue to find fault with these arrangements, yet it is only by the experiences of those who use the buildings that these faults can be found and pointed out to those who design and build them.

Taking these apartments in their natural order; on entering by the outer door, one found an excellently arranged porch which on wet and windy days allowed one to enter the building and close the outside door before opening the inner, thus shutting off the great

blast which would otherwise have rushed through the passages and closets, banging doors and creating disturbance. The only regret was that the inner door had not been placed still further back so that the stretcher might have been brought into the porch, and space left to close the outer door ere opening the inner. Following a stretcher in, at once another difficulty is encountered. The passage is narrow and the door into the large ward is at right angles to it, and narrow also. Had the door been where the scullery sink was, and the part marked "Porch" been used as a scullery, the arrangement, as far as regards carrying patients in, and removing dead bodies, would have been perfect. This difficulty was more accentuated in the old buildings as will be seen in a glance at the plans, and I can well remember that the removal from the most north-westerly of the four wards of the body of an extra large and heavy man was a feat, which at the time appeared almost impossible. Indeed, on one occasion, when trying to remove a bedstead which must have been built together within the ward, the only solution of the difficulty was to pass it through one of the windows.

There is a room in the plan marked "Nurses Room". For a time we had to use it as such, but it was most unsuitable for the purpose. In these wooden buildings, there is no deafening and the partitions almost seem to act as resonators and conductors of sound, and small noises are conducted from the other end of the building with most surprising distinctness. For this reason, and because it was so near the pantry, it was next to impossible for a night nurse to sleep in it during the day.

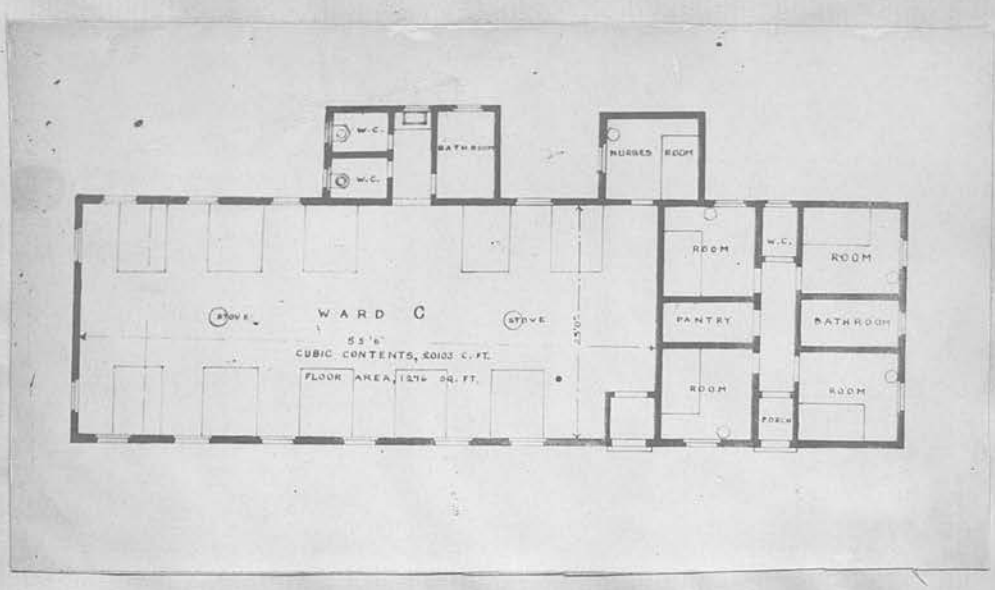
Again, it is hardly fair to expect the nurses to use the same bath and water closet with the small-pox patients, the more so when the ward is a male ward, as in this case. For this reason, we used it as an isolation room, though the isolation was mostly nominal for the same reasonsas those given in reference to the isolation room in the old buildings.

The water closets and bathroom were well fitted and worked well. A large copper tank or boiler was placed in a corner of the bathroom and this was heated easily by a rose of bunsen burners below. An ample supply of hot water was thus always at hand both for the bath and for the scullery sink, and was much used and greatly appreciated by those patients who were casting off their crusty scales and desquamating. This copper boiler stood upon a sheet of

thin iron to keep it off the wooden floor, but this was by no means sufficient protection. Such a rose of large bunsen burners makes a great heat, and though the metal of the boiler cannot get to a greater temperature than that of boiling water, the supports of the boiler and the metal burners themselves reach a great heat, and if this is kept up all day, the iron plate on which the whole affair stands gets hot, drys the wood below, and,as we actually found, browns and chars it. This was brought to my knowledge in a rather alarming and undesirable way. Some one entering the bathroom felt a strong smell of singeing and burning and saw that there was some smoke hovering about the boiler. I was at once informed, and on arriving at the place found that to the hand the floor for fully two feet beyond the ironplate was very warm. The gas was at once turned off, and to the ear there came most distinct sounds of crackling, as of smouldering fuel, from under the floor. Knowing the construction of the building, I feared to open the floor and so let air in to feed the fire. Without giving further details I may say that when we got the fire out, it was found that a large hole was burnt right through the floor below the iron plate and that the felt below the floor had

been singeing and smouldering like brown paper. Obviously the risk was tremendous, and an iron plate quite insufficient protection of the floor from the heat of the burner. This was remedied by putting in a slab of stone below the burner, and with such a pedestal, the boiler was used constantly and with perfect freedom afterwards. It would, therefore, seem that this stone pedestal is a necessary and ample safeguard against the occurrence of such an accident.

Pavilion No.II.



Turning now to the consideration of the other new pavilion, (Ward C.) it will be seen that it was a ward which came much nearer the requirements I have indicated than did the first. On entering the ward, that useful arrangement of an outer and inner door leaving an intervening porch, is found, only here again this might have been greatly improved if it had been large enough for the accomodation of a stretcher. The ward itself was well lighted and ventilated. In one corner was the useful side room, and the bath-room and waterclosets were in a small wing projecting from the north-east wall, and opening off a small recess about the centre of this wall. This was a much better arrangement than those in the outer wards, for it did not require the patient coming from the warmth of his or her bed to expose themselves to the chills and draughts of passages connected with the outer doors. The only thing this ward lacked was a suitable ward-kitchen or pantry.

I would like to draw attention to the stoves fitted into this ward, for they were in every way superior to those in Pavilion No.I. They, too, were called slow-combustion stoves, but were by no means so elaborate in their internal construction as the former pair. In fact they were simply iron

cylinders with a very narrow iron chimney coming off from a point on the circumference very near to the top, and with an opening at the opposite side,placed low down,which could be closed or opened to regulate the current of air passing through or to remove the ashes, and another opening towards the upper part of the same surface of the cylinder which served the double purpose of admitting fresh fuel, and, when the opening below was closed, air, which simply passed over the surface of the fire, keeping it alive but reducing to a minimum the rate of coal consumption. The amount of coal burnt in these stoves was very much less than in the others, and the heat radiated was greater. At much less expenditure in coal and attention the ward in Pavilion No.II. was kept more comfortable than in No.I.

There is only one provision which must by no means be overlooked, or the risk of fire is great,and that is the isolation of the stove from the wooden floor on which it stands. The ironwork gets very highly heated, coals fall out, and on windy nights I have seen the down-draught cause the flames to flow out from the lowest opening, licking the wood-work of the floor in a manner which was terrifying to those sleeping in the ward. The stove must stand on a stone slab, and be surrounded by a large iron tray

with a well raised lip on it.

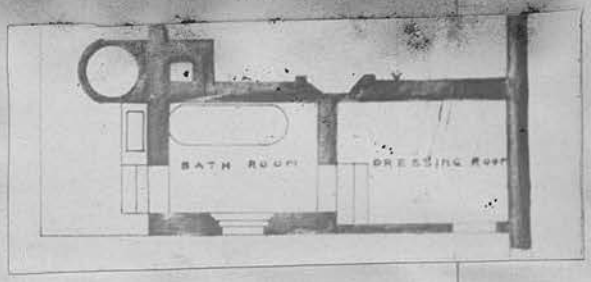
At the south-east end of this building will be seen in the plan a suite of rooms with W.C. and bathroom accomodation quite separated from the common ward, and entered by a separate door. These would have made excellent isolation rooms, but we required them as apartments for the nurses.

This whole pavilion was erected in a much less elaborate style than the first. The walls were lined with planks outside laid on in an imbricated manner (clinker-built), with ordinary wood planking inside, unvarnished, and with a layer of felt between. The roof was covered with galvanised iron. It was begun on March 5th and completed on March 22nd.

The cost of erecting these two temporary buildings was roughly £600 each, allowing for the accomodation of 21 beds, at the Local Government Board standard of 2,000 cubic feet to each bed.

These then were the buildings, with their advantages and disadvantages to which we received the victims of this epidemic. Upon arrival at the Hospital, they were admitted to the wards, and their clothes were collected, carefully catalogued, and sent down to the Disinfection Station which stood in the same grounds as the Hospital, and there carefully

cleaned and disinfected. They were then returned and placed in a special store on the north-east side of the court and kept there till the patient was dismissed. We devised and adapted a couple of dismission apartments which we considered a most efficient method of finally disinfecting the bodies of the patients ere they were allowed to go home. When the day arrived on which a certain patient was to be dismissed, his clothes were removed from the store and placed in a dressing-room at the gate of the Hospital court-yard, as seen in the plan. The patient then bid his final farewells to the others in the wards, and entered the bathroom next to this dressing-room by a door leading from the court. He here stripped off all the clothes he had worn in the ward and flung them in a corner. He then entered a bath where with abundance of soap and hot water he scrubbed and cleaned himself from top to toe, it being insisted on that this process of bathing should not be hurried, and that the head, both in the case of the men and the women, be thoroughly cleansed. After drying himself the patient stepped, a clean man, through the door into the dressing room, where he found his own old familiar clothes waiting him, and looking usually a great deal fresher, cleaner and tidier than they had



done for many a day. Then when he had clothed himself he stepped from the dressing room into the open air, and turning to the left, passed through the gate, and immediately left the vicinity of the Hospital. The women passed through the same process, and,had it not been insisted on, there would have been sturdy objections in the case of those whose hair had not been cut, to the washing and drying of their heads. Obviously this process took some time, and some trou trouble in the superintendence, and on days when there were a large number of dismissals, it was late ere the last left the premises.

When the termination of an illness unfortunately was death, the bodies were removed on a stretcher to the Mortuary, and arrangements were made for the funeral as speedily as possible. If the person died before noon or even one in the afternoon, they were buried that evening; if later than that, early the next forenoon. The undertaker brought the coffin to the gate, and the fireman and myself carried it to the dead-house. There we coffined the body and screwed the lid down. In very bad cases where there were many discharges oozing and flowing from the corpse, we usually wrapped it in a piece of oil-cloth. After the coffining, the fireman and I again carried the coffin to the hearse and place it inside, the under-

taker's men only handling it when it reached the cemetery. The relatives and friends of the deceased were told to meet the hearse at the cemetery gates. All this was done to minimise as much as possible the opportunities for infection. It was most impressive to see a man die before noon, and then to see the hearse leave the court with his body for the graveyard at sundown. On only one occasion was a body kept more than 24 hours in the mortuary and even then it was put in a leaden shell and sealed before 18 hours were over.

Other measures were adopted and carried out, all with the intention to reduce the possibility of the spread of contagion. Amongst these were, a daily bulletin giving an individual short report on each serious case which was telephoned by me to the Sanitary Office, where it was written out and communicated to the friends and those enquiring. This gave no excuse for these to come out to the neighbourhood of the hospital to make enquiries, and when such were made at the door they were refused and the enquirers referred to the Office. The excuse, too, of calling to leave tobacco and other small presents was taken from them, by an arrangement to have these received at the office and conveyed by van to the hospital. These measures we found necessary, for the fearless,

foolhardy and dangerous exposure of themselves to the immanent risk of infection made by the unaffected relatives and friends of the patients, in coming around the buildings and seeking surreptitious interviews, was surprising and annoying. So much did this prevail, that we were at length compelled to engage a watchman to patrol the outside of the buildings and to keep an eye on what might occur in hidden corners, suitable for such impermissible interviews.

SOCIAL CONDITIONS.

Going on to note the social conditions of those affected, it falls to me to consider first the streets and districts most implicated, then the house accomodation of the families affected, and lastly the employments of those admitted to hospital.

Site of First centre
Site of Second centre.
GREENOCK
ESPLANADE
PRINCES PIER
PRINCES PIER STATION
ALBERT HARBOUR
WEST HARBOUR
EAST HARBOUR
VICTORIA HARBOUR
STEAMBOAT QUAY
Custom Ho.
Ship Building Yards
CALEDONIAN RAILWAY STATION
WELL PARK
Mariners Asylum
NEWARK STREET
UNION STREET
ARDGOWAN STREET
BRISBANE STREET
SOUTH STREET
Bowling Green
8TH WARD
7TH WARD
6TH WARD
5TH WARD
4TH WARD
3RD WARD
2ND WARD
Infirmary
Burial Gd.
GREENOCK WEST STATION
Golf Course
Golf Club House
Mill Pond
Jardine's Burn
Berfern
The Hill
GREENOCK CEMETERY
Old Parliamentary and Municipal Boundary
Old Quarry
Bow Hill
Rope Walk
Shaws Water Filters
Cowdenknowes Reservoir (Shaws Water Works)
Cowden Knowes
Low Murdieston
LYNEDOCH STATION
UPPER GREENOCK STATION
WELLINGTON PARK
Foundry
Coal Depot
Tunnel
Bellview
Mountview
Balwharly

GREENOCK
ESPLANADE
OCTAVIA TERRACE
NEWARK STREET
Mariners Asylum
Bagatelle
Glenburn
Bellevue
Greenock Club Cricket Ground
8TH WARD
Crags
Golf Course
Golf Club House
Mill Pond
Jardine's Burn
Berfern
Finnart
PRINCES PIER
PRINCES PIER STATION
Custom House
ALBERT HARBOUR
ALBERT QUAY
Ship Building Yd.
Basin
WEST HARBOUR
STEAMBOAT QUAY
Custom Ho.
EAST HARBOUR
VICTORIA HARBOUR
WESTERN TIDAL HARBOUR
Ship Building Yards
2ND WARD
1ST WARD
CALEDONIAN RAILWAY STATION
WELL PARK
4TH WARD
5TH WARD
6TH WARD
7TH WARD
3RD WARD
LYNEDOCH STATION
Goods Station
Grosvenor Bowling Green
Rope Walk
Shaws Water Filters
Highlanders Academy
Girls Home
Infirmary
Academy
Greenbank
The Hill
CADDLE HILL
GREENOCK WEST STATION
ARDGOWAN SQUARE
Bowling Green
UNION STREET
SOUTH STREET
REGENT STR.
Coal Depot
Foundry
Bellview
Mountview
Tunnel
WELLINGTON PARK Bowling Green
Upr. Inglestone
Cartsburn Mill
Dam
GREENOCK CEMETERY
Old Parliamentary and Municipal Boundary
Old Quarry
400
Bow Hill
Low Murdieston
Cowdenknowes Reservoir (Shaws Water Works)
Bow

Streets affected:

A glance at the two accompanying plans of Greenock, on which I have marked off with red spots the addresses from which the cases were removed at the earlier and the later periods of the epidemic, will serve to show the areas most affected. It is a pretty fair guide to what are the poorest and most densely populated parts of the town, if one takes it, that such areas are those which on the plan are shaded off in complete blocks, intersected by the unshaded streets. It will be seen on looking at the first plan, the one whereon the cases reported in January and February 1904 are marked, how that the vast majority of the cases came from such parts, and how the place where these spots are most frequent is the neighbourhood of 21 Bearhope Street, where the primary centre was established. It is striking to look at the second plan and to see how the first centre is deserted, and how the cases were then coming from a much wider district, how the disease had crept out eastwards, reaping a full harvest of the susceptible and unprotected in that part of the town, and how the west end is clean and unaffected, unless in two instances, and these were cases where on the one hand a draper, who has a large shop in one of the poor streets, received the infection from his customers,

and on the other hand, an insurance agent who visits from door to door in the poorer parts of the town.

To count the number of cases occurring in each street and to say that the street with the greatest number is the one most affected, is obviously to mislead. Streets vary in length. They also vary in the amount of buildings and number of dwellings in them. But as the street with few houses in it must either have considerable length, or a sparser population, therefore it comes to be a pretty fair criterion to compare the number of cases in one street with its length, and to come to the conclusion that that street which gives the fewest number of feet to each case is the most affected. Accordingly I have made such comparisons and now tabulate them.

TABLE OF MOST INFECTED STREETS.

	Name of Street.	No.of cases	No.of feet in the length of street.	No.of feet to each case.
1.	East Shaw	24	750	31
2.	Duff	9	300	33
3.	William	6	350	58
4.	Market	11	700	63
5.	Tobago	10	700	70
6.	John	7	500	71
7.	Carwood	5	370	74
8.	Hamilton	12	1000	83
9.	Bearhope	7	700	100
10.	Sir Michael	9	900	100
11.	Sugarhouse Lane	6	600	100
12.	Mill	3	350	116
13.	Dalrymple	10	1200	120
14.	Vennel	9	1150	127
15.	Crawford	12	1650	137

The street which stands out pre-eminently from the others, not only in the comparison of degree of infection, but also in absolute numbers, is East Shaw Street. It is a short street about 750 feet in length, and when it is remembered that there are in the street the side of the Infirmary, a school, a church and two halls, the space left for dwelling houses is much lessened, and the number of feet to each case should be much less than 31. This street crosses Bearhope Street, and runs through the centre of the most infected neighbourhood. To any acquainted with Greenock, a glance at the above table would call forth the remark that the 15 streets mentioned are a fair selection of the poorest and socially lowest streets in town. In fact, the point emphasised by this list is that in this epidemic, it was the poorly housed, poorly fed, poorly clothed, dirty, ignorant and improperly protected who suffered. If they had all been periodically revaccinated, of course, there would have been no epidemic, but this neglect of the protection of recent vaccination is not the only factor in determining an invasion of the individual by the virus, or the infliction on the community of an epidemic. Unclean and unhealthy bodies, overcrowded and dirty houses, and circumstances which depress the stamina, vitality

or resisting power of the person are factors which in the absence of any powers to enforce periodical re-vaccination, rise to first importance in the consideration of the causes of such an epidemic. No doubt there are in the west end of the burgh very many who are not sufficiently protected by vaccination and who would undoubtedly contract the disease if they had to live in the same conditions as their less fortunate fellow citizens of the east end. But in the west end there is no overcrowding, gardens and open places abound, sanitary arrangements are attended to, and all that conduces to bodily health is considered; hence the chance of infection even in the unprotected is very materially reduced.

Number of apartments in affected houses.

This question of the conditions of home life being a strong factor in the etiology of the disease is again strongly brought out in considering the number of apartments in the houses from which cases were removed. Over 91% of the cases came from houses of from 1 to 3 apartments, and 73.68% or three quarters of them all from where there were but one or two apartments. Half of the infected were removed from houses of 2 apartments, the percentage number being 50.15%.

The following table shows the numbers and percentages.

NUMBER OF APARTMENTS IN HOUSES AFFECTED.

No. of apartments in each house.	No. of such houses.	Percentages
1.	76	23·53% } 73·68% } 91·01%
2.	162	50·15% }
3.	56	17·33% }
4.	19	5·88%
5.	6	1·85% } 3·08%
6.	3	·92% }
9.	1	·31% }

The next table shows the comparison of the number of one-roomed, two-roomed, etc. houses affected, with the number of such roomed houses as returned in the Census of 1901.

No. of apartments in each house.	No. of such houses in Greenock in 1901.	No. affected with smallpox.	Percentage.
1	2473	76	3·07%
2	6725	162	2·40%
3	2810	56	1·99%
4	815	19	2·33%
5	386	6	1·55%
6	156	3	1·92%
9	110	1	0·90%

Looking at the percentage column, it is evident that the tendency is to have a marked falling off in the percentage of affected houses as you rise in the scale from the one-roomed house to those with more accomodation. The exception to this occurs in the three-roomed houses, where the percentage is 0·34 less than that of the four-roomed dwellings. The families most susceptible are evidently those who find it necessary to live in but one apartment.

Number of persons to each apartment.

Taking next the question of the average of persons to each apartment in the house, I have collected some statistics, which I now give.

These numbers range from between 0·51 and 1 to between 7·01 and 8 per apartment. The great majority of the cases admitted to hospital came from houses where the average accomodation ranged from 1·51 to 3 adults per apartment. This was 62·28%. While 24·29% of the total cases came from houses where the average was 1·51 to 2. The following is the table, children under 10 years counting as 0·5 adults.

TABLE OF NUMBER OF OCCUPANTS PER APARTMENT IN THE HOUSE AFFECTED.

(Children under 10 years reckoned equal to 0·5 adults.)

Average adult persons.	No. of such houses.	Percentages.	
0·51 to 1	21	6·54%	
1·01 to 1 5	27	8·41%	
1·51 to 2	78	24·29%	
2·01 to 2·5	57	17·75%	62·28%
2·51 to 3	65	20·24%	
3·01 to 3·5	23	7·16%	
3·51 to 4	19	5·91%	
4·01 to 5	18	5·66%	
5·01 to 6	8	2·49%	
6·01 to 7	4	1·25%	
7·01 to 7·5	1	0·31%	

In 18 houses the people were living together almost 5 to each apartment; in 8 cases it was between 5 and 6; in 4 cases it admittedly was between 6 and 7; and in one occasion it actually rose to between 7 and 7½ persons! After the average reaches 4 the number of houses with this state of affairs quickly falls off. It must be noted that in these averages I have counted all children who were under 10 years of age as half an adult. On turning to the Census Returns for Greenock in 1901, I find that no such distinction is indicated, and therefore for the purposes of comparison I have been compelled to make out a new list which shows the total number of persons in each house irrespective of age.

The following is a table compiled on these lines.

TABLE OF NUMBER OF OCCUPANTS PER APARTMENT IN THE HOUSES AFFECTED.

(Children under 10 reckoned equally with adults).

Average persons	No. of such houses	Percentages.
0·51 to 1	19	5·93%
1·01 to 1·5	18	5·62%
1·51 to 2	53	16·56%
2·01 to 2·5	38	11·87%
2·51 to 3	69	21·56%
3·01 to 3·5	33	10·31%
3·51 to 4	38	11·87%
4·01 to 5	21	6·56%
5·01 to 6	17	5·31%
6·01 to 7	7	2·18%
7·01 to 8	5	1·56%
8·01 to 9	2	0·62%

These figures are different from those in the former table and to my mind do not lie so near the truth.

While these two tables are interesting in that they point out from what class of houses the most cases were received, they do not indicate to us the effect of overcrowding on the incidence after disease. To do this, it is necessary to find out how many houses there were in town in which the same conditions of accomodation existed, and to compare with this the number of cases removed from each class, expressing each comparison in the form of a percentage, from which we may draw inferences. There is a table in the Census Returns of 1901 which enables us to get these data for that year, in which I have assumed there has little change occurred by now, and with which I have compared my numbers. The table referred to is this:-

Number of rooms to each family, specifying the number of persons in each family, and the number of families in each size of house.

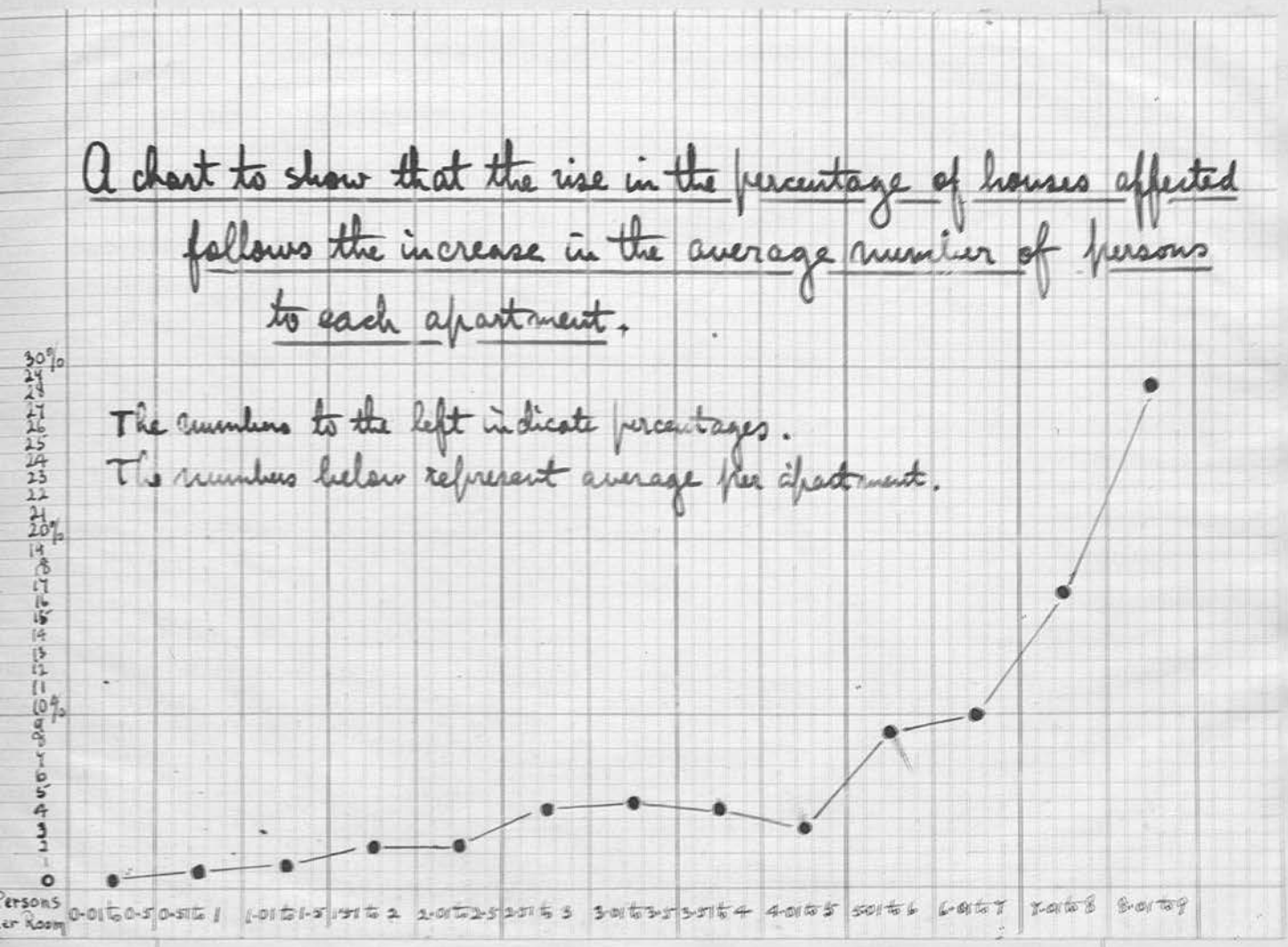
No. in each family.	ROOMS. 1	2	3	4	5	6	7	8	9	10	11-15	16-20	21-25	26-30	31+	Total.
1	476	223	58	18	8	1	0	1	0	0	0	0	0	0	0	758
2	605	901	313	90	36	17	9	10	5	2	8	2	0	0	0	1998
3	485	1077	440	108	52	30	21	23	14	13	8	3	0	0	0	2274
4	389	1072	438	133	66	23	33	21	17	16	18	2	0	0	0	2228
5	275	1044	421	97	61	24	19	26	14	12	26	4	3	0	0	2026
6	134	825	358	98	50	22	22	17	14	19	22	3	0	1	0	1585
7	69	666	266	83	32	12	10	18	18	15	12	9	0	0	0	1210
8	30	460	217	82	27	4	15	10	13	16	9	8	1	1	0	893
9	7	266	131	44	21	11	7	9	2	7	11	4	1	0	0	521
10	2	122	87	25	13	5	3	5	8	5	12	0	1	0	0	288
11	1	45	47	20	10	2	2	2	2	1	2	0	0	0	0	134
12	0	20	19	8	4	1	1	0	2	2	3	0	1	0	0	61
13	0	3	11	4	1	1	2	2	0	0	1	0	1	0	1	27
14	0	1	3	2	3	1	0	1	0	0	0	0	0	0	1	12
15	0	0	1	2	0	1	0	0	0	1	0	0	0	1	0	6
16 - 20	0	0	0	0	2	0	2	1	0	1	0	0	0	0	1	7
21 - 25	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	3
26 - 30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
31 +	0	0	0	0	0	1	1	0	1	1	1	1	1	3	4	14
No. of Families.	2473	6725	2810	815	386	156	148	146	110	111	133	37	9	6	8	14073

From this table with a little labour, it may be calculated what is the average number of persons per apartment per house, and to arrange your resulting numbers in groups to compare with the number of such houses affected by smallpox. This is done in the next table. The first column gives the average accomodation groups we have been using in the other tables. The second column gives the total number of houses in these groups, as calculated from the last table. The third column gives the number of affected houses in each group; and the last gives percentage of affected houses in the group.

Table showing the percentage of houses affected in each group of accommodation averages.

Average number of persons to each apartment in the house.	No. of houses in each group of accommodation averages.	No. of affected houses in each group.	Percentage of house in each group, affected with smallpox.
0.01 - 0·5	756	0	0
0.51 - 1	2999	19	0·63%
1.01 - 1·5	1869	18	0·96%
1.51 - 2	2702	53	1·96%
2.01 - 2·5	1399	38	2·00%
2.51 - 3	1691	69	4·08%
3.01 - 3·5	761	33	4·33%
3.51 - 4	917	38	4·14%
4.01 - 5	679	21	3·09%
5.01 - 6	201	17	8·45%
6.01 - 7	73	7	9·58%
7.01 - 8	30	5	16·66%
8·01 - 9	7	2	28·57%

Looking at the percentage column the inference which is to be drawn is that as you rise in the scale of crowded accommodation in the home, the greater is the risk and incidence of smallpox infection. That is to say, one of the factors in the spread of the disease is a high average of occupants to each room, the higher this average rising the more cases of smallpox occurring. The percentages rise quickly and get to a considerable height when the average gets to 7, 8 and 9 per room, but although this probably indicates the direction in which the truth lies, it cannot indicate the exact amount of the truth, for where your totals are so small as 30 and 7 a case either way makes an unduly great rise or fall in the percentage. The accompanying chart gives the above percentages in a graphic form.



Families from which came more than one case.

In the great preponderance of instances there was only one number of the family smitten with the malady, but sometimes it occurred that 2, 3 or even 4 cases were removed from one house. This took place in 49 households, two cases being removed from 35 of them, three cases from 12, and four cases from 2 houses. Thus in about five sixths of the houses only one member of the family was affected, it being very rare to find more than two in a family contracting the disease.

The average number of adults per apartment in these 49 houses was 2·74, again indicating the trend of influence of crowded accommodation.

Employments.

Going into the question of the nature of the employment of the patients, the following are the classes of occupations, and the numbers of those so occupied, who were affected.

Standing out pre-eminently from the others is the class of labourers, of whom we admitted 54. I have detailed them thus:-

Labourers	(General)	14	
"	(Ship-yard)	19	
"	(Sugarhouse)	7	
"	(Dock)	10	
"	(Store and Warehouse)	4	
	Total	54	54

The next class I have grouped together as workmen using a little more skill and knowledge in their employment. They total 37.

Riveter	12		
Holder-on	4		
Boilermaker	4		
	20	20	
Fitter	3		
Blacksmith	6		
Moulder	3		
Mechanic	5		
	17	17	37
			91

		91
Carpenter	5	
Cartwright	1	
Cauker	5	
Joiner	6	
Rafter	1	
Mason	1	
Plasterer	1	
Slater	1	
Steeplejack	1	
Ropemaker	1	
Engine-driver	2	
" fireman	1	
Tailor(journeyman)	1	
Seaman	1	
Engineers	5	
Farmer	3	
Baker	5	
	41	41
Tramp	1	
Hawker	2	
Porter	1	
	4	4
Undertaker	1	1
Shop-keeper, (Master)	1	
Shop Assistant	7	
Pawnbroker	2	
	10	10
Carter	6	
Cab-driver	1	
	7	7
Mill-girl	9	
Charwoman	6	
	15	15
Errand boy	2	
Newsboy	1	
	3	3
Policeman	3	
Officer, Cleansing Dpt.	1	
	4	4
		176

			176
Station-master	1		
Ticket Collector	1		
Signalman	1		
	3		3
School-teacher	2		2
		Total	181

Of the others the great bulk were married women keeping their own houses, or children and others dependent on parents and friends. Running one's eye up and down the list of these employments, it is easy to pick out some whose calling has specially exposed them to infection. This naturally leads on to the next subject of consideration, namely the probable source of infection.

THE PROBABLE SOURCE OF INFECTION.

(1) Not traceable:

Out of 342 cases in which I made enquiries and some endeavour to trace the source of infection, 99 cases I have noted as not being clearly traceable to any known source. This leaves for our consideration only 243 records where infection has been pretty clearly traced to some source already known.

(2) Contact with other cases directly and indirectly:

Of this 243 there were traced 186 to what is of course the most likely source of infection, namely the actual contact with relatives and friends who have the disease, or are living in houses where the disease exists; that is, 76·54% of the traced cases were due to this cause.

(3) School:

The school was directly responsible for 18 cases amongst scholars and teachers. These cases all came from the one school, though they lived in various parts of the town, some being in areas but little infected. This school was St. Mary's Roman Catholic School, which is situated at the corner of Bearhope and East Shaw Streets, and is attended by great

numbers of children from the dirtiest quarters in the burgh. There were several children in the east-end Roman Catholic School in Belville Street affected, but these could be traced to sources not so distant. Two teachers and 16 scholars from one school was so alarming that steps were taken to have it closed early in the epidemic, and it was not opened till thoroughly cleaned and until the outbreak had assumed a very quiet character.

It so happens in Greenock that the vast majority of our lowest classes are Roman Catholic, and at the earlier part of the epidemic the numbers of such so preponderated in hospital as to give the outbreak the appearance of being confined to those of that religious persuasion.

(4) Glasgow:

In six cases so definite a relation of the onset of the disease to a visit or stay in Glasgow, limited to the usual period of incubation, was traced that they were specifically stated to have received their infection there, where the disease was pretty common at the time.

(5) Shops:

Four cases were considered to have got their infection from being employed in shops, to which had

come articles or customers from infected houses. Alexander Carmichael, who was admitted on February 8th, 1904, was a pawnbroker in the office of Cairns & Co. at 17 Sir Michael Street. Mrs Docherty of 6 East Shaw Street, who, with two of her children, was admitted to hospital about the 28th of January, was a frequent customer to this pawn office. Carmichael remarked to her that he did not like the look of the eruption on her face, and that he thought she ought to see a doctor. At the same time he accepted some clothing from her which had been brought from her house in which one of her children was already lying with the disease.

George Johnstone, another pawnbroker, was admitted on February 10th. He worked in an office at 39 Hamilton Street, and traced his infection to dealing with people from houses in the infected area.

Owen McAulay who lived at 8 Charles Street, was a salesman in a spirit store in one of the lowest parts of the town, and no doubt was often in contact with people from the infected houses in the neighbourhood .

Mr George Wilson of 50 Brougham Street (our most westerly case) has a shop in the Vennel in which he himself serves customers. It was undoubtedly thus that he contracted the disease.

(6) Workmen about hospital:

By March 15th we had in hospital six workmen in the employ of the Corporation, who had been engaged in work about the hospital, and four joiners, who had been amongst the builder's men in the construction of the first Pavilion, and another joiner who had been engaged in odd jobbing work about the Administration block. That is to say, that about 16% of the joiners working about the place were laid down with the malady they were employed in combating, two of them, or about 6½% being killed by it - casualities as severe as many a skirmish in war, yet the risks were not taken nearly so seriously as those of a battle, neither by the men employed, nor by the general public opinion. In war men are warned not to expose themselves unnecessarily rashly, and the taking advantage of all possible cover is a sign of skill and cleverness, yet where it is possible to obtain at little trouble and no expense ample protection to the combatants engaged in resisting the attacks of an epidemic of smallpox, there is no general feeling that there was wanton carelessness on the part of the men and their employers, or that they were to be blamed, but rather commiserated with, in that they fell victims to the scourge. That a public body such as the Corporation of Greenock should employ men

more especially send them to work in the midst of smallpox patients, without requiring that they be amply vaccinated, is a condition of things which has but to be stated to be condemned.

(7) The question of aerial infection:

Aerial infection is a subject on which alone a lengthy paper might be written, balancing up the arguments for and against, without arriving at any definite finding. There are many and good authorities ranged on both sides, and some would have smallpox hospitals entirely removed from the habitations of man, and others see no objection to conducting them in the centre of dense population. It was a question I had ever before me in making enquiries on this subject, but my efforts were not successful in getting clear proof of any case of aerial infection. I have selected seven cases which at first seemed to lend some colour to it. Mrs Hetherington, admitted on February 20th and Henry Collins, on March 1st, both admitted at the earlier part of the great epidemic wave, came from houses in Sinclair Street, which are within 700 feet of the hospital gate, Sinclair Street being that which passes the front of the buildings and up which all the cases had to be brought to hospital.

In the later part of the epidemic there were many families just as close to the hospital and also on the route of the van, but they could be traced to direct or indirect contact with pre-existing cases. Neither of the two cases mentioned can be traced to any definite source, but there are other 99 cases which cannot be traced. In other words, while both these cases lived on the van route and close to the hospital, there is no proof that they got their infection through the air. Late in the epidemic a man named Meichan was admitted, who traced his infection to taking walks regularly up about the small-pox hospital, but his statement and opinion count for little for he was removed from 53 Main Street, a dirty quarter, and, no doubt, was mixing freely with people from infected houses in the neighbourhood.

Wm. Moore, an engine-driver on the Caledonian Railway, lived at Bridge-end, a group of houses about 2,200 feet from the hospital and passed down the road behind the buildings which is close to them, as shown in the plan, several times a day on his way to the engine-shed a little to the east of Craigieknowes. When he was admitted he affirmed that this was the obly possible source from which he could have contracted his disease. But it was found later on that he had been visited By people from an infected house, and as he was a Roman Catholic, he must have mixed at

chapel with many from the stricken areas.

Two other Caledonian hands employed on engines were admitted. It was strange that while we had six cases from amongst the employees on this line, there was not one from amongst the men working on the Glasgow and South-western Railway. I mentioned previously that this latter line was much further from the hospital than was the Caledonian line to Gourock which skirted the grounds. These other two Caledonian hands at first inclined to suggest that the frequent passing along this Gourock line on their engines had exposed them to infection, and had it been the case, it would have undoubtedly been air-borne. But afterwards it was found that the one, Sinclair, relieved Moore, meeting him on the same foot plate, and driving the same engine, while the other was found to have been mixing in company in town where he could more easily have got the infection by direct contagion.

One other case remains to be examined. It is that of Wm. Orr, the farmer owning and working Craigieknowe Farm,which is almost just across the road from the hospital. Here surely was a case of aerial infection, for did not the man live just over the way, and work in the fields round the buildings? But here again indirect contagion was the cause.

Children and messengers came to the farm daily, and met Mr Orr personally, from the house of Wm. Moore, the engine driver, who lived at Bridge-end.

Thus there is not left a case in which it can be clearly proved nor indeed strongly suspected to have been the path of infection.

(8) Others:

There are still eleven other cases to mention. There was a message boy who delivered goods at the front door of the Administration Block, who, though he had no direct communication with any one in the hospital, took the disease and died of it, and his infection could not be traced to any other source. There was the driver of the baker's van which called daily at the same door. He undoubtedly got his illness in this manner. Margaret Aitken cleaned out the Sanitary Office, at which there were calling daily people from infected quarters and officers coming into close contact with cases. Kate Livingstone was the daughter of one of the officers, and probably got the trouble by indirect contagion through her father. Andrew Chalmers was an assistant in the outdoor staff of the Cleansing Department, and had to deal with the refuse and filth of the lowest quarters, superintending the cleaning of ashpits and collection of dirt and rubbish. Wm. Dunbar

was the driver of the smallpox van. He also took the disease, and probably from this source, and it is astonishing that he was permitted to carry out his duties without being protected by revaccination. Wm. Sheriff was a carriage-builder, and took his infection from the van, the shaft of which he repaired about a fortnight before he sickened. James Wright was an undertaker and coffined the body of a child which died of the malady about three weeks before he sickened. James Gray, a case from Portglasgow where there were few centres of infection, so expressly stated that he had been about the smallpox van and quite close to the stretcher on which a case was carried from a house to the van, seven days before the onset of his illness, that I took note of it as a possible source of contagion.

It shows how the servants of railways and Companys who handle numbers of the people are exposed to the risk of smallpox, and how little protection apart from vaccination can be offered to them, when Mr Martin the Station-master at the Central Station, Greenock, who lives in Gourock, and Mr Hoddart, a ticket-collector, who lives in an uninfected and healthy street in Greenock, both contracted the disease, suffering pretty severely, and could in no-wise trace their infection to anything but their calling.

INCUBATION PERIOD.

In trying to get data on which to come to a conclusion as to the average length of the period of incubation, it is difficult to get in the first place cases where a definite source and a certain date are ascertainable, and in the second place, cases where t there is clearly but the one date of infection. Ten to 15 days is the recognised average period of incubation, and this was borne out pretty well in such cases as could be approximately estimated. Most of these cases have been already mentioned with the sources of their infection and time of incubation. James Gray was exposed to infection seven days before the onset; Robert Riddick was in Glasgow eight days before he sickened; Joseph Gallachar left Govan a fortnight before he took ill; Wm. Sheriff mended the trams of the smallpox van a fortnight prior to the commencement of his symptoms; Rita White showed spots 13 days after spending Christmas day in Glasgow, and her father discovered his few spots on the 17th, and the other two children on the 18th day after their visit. I have no notes as to whether these Whites had any sickening, and so have given the dates of their eruptions. It was three weeks from the day on which Mr Wright the undertaker coffined the body

of the child which died from smallpox till the day on which he sickened. These few cases would indicate a range of from 7 to 21 days as the period of incubation.

THE SICKENING.

The onset or the sickening is the next subject for consideration.

The five cardinal symptoms of smallpox are headache, pain in the back (lumbar region), sickness, vomiting and shivers. These may all be present together and appear all on the first day of sickening, but they appear in differing sequence and in varying degrees.

Out of a total of 295 cases in which there are notes under this heading, 61 or 20·67% reported that all five symptoms were present. In 31 cases or 10·5% the only one not felt was the pain in the back. Pain in the lumbar region is ever looked to as a helpful symptom in the diagnosis of smallpox, and the practitioner is inclined to lay much stress on the

point. Yet here are 10·5% of the cases in which it was the only symptom not found, and, if we add those cases where along with other symptoms it was not experienced, we find that in 126 or 42·72% or two-fifths of the cases it was absent.

In 30 of the cases there were headache, backache, sickness and vomiting but no shivering. This is a percentage of 10·16. These shivers or rigors occur in more than half the cases, the numbers being 171 or 57·75%. They vary in degree, and are no more prominent amongst the symptoms of the onset of small-pox than they are in similar acute diseases.

Headache is a prominent symptom and was present in 253 or 85·74% of the cases. I know of only one case in which it was definitely stated to have been the only symptom which was not present, and yet the case was that of a woman - and women seemed to lay stress on the prominence of this symptom more often than men - and a pretty severe case too.

Sickness was present at the onset of the malady in most cases. The actual numbers are 204 or 69·10%. In four cases it was the only one of the five not present. Sickness was very often accompanied by vomiting. This was the case with 143 or 48·44% of the 295 patients noted. But in 65 or 22·01% it was present, but was not accompanied by vomiting.

This vomiting occurred in 144 or 48·77%. Five cases said they had vomited but could not remember any feeling of sickness. In 27 or 9·15% vomiting was the only one of the five symptoms absent.

Twenty three patients or 7·85% had no symptoms of onset at all, the coming out of some spots on the surface of their body being the first thing to cause suspicion that they had been infected with the small-pox virus.

I give now in tabular form the different groups of onset symptoms with the numbers and percentages in each. From this list all the above calculations may be made.

TABLE OF SYMPTOMS OF ONSET.

N.B. Hd. indicates Headache,
Bk. " Pain in the back,
Sk. " Sickness,
Vom. " Vomiting,
Rig. " Rigors or shivering.

Group.	Total No.	Percentage No.
All five symptoms present	61	20·67%
Bk. only symptom absent	31	10·50%
Rig. " " "	30	10.16%
Vom. " " "	27	9·15%
No symptoms	23	7·85%
Bk. and Rig. only symptoms absent	17	5·76%
Sk. and Vom. " " "	16	5·42%
Bk., Sk., and Vom. " "	16	5·42%
Sk., Vom., Rig. " "	14	4·74%
Bk., Sk., Vom., and Rig. " "	13	4·40%
Vom. and Rig. " "	10	3·39%
Bk. and Vom. " "	9	3·05%
Bk. Vom. and Rig. " "	8	2·71%
Hd., Sk., and Vom. " "	4	1·35%
Hd., Vom. and Rig. " "	4	1·35%
Hd., Bk., Vom. and Rig. " "	3	1·01%
Hd., Bk., Sk., and Vom. " "	4	1·35%
Hd. and Bk. " "	2	0·67%
Hd. only " "	1	0.34%
Hd. and Rig. " " "	1	0.34%
Sk., and Rig. " " "	1	0.34%
Total	295	

Turning now to consider more particularly these different symptoms, there are points in reference to each which are of some interest. For instance, we may study the questions of the most usual site of the headache, whether frontal, occipital, vertical, parietal etc., of the degree of the headache and its dur-

ation. The degree and duration of the pain in the back; the degree and duration of the sickness and vomiting and shivering, fall to be noted. And then the question of the order of appearance of these symptoms may be discussed.

The most frequent site of headache amongst my cases was frontal, 137 out of 212 patients locating it there - a percentage of 64·62. This frequency is much in advance of any other site. Twenty six of the cases, or 12·26% said that their headache was "all over". Twenty three, or 10·84% put their hand to the vertex of their head and said the pain was most severe there. Seventeen, or 8·01% indicated the occipital region, and four or 1·88% the parieto-temporal regions. Two said the headache was equally severe in the frontal and occipital regions at the same time. The left side, the frontal and vertical together, and the occipital and lateral together, were areas of intenseness mentioned by one person in each case.

As to the degree of the headache, this can only be estimated by the patient, and he or she makes much or little of it as they have been accustomed to other headaches or not. Of the 238 who gave me their opinion as to the severity of their head pain, 98 or 41·17% said it was "very severe".

One of these said it was so severe as to be a "blinding headache". Fifty one others called it "severe" and they were 21·42% of the total. The remaining 89 or 37·39% said that their headaches were slight or moderate. Thirteen persons stated that along with the headache they had "giddiness" or "lightness of the head", and one said he had a "singing" in his head.

There were 223 patients able to say pretty definitely what was the duration of their headache and these estimates vary from about half a day to seven days.

TABLE OF HEADACHE DURATION.

Number of days.	Number of cases.	Percentage
Half a day.	9	4·03%
One day	46	20·62%
A day and a half	2	0·89%
Two days	40	17·93%
Three days	70	31·39%
Four days	26	11·21%
Five days	20	8·96%
Six days	4	1·78%
Seven days	6	2·67%

It would seem that the most usual duration is three days, and that from a half to one day is the duration next in frequency. A duration beyond five days is very infrequent.

As regards the degree of the pain in the back, out of 166 patients who expressed their opinion either as to suffering slightly, severely or very severely, one half, or 50% estimated it as only slight or moderate. Twenty seven or 16·26% said that in their cases it was severe; and the others, being 56 in number or 33·73% reported it as "very severe". One of these who happened to be 4½ months pregnant, said that this pain in the back was so severe as to be like labour pains and to make her fear that she was about to miscarry. Another stated that the pains shot round into the iliac regions of the abdomen, and others said they had pains down their thighs. In one case the backache was so light as merely to amount to a "stiffness".

The duration of the pain in the back again varies as in the case of the headache from one to seven days. The numbers are as in the table below.

TABLE OF DURATION OF BACKACHE.

Number of days.	Total number.	Percentage.
One	33	23 40%
Two	37	26 24%
Three	32	22 71%
Four	23	16 31%
Five	12	8 51%
Six	1	0 71%
Seven	3	2 12%
Total	141	100 00%

It is evident from this list that the most of the cases suffered from one to three days and that the number of those who suffered for more than four days is small.

As to the sickness it also varies in degree. Of the 108 records, 67 or 62·03% were slight or moderate; 15 or 13·88% were severe, and 26 or 24·07% were very severe. Thus great sickness was not a marked symptom and the majority characterised their sickness as slight. Some three of the "very severe" seem to have suffered heavily, however, and one described his condition as "dead sick". The duration as in the other two was from one to three days in the most of cases, but also varied between one to seven. The numbers are these:-

TABLE OF DURATION OF SICKNESS.

Number of days.	Number of cases	Percentage
One	45	26·94%
Two	44	26·32%
Three	34	20·34%
Four	28	16·76%
Five	7	4·19%
Six	3	1·79%
Seven	6	3·58%
Total	167	

The same points are brought out in considering the duration of the vomiting, only much more marked-

ly. The vast majority 124 out of 146 or 84·84% having no vomiting after the third day.

TABLE OF DURATION OF VOMITING.

Number of times or of days	Number of cases	Percentage.
One occasion	20	13·69%
Three occasions	9	6·16%
"Occasionally"	4	2·74%
One day	42	28·7%
Two days	31	21·23%
Three "	18	12·32%
Four "	13	8·90%
Five "	3	2·05%
Six "	1	0·68%
Seven "	5	3·42%
Total	146	

Turning lastly to consider the shivering or rigors, we find that 20 out of the 146 cases noted, state that they had one definite rigor at the onset. This is a percentage of 13·69. Thirty five or 23·94% said that they felt "shivery" during the days of their sickening, and 66 or 45·20% say they had frequent slight shiverings. Taking these three groups together as making up the class of cases where the rigors were slight, we have 121 cases or 82·83%. Those who said they had severe shivering were 21 in number or 14·36%, and only four seemed to suffer very severely from rigors, a percentage of 2·74.

This shivering was present not constantly throughout any one day, but at various intervals on one, two, three or more days. I have noted in 166 cases the number of days on which this symptom was present, and find 65·06%, or 108 out of 166 suffered thus only on the one day, 13·85% on three days, and 10·84% on two days. In the table the numbers will be found detailed.

TABLE OF DURATION OF RIGORS.

Number of days on which shivering occurred.	Number of cases	Percentage.
One	108	65·06%
Two	18	10·84%
Three	23	13·85%
Four	10	6·0%
Five	6	3·61%
Six	1	·6%
Total	166	

Other symptoms:

In addition to the five above mentioned symptoms there were other minor ones mentioned by a number of patients. About 16 complained of being

"sore all over". Twelve said they suffered from "pains in the legs". Five had pain in the abdomen, and it seemed to me that in these it was referred to the front from the back. Although an eruption was present in a large number of cases on the throat, yet it is remarkable that only four persons mentioned "a very sore throat" as one of the early symptoms. Three complained of a general weakness at the time of the onset. Two had a pain in the left side, and when asked to point to the place, indicated the splenic region. General malaise was experienced as the only, or most prominent symptom by seven of them, and each of the following symptoms were mentioned by one person in each instance - a burning pain in the right shoulder, fainting, bleeding from the nose, pain in the right arm, pain over the sternum, and pain in the sides of the chest.

Order of appearance of symptoms:

As to the order of appearance of the five chief symptoms, they all usually appeared on the one day, but 64 showed some variation in the order of appearance. The most frequent variety was the class of cases in which the sickness and vomiting did not supervene until the day following the appearance of other symptoms. This occurred in 14 of the 64 cases, or in 21·87%.

In 11 cases or 17·18% the sickness and vomiting were deferred to the third day of the onset. These two deviations from the ordinary course, in which all symptoms appear on one day, were the two most marked.

The next in order of frequency were those cases in which the rigors did not occur till the third day of the onset. This happened in four cases or 6·25% of these variations.

In the same number of cases I found that the rigor was the first symptom complained of, and that the other symptoms did not appear till the third day of the sickening.

In three cases the rigor was again the first symptom, but in them the other symptoms appeared on the following day.

Still keeping to their order of frequency of occurrence, there are six varieties, each represented by two cases. These are:-

(1) Headache not present till the day following the appearance of the others.

(2) Pain in the back beginning on the next day.

(3) Pain in the back deferred to the third day of sickening.

(4) Vomiting not coming on till the third day.

(5) Vomiting deferred to the fourth day.

(6) Sickness and vomiting both deferred to the sixth day.

Then follow 16 other varieties each in only one case. There is little to be learned and little of interest in considering them, but that the enumeration of them may be complete, I give them in a list.

List of 16 other varieties.

N.B. as before Hd. indicates Headache,
Bk. " Pain in back,
Sk. " Sickness,
Vom. " Vomiting,
Rig. " Shivering.

The numbers 1st, 2nd, 3rd etc. indicate the day of the onset, in which these symptoms appeared.

(1) Bk. on 1st - Sk. on 2nd - Hd. on 3rd.

(2) Bk. on 1st - Sk. and Vom. on 2nd - Hd. on 3rd Rig. on 5th.

(3) Bk. and Rig. on 1st - Hd. on 5th.

(4) Hd. the only symptom deferred, and that to the 6th.

(5) Bk. on 1st - Hd. and Sk. on 3rd.

(6) Bk. on 1st - Sk., Vom., and Rig. on 4th.

(7) Vom. alone deferred to the 2nd.

(8) Vom. not till the 4th.

(9) Sk.and Vom. not till the 4th.

(10) Sk. and Vom. not till the 5th.

(11) Sk., Vom. and Rig. not till the 2nd.

(12) Sk., Vom. and Rig. not till the 4th.

(13) Bk. and Rig. not till the 6th.

(14) Rig. the only symptom.

(15) Rig. not till 2nd.

(16) Rig. not till 4th.

DATE OF ERUPTION.

It is usual to expect the appearance of the eruption about the third day of the onset. This was borne out in the histories of the cases in this epidemic. Out of 291 cases noted 83 or 28·52% were on the third day, and 84 or 28·86% on the fourth day. That is to say that 167 cases, or 57·38% were on these two days. The day before and the day after these two dates were each represented by about half the number of cases occurring on either the third or fourth, there being 42 or 14·43% who stated that their eruption appeared on the 2nd day of sickening, and 46 or 15·46% on the fifth. The numbers occurring on the other days are trifling, there being 13 or 4·46% on the first and 17 or 5·84% on the sixth. Six cases did not have any eruption

till the seventh day, three till the eighth and three till the ninth. These last six cases I have not included in my total of 291.

Where eruption appeared:

In making any enquiry as to the place where the eruption first made its appearance, there are two sources of fallacy to be ever kept in mind. One is the memory of the patient. He may not really remember, and give as his answer what occurs to him. The other is his power of observation. I feel certain that a great number who said that their spots first appeared on the face or back of the hands, say, were people who did not know of their presence on other parts of the body, but either had their attention drawn to these exposed parts by their friends or were more impressed by the appearance of an eruption at these places. While these factors must be borne in mind as having a tendency to increase the numbers of those stating that their eruption first appeared on the prominent sites, they must not lead to the impression that it is not really the case that such parts are most frequently the first affected, but must disenhance the great majority of such. Most patients pointed to or distinctly mentioned one area as being the place where spots

first appeared, but many would not do this, and gave two sites, saying that the eruption occurred at both of them simultaneously and before becoming general. Out of 285 cases noted, 43 or 15% thus gave a double site. I find that the face was indicated by 175 or 61·39% of them. Of this 175 there were ten or 3·5% of the whole who mentioned the face(or a part of it) in conjunction with some other part of the body. One said the brow and the front of the chest were affected simultaneously; three said the brow and the forearms; three others, the hands and face and other three, the arms and face. There were 165 of the 175 who gave the face alone as the place where they were first aware of an eruption. Of these, 47 stated that it was the forehead where the first spots appeared.

92 or 32·26% (this is about half the number who indicated the face as the first site) said that with them it was the upper extremities.

Of this number the vast majority, really 81 or 28·41% of the total records, gave the single area, the arm, or a part of it, and the remaining 11 gave double sites.

Of this 81 there were 31 or 10·87% of the whole who limited the area to the wrists and backs of the hands, the remaining 50 merely saying "the arms" or "the forearms".

The 11 cases giving double sites are arranged in this way. Two said arms and legs at the same time, three forearms and brow, three hands and face, and three arms and face. These 11 cases only make 3·85% of the total of such records.

Taking now the lower extremities, we find 12 cases or 4.2%. Of those two said legs and arms were simultaneous sites. The remaining 10 are disposed thus:- 7 or 2·45% of the whole merely said that spots first came on their legs, 1 said thigh, 1 said buttocks and another most pointedly insisted that the very first spots to appear were those in the inguinal regions.

Turning next to the trunk, there are 11 cases mentioning this as the first site. These make 3·85%. One of them said brow and chest simultaneously, six the back and four the front of the chest.

One patient said his spots came on his neck first and another first found them on his scalp.

Lastly, five persons or 1.75% said their rash appeared over their general surface at once time, no particular part being affected first.

It may be interesting to note all these vagaries in the place of first appearance of the rash, but obviously the numbers of instances of some of them are so small that they are of little moment. The

most usual places are evidently the face and the arms, with percentages of 61 and 32.

The two following points are merely given as matters of a passing interest. They are, first the number of days the cases remained outside the hospital and as a source of danger amongst their friends, calculated from the day on which their rash appeared, and second, the usual time to diagnose and notify a case taken by the local practitioners. Obviously they are questions of importance from a preventive point of view, but in this paper are merely recorded as of interest at the moment.

Number of days outside hospital after appearance of rash:

324 was the number of cases in which enquiry was made into the matter of how long they remained amongst the general population after their spots came out, and the great percentage - 80·56% were removed before the end of the third day. Most - 108 or 33·33% were isolated on the second day. After the sixth day there are but the smallest fraction of cases, and what are, are almost wholly cases of concealment of disease. The one discovered on the 25th day was a case taken to be chickenpox and when admitted to hospital he was perfectly clean.

The table is as follows:-

Day on which case was removed to hospital, counting from the appearance of the rash.	Number of cases	Percentage.
Same day	73	22·54
2nd "	108	33·33
3rd "	80	24·69
4th "	30	9·26
5th "	17	5·24
6th "	7	2·16
7th "	1	0·31
8th "	3	0·92
9th "	1	0·31
11th "	2	0·62
14th "	1	0·31
25th "	1	0·31
Total	324	

TIME TAKEN TO DIAGNOSE.

In many cases the doctor was in attendance from the day of sickening, and would wait till the rash came out before committing himself to a definite diagnosis. In such cases the time taken to diagnose is counted from the day on which the spots appeared to the day of ratification. In other cases he was not called in until there was active eruption, and in these instances the days taken to confirm diagnosis only count from the day he was summoned and attended. The skill in diagnosis and promptness in notification are most marked. I have only 101 records, but of these 64 were notified on the same day, 25 on the next and 11 on the third; while in only one case did the practitioner pospone his diagnosis till the fifth day after he had first seen the rash.

GENERAL CHARACTERS OF THE ERUPTIONS.

The eruptions presented by the various patients admitted to the hospital varied in a most interesting manner. Few cases were received with their eruption at a very early stage, it being rare to get them in the papular stage. Only in cases where the eruption of a large crop of papules on a very red, hot, swollen skin, leaving no possibility of doubt as to the nature of the disease, did the medical attendant declare his diagnosis and send the case to hospital. In milder cases he waited till these papules began to vesicate, and then notified. Still fewer cases came in with any trace of an initial rash, and often this would have escaped notice if the skin surface had not been inspected by me shortly after admission. To have waited for 12 hours, would probably have been to have lost an opportunity of inspecting such a rash.

Thus then it was at the vesicular stage that most cases came under my observation, and indeed many had reached the pustular and some even the dried-scab stages.

In this way cases varied in the general characters of their eruption from their admission. Again, many cases were received when it was not

possible to state in one sentence the general character of the entire eruption, for the face might have progressed to the desiccating stage, the arms be at the pustular and the legs still unripe, still vesicular. The various areas of the body in one case not only might vary in the stage of their eruption, but also in such points as the size of the spots, whether they were typical or atypical, whether their bases were wide or narrow, active or quiet, and in the amount of eruption. Thus you have varieties in the eruption not only in comparing individual with individual, but also in comparing different parts of the one individual. Obviously this makes the difficulties of comparison and classification so great as to be almost insurmountable, and if not, at least it leads to the multiplying of divisions and subdivisions, till it would reach a condition of obscurity, indefiniteness and unintelligibility. In addition to thus segregating the conditions found on the different parts of different persons, it would be necessary to follow out by observations at least every 24 hours (and in the early stages almost every 12 hours) the progress of the eruption, comparing area with area, and corresponding areas in different individuals, before conclusions could be reached, based on averages or percentages, which would warrant any true authority in making statements,

and court confidence in others in accepting conclusions. Such a research would entail persistant, careful and laborious observation and note taking, which would demand the time and strength of several observers. Obviously where cases were coming in at any hour in the 24, it was quite a task to obtain from each facts as to history and condition on admission. Add to this all the routine of a hospital and its administration, add further the labour of obtaining notes of history and course of illness of some 57 cases previously admitted, and the time and opportunity left for gaining notes satisfactorily full and periodical of each and every case, and a full dismission note about their condition then is small and uncertain. And as a few links lost out of each chain makes any comparison inadequate and unsatisfactory, so it is with my notes. It was impossible I found, singlehanded as I was, to obtain in any one case such a consecutive series of notes of the condition of the various areas of the entire skin surface as to give me a complete panoramic view of its progress, still less was it possible to obtain a series of such perfectly-recorded cases. I shall not, therefore, attempt to classify, enumerate and take the percentages of the observations under the various headings indicated, as relating to the

general character of the smallpox eruption, but shall confine my statements to general terms.

A case is admitted. A glance at him is enough to assure one that he will be a severe case, and will run great risk of death. His face is a fiery, angry red, and somewhat swoollen. It is very hot to the touch, and the fingers feel the prominent papules which may now be detected on looking closer, and the real state of affairs is evidently that there is present a superabundant crop of early papules on very active, wide bases which are so close as to be contiguous, leaving no healthy skin between, and so giving the face its general red swollen appearance. Look at his palate, fauces and pharynx, there is a score of small white vesicles, some umbilicated and some with their centre eaten out, leaving a crater-like cavity. On his chest you find a very large number of small vesicles just beginning, umbilicated, and on red, active bases, which are not very wide and do not touch, but leave intervening channels and straits of white unaffected skin. Over the surface of his abdomen there are a score or two of similar vesicles; they are not so numerous here as on the thorax. Now make him sit up and look at his back. There is a very large crop of "spots". Some you see are still papules, large and flat and on wide, red, active bases.

Some are already vesicating, and you have medium sized and large, as yet unfilled, flat, umbilicated vesicles on markedly wide, red, moist bases. It looks as if the lying on his back had flattened and spread them out, and irritated their bases. The back bears a greater crop than the front. His upper extremities are almost covered by very young vesicles on very active narrow bases. The crop on the lower extremities are not just so far advanced, being yet in the papular stage. His temperature is 101° or 102°F. He is slightly delirious, has a headache and no appetite.

In 12 to 18 hours all the papules have vesicated, and he is in great discomfort. In another 24 hours they are almost fully filled, of medium size and confluent. Now his temperature is about the normal line and he is feeling much easier. His vesicles, however, go on enlarging and in another day he is not just so comfortable. His whole skin surface is very red, and swollen and painful to the touch. He cannot use a bed-pan, it is too painful to lie on, and he insists on being assisted most carefully to the stool at his bedside. His face and neck are getting much more swollen and his features thick and blurred. On the next day his temperature is rising, his vesicles getting yellowish, and ripening into pustules, and his discomfort

is increasing. Just as the "ripening" is setting in, he receives a coat of gutta-percha dissolved in chloroform and painted on over his face. This is done with the hope that it will lessen the "pitting" of his face, should he recover. He feels thankful for this, as his face is now not so hot or painful. But at once the swelling of the face and neck quickly increases, and the eyelids swell till they almost meet and prevent him seeing. His discomfort increases. He is now obviously seriously ill. He is restless, constantly throwing down the bedclothes from his arms and chest, and sleeps little. His temperature is again about 102°F. Next day he is worse. On the following day his pulse is very fast and irregular in spite of stimulant and cardiac tonics. He is now very smelly and the odour from his breath and skin is most repelling. His pustules have given up resemblance to the umbilicated vesicle, and now are filling out with watery, yellow, opalescent fluid, till they may become really round, dome-topped bags of purulent fluid, with walls which are getting thicker. He is now hopelessly ill and he is a most distressing picture of misery and discomfort, shouting loud with pain if any one touch him suddenly or even jolt his bed. He rests neither day nor night, ex-

cept in broken snatches of sleep. He sinks fast, overwhelmed with the poison. But he lives yet for a day and a half or two days. His pustules burst and the skin surface gets sodden, and it is necessary to dust it with Boric Acid and wrap it in surgeons' lint. The walls of the pustules are now really leathery in thickness, and their contents inspissated. He remains mentally clear; can answer questions and express his wants. But his temperature quickly rises and may reach a 104°, 105° or even 106°F. before his death.

Such is one of the clinical pictures presented during such an epidemic. It is only one and there are many.

Here is another clinical picture with illustrations which are enlargements from quarter plate negatives. It was only at the end of the epidemic that I got time to secure some photographic records, and I was fortunate enough to get one or two series of severe cases.

This patient is Mrs Warwick, aged 38 years, who lived in a one-apartment house, which accomodated five persons over 10 years and one child under 10. She sickened on April 11th 1904 and her symptoms were violent. Her eruption appeared on the 13th, she was seen by a physician the same day,

notified to the Sanitary Inspector, and removed to hospital. On admission she presented no vaccination marks, but stated that at 18 months of age she had had an attack of smallpox which was not very severe.

On examination the skin surface generally presented a very red appearance, most marked on the face, and through this rash there presented a copious eruption of very small, raised, shotty papules, and some larger ones. The symptoms of onset were still present, and she was very sick, vomiting frequently.

On the 14th these symptoms had gone, the papules were larger and some attempting to vesicate, and she was much easier and more comfortable. It was on this day, the 14th, that I obtained the first photograph.

Photograph No.I.

In the absence of colour this portrait shows but the general small papular eruption, so small as to be seen with difficulty on the hands, though somewhat plainer on the face. There is little or no swelling of the features, and the patient is obviously in little discomfort.

Photograph No.II.

On the following day, April 15th, this second photograph was taken. On the forenoon of this day she was delirious and very noisy, and not having slept all the previous night, I gave her a hypnotic and got this picture while she was asleep under it. Her temperature this morning was 101°F. but fell in the evening to normal, after she had wakened from a very refreshing sleep. Active vesication was just commencing in her papules, which were still small.

Photograph No.III.

This third photograph was taken on the 16th the day after the second. Comparing it with the first it will be seen how the face and fingers are beginning to swell - these are the parts where swelling is most readily noticed. The face is very red, and vesication is complete and there is a hint even of ripening into pustules. As yet these vesicles on the face are illfilled, and of small size mostly. At the base of the left ala nasi is seen a ring of

such small contiguous vesicles, with a depression in the centre of the ring, the whole simulating a large vesicle with marked umbilication. On the arms the vesicles are much larger and better filled than those on the face, though they are not so matured and showed no sign of pustulation. She was not delirious this day. Her temperature rose from 99·6°F in the morning to 100·8°F. in the evening.

Photograph No.IV.

A great change will be seen on looking at the fourth photograph, which was taken on the 17th. Early that morning maturation was setting in so quickly in the vesicles of the face, that the gutta-percha solution was painted over them, forming a mask as seen in the portrait. The swelling of the face is getting greater, and the vesicles on the arms are quickly filling up and enlarging, and are commencing to ripen. Her temperature on this day was 100°F. in the morning and 102°F. in the evening.

Photograph No.V.

Two days have elapsed between the fourth and this, the fifth photograph, and the changes are obvious. The face has greatly swollen, and so have the arms and fingers. All the vesicles have developed into pustules and greatly enlarged. The patient is now just about her worst, and the offensive smell is very pronounced. It is a great misfortune that the natural colouring is absent from this picture for the effect would have been very beautiful. Her arms are at a stage and in a condition which though they are very painful and uncomfortable and very tender to the touch, are to the observer really very pretty. Picture the forearm and hand somewhat swollen, just enough to give it a graceful rounded appearance. The skin thus slightly distended has a glossy, smooth look, and is of a very delicate, rosy, pink tint. With this as a general back ground, and on an excellent setting of a narrow bright red base, are the well-filled pustules, like flat topped domes, with thin walls through which shines the yellow cream colour of the contents. It is almost like a display of opals in strings and rings and singly. But the patient feels them very uncomfortable, and to give her some relief, her arms are also painted with the gutta percha. Her temperature is now swinging between 100·6°F. in the morning and 101·6°F. in the evening.

Photograph No.VI.

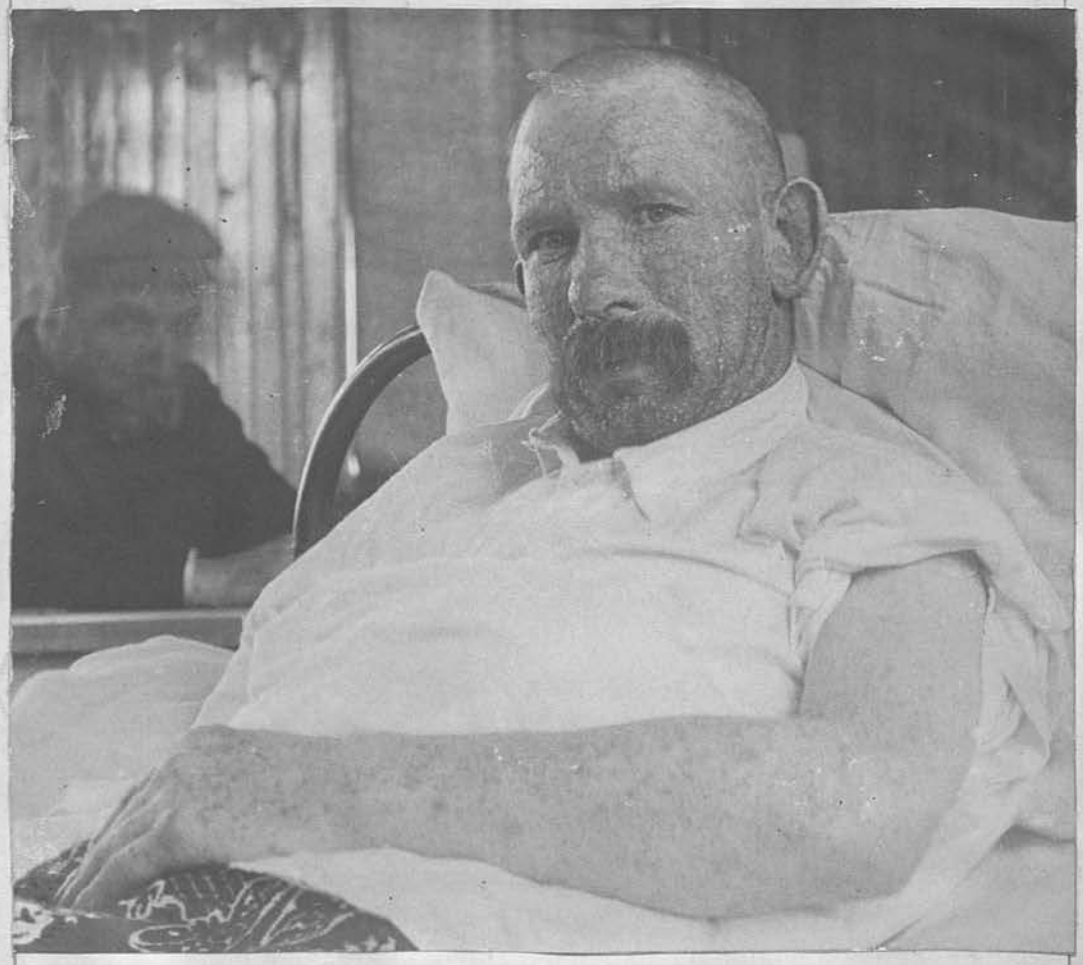
Two more days elapse and on the 21st this sixth photograph was taken. The patient has got past the most active stage of the eruption. She is somewhat easier, the swelling is subsiding, and throwing its gutta-percha coat into folds and wrinkles.

Photograph No.VII.

Five days later, on April 26th this last photograph was taken. It shows the patient in a semi-recumbent position, in not great discomfort, with almost all her pustules dried up either into thick yellow friable crusts as on her face, or into dark brown scales, like the operculum by which a wilk (or whelk) closes the opening of its shell, as seen on the hands and arms. The mask is peeling off her face and arms. In twelve more days she will be allowed to get out of bed and dress, and 10 days later on May 21st she will be dismissed clean. Her temperature since the 20th has not been higher than 100.2°F. in the evening, nor lower than 98·6°F.in the morning. From now on it will gradually fall to normal.

The next series of photographs were taken of a man, John Shaw, aged 40 years who was admitted on April 14th, having sickened on the 11th. His eruption appeared on the 13th, the day before admission. He had some doubt as to whether he had been vaccinated, and showed a very indefinite mark on his left arm which appeared to be his vaccination mark.

Photograph No. VIII.



This first photograph was taken on the 15th, the day following his admission, and the fifth day of his disease, the third of his eruption. His face shows an abundant crop of papules, just about to commence vesicating. There is as yet no marked swelling of the face. The temperature had fallen from 101°F. to 99°F.

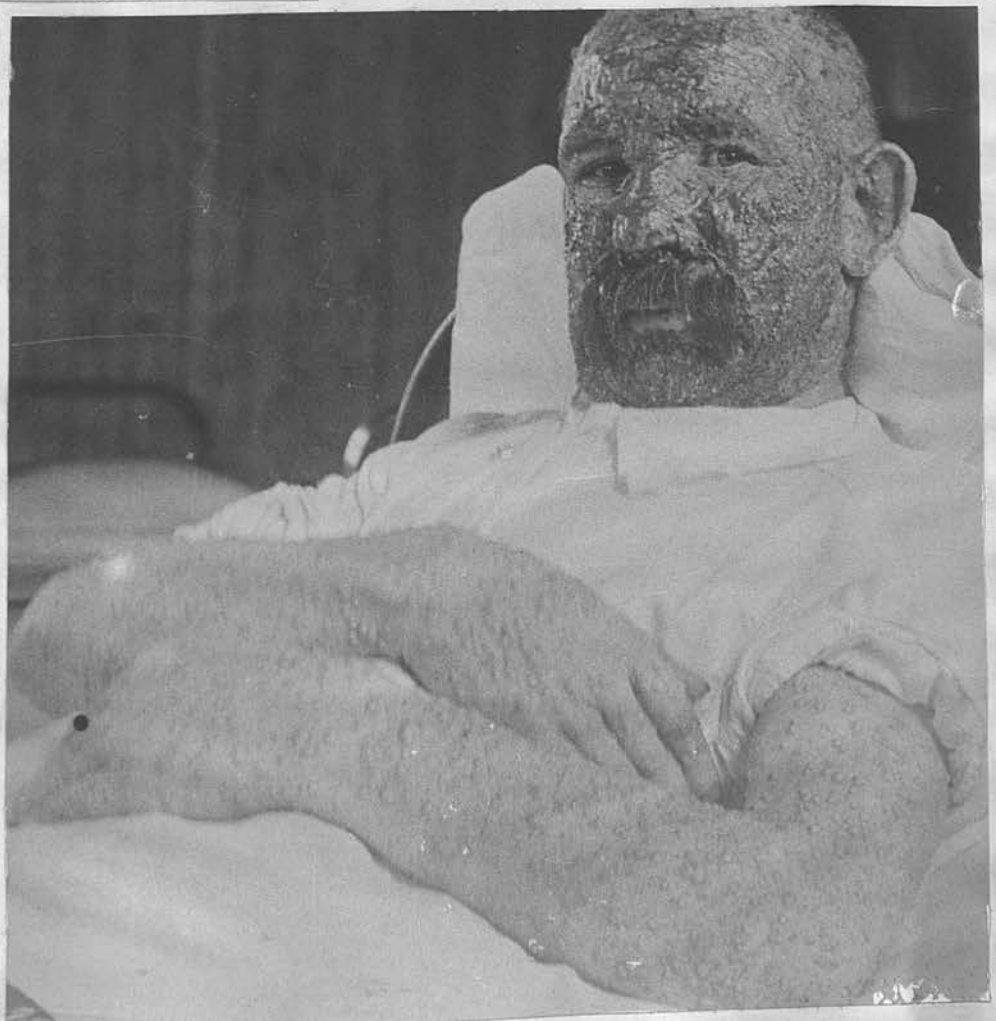
Photograph No.IX.

This photograph was taken on the next day, the 16th of April and the fourth of his eruption. The great increase in the swelling of the face will be seen, and the vesication on the face, while the arms as yet are not so advanced. His temperature, which was 98°F. in the morning rose to 99·4°F. in the evening.

Photograph No.X.

Photograph number 10 shows the condition of the man on the 17th day of the month, and the fifth of the eruption. Here the activity of his eruption has just about reached its height. The face has lost its character, and is bloated, red, hot. The "spots" on his face are almost mature and he has received a coat of gutta-percha paint. Those on his arms, which unfortunately are not in very good focus are obviously larger and better filled than those on the face. His temperature to-day both in the morning and the evening is only 99·8°F.

Photograph No.XI.

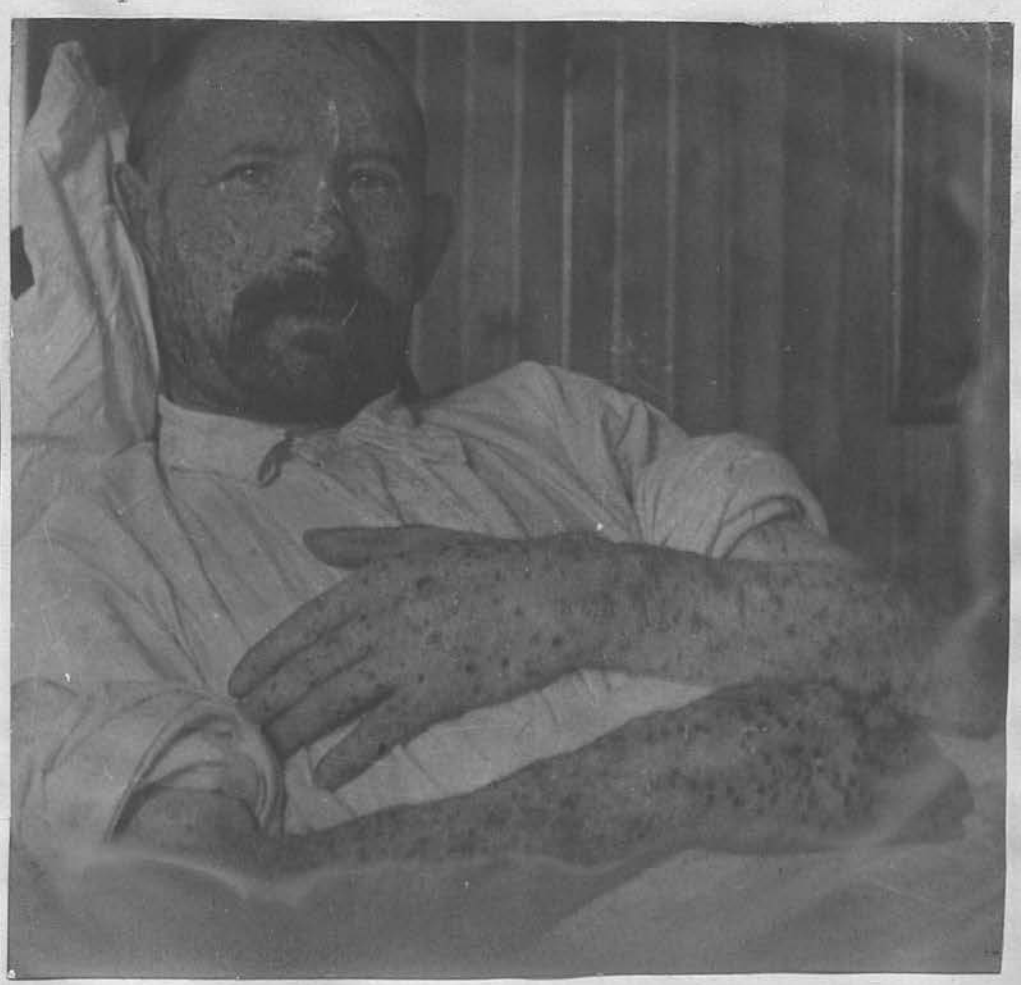


Two days later on the 19th, this photograph (No.XI) was taken. The pustules have now all enlarged, filled up, and ceased activity. The swelling of the face is subsiding and the mask is loosening and coming away. The small bosses on the mask are only casts, as it were, of the pustules as they ripened, not now representing the condition of affairs beneath. His temperature is now never above normal.

Photograph No.XII.

This next portrait was taken on April 21st, the 11th day of disease, and the 9th of the eruption. His face has now resumed its usual characters. The mask has all peeled off and on the skin surface are now yellow and brownish granular crusts, some moist, some dry. His arms (as is usually the case) are not so far advanced as the face, and the pustules are seen in all stages of desiccation. Some have not apparently begun to dry. Some are drying in their centre and getting depressed there (as in those just over the left moist joint.) Others again have become that dark brown scale which I have likened to the operculum of a wilk's shell.

tograph.
o.XIII.



This is the last photograph of this series, and was taken on April 26th - five days after the preceding one. It shows little beyond the fact that all the pustules have dried, and that the face is fast cleaning. He was up and about the ward five days after this, that is on the 20th day of his disease.

The next series is perhaps a better one. It shows more regular vesicles and those on the arms are better reproduced.

They were taken of a man, James Black, aged 31 years, who was vaccinated as an infant in Rio-de-Janeiro and showed five small fairish marks on the left arm. He sickened on April 1st 1904, broke out in an eruption on the 4th and was admitted to hospital on the fifth.

Photograph No. XIV.

This first photograph was taken on April 11th, the 11th day of disease and eighth of eruption. The eruption is now entirely pustular - large well-filled, and frequently umbilicated pustules. This umbilication will be seen at the left wrist. The dark ring round the pustules indicates the narrow red base. The great swelling of the face and neck is well shown. There were so many pustules on his eye-lids and around his eyes that for his comfort they had to be kept covered by wet dressings and a bandage - as in the photograph. He was very uncomfortable, sore and foul smelling on this day, and his temperature was 102·2°F.

Photograph No. XV.

Photograph No.XV.

Photograph No.XV. was taken on April 14th, the 11th day of eruption. It shows how the facial swelling has subsided, leaving the mask, now too large to fit it closely, and peeling off, as the portrait shows. The pustules on the arms are shrinking and flattening, and some are drying at their centre. (Two prints are shown).

Photograph No.XVI.

Two days later on April 16th, I got this photograph, which shows a marked advance on the preceding. The mask is gone, leaving the skin surface of the face almost covered with small friable, granular, sticky, yellow and brown scabs. All stages of drying are well shown on the arms and hands. First there is absorption of the fluid part of the contents of the pustule. This is accompanied by flattening of its top, and then depression, leaving a dark dry umbilication. "The drying proceeds till the "wilk-operculum" condition is reached. These fall off and leave the cicatrix below.

Photograph No.XVII.

Photograph No. XVIII.

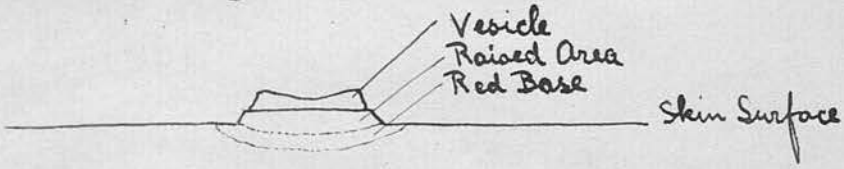
Photograph No. XIX.

The three following photographs, Nos. XVII., XVIII. and XIX. were taken on April 19th, 21st and 26th respectively, and merely show further stages of drying

These cases serve to give in a general way the characters of the smallpox eruption. The majority of the cases were of a very mild and much modified type, and amongst these a typical rash was rarely got. Umbilication was more often absent than present in the vesicles of these modified cases, and many of them could only have been called smallpox in a time of epidemic. At a time when no epidemic was present, they would probably have been unnoticed or called chickenpox. They ran a very rapid course, were never really ill, and the spots were dry in a few days. Many of them were ready for dismissal in 10 or 12 days.

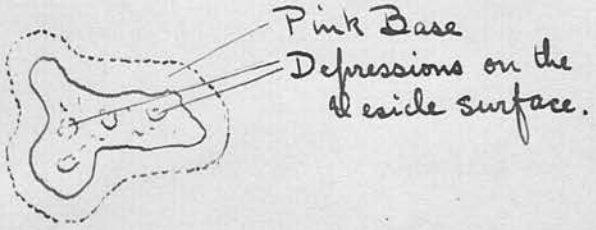
Apart from these variations in eruption, there were cases with peculiar "blae" vesicles. Three of the cases showed this phenomenon very markedly. Amongst the notes taken on admission of one man, I find attention specially called to "Peculiar elevated areas varying in size from $\frac{1}{4}$"x$\frac{1}{8}$" to 1" x $\frac{3}{4}$" most common on the backs of the thighs, but also found on the arms and chest. These are of a deep raspberry-red colour elevated, firm, but not hard, the surrounding skin not reddened, and no attempt as yet at vesication. Their surface was not moist." Two days later the note runs, "The peculiar elevated areas of last note have subsided a little as to their

elevation and colour, and on the surface of each have come out a crop of small firm vesicles. At some areas the vesicles have formed one entire vesicle, which is not well filled, is of a bluey white tint, on a base, which does not seem at all active. This large vesicle is sunk in the centre so that there is a depression large enough to admit the finger tip. There is a leathery feel about this vesicle wall. Here is a diagram of the condition. "



The note goes on, "The inner surface of the thighs show a striking eruption. The skin itself is of a normal colour, but its surface is interrupted by irregular areas, varying in size from a pinhead to a sixpence - only the outline is most irregular. In addition to these irregular areas there is a general mottling of skin between with small, punctate injections, which are not blanched by pressure. These injections are of a quiet pink colour - some are bluish. In contrast to this the small pin-head 'irregular areas' have a vivid pink colour which is limited to a very narrow ring or zone around a very small central vesicle, and abruptly distinct from the surrounding skin. The larger 'irregular areas' have the same characteristic base, but the surface of the

vesicle is peculiar in colour, shape and feel. The colour is almost gray. As to shape, instead of one central depression there are several dips on the surface. To the finger it feels peculiarly leathery. One is of this shape."



Two days later this occurs in the note, "Inner surfaces of thighs have the vesicles now much filled up, and of the colour of a recent bruise."

This description of these "blae" varieties of the eruption is what might be applied to the other two with slight alterations. This man was never considered a serious case, and he recovered without delay, being out of bed a week after the note from which the last extract is taken.

The only point which is emphasised in the second case is the vivid pink tint of the zone round the area.

The third case was a severe one and the colour of these eruptions led to the fear that he might develop into a haemorrhagic case.

There is a type of eruption which I got into the habit of calling "suppressed". The vesicles are small, very ill-filled, and of gray, rather than a pearly colour. The bases are small and may not be very red. The rash is usually very abundant, but the vesicles never properly fill up. The patient is usually delirious, restless and sleepless. The pulse is small and quick, and the breathing is rapid. The patient seems to suffer from a profound poisoning and the presence of a "suppressed" rash makes one very anxious as to the result in the case. Usually they die, but I have seen such considered quite hopeless yet recover.

Mrs Donnachie, our last fatal case, was one of such a type. She was 26 years of age, had never been vaccinated, and repeatedly refused vaccination though offered to her free of cost, even after her daughter took smallpox. It was only when she sickened and feared she was taking the disease that she requested vaccination, whichwas given, and which ran a concurrent course with the smallpox.

Photograph No. XX.

This first photograph of her I have printed darkly, trying to bring out the early papular eruption which does not show up very well. It was taken on April 24th 1904, and shows her at a very early stage, and the vaccination mark on her arm.

Photograph No. XXI.

This second photograph was taken on the 29th. Some wet weather in the interval did not give me enough light to get a satisfactory negative till this date. It shows how literally she is covered with the eruption, how small and ill filled the vesicles are, the swollen face and limbs, the open mouth to lessen the respiratory difficulty, and the apathy of the patient. I hardly think she took any real notice of affairs around her. Her temperature this day was 104°F. in the morning and 102°F. in the evening. Her pulse was 130 and 120.

Photograph No. XXII.

This last photograph was taken the next day and two days before her death. The flat, ill-filled, "suppressed" condition of the eruption is well shown.

METHODS OF DRYING AND CLEANING.

I have mentioned already, in passing two of the methods of drying I observed amongst the cases.

1. There was the "crust". Here the pustule dried and left a friable, granular, somewhat sticky crust, which got drier and drier, and crumbled away. This was usually the method of drying on the face, but it was not limited to that area. It often occurred on the arms and on the chest. I have noted at least half a dozen cases where these crusts on the chest and arms in place of drying and crumbling and falling off began to grow, by accretion from underneath. They took on a ropioid character, and increased till they found a cone with a base about the diameter of a halfpenny. On pressing these horny sort of pyramids, some fluid purulent discharge would come from underneath. I ordered usually in these cases that the crusts should be poulticed off with starch poultices, and an ointment of 10 grains Acidi Salicylici in 1 ounce of Lanoline applied. After removal of these crusts a soft pink base was found, like a halfpenny in size, with the cicatrix of the original pustule in the centre. This base was not cicatrical, except at the site of the pustule for under the ointment it resumed the normal, healthy con-

sistence and colour of the skin.

2. The other method of drying I have got into the way of referring to as the "wilk-lid" method, on account of the resemblance of the dry brown scale to the operculum of this well-known salt water molusc. It usually fell off and left a dry, healed, small cicatrix.

3. Some few cases underwent a desquamation of the cuticle of the skin similar to that occurring after Scarlet Fever, but their numbers were few. Peeling of the skin on the soles of the feet was a condition leading to a lot of trouble and detention of the case in hospital for a protracted time. It usually occurred in severe cases, and in those who had had a considerable crop of pustules on the soles of their feet. Frequent soaking in hot water, and scrubbing with a brush had to be resorted to. Finally they had their feet treated by a wet dressing of 1 in 2,000 Corrosive Sublimate Solution for two nights before dismissal.

4. One other method of drying I shall mention. In this case some of the pustules seemed either to burst, and so spill their contents, or these contents were absorbed without drying. At any rate the con-

tents were removed from under the thin walls of the pustule, leaving them wrinkled, collapsed and moist, like wet tissue-paper on the surface.

Usually after drying and cleaning the skin was left soft and healthy, with the thin, pink cicatrices of the eruption dotted over the surface, but sometimes the victims of the disease did not get off so easily; but were troubled by one of two conditions, which necessitated a long and weary wait in hospital, before they could be considered fit and safe to mix with the general public.

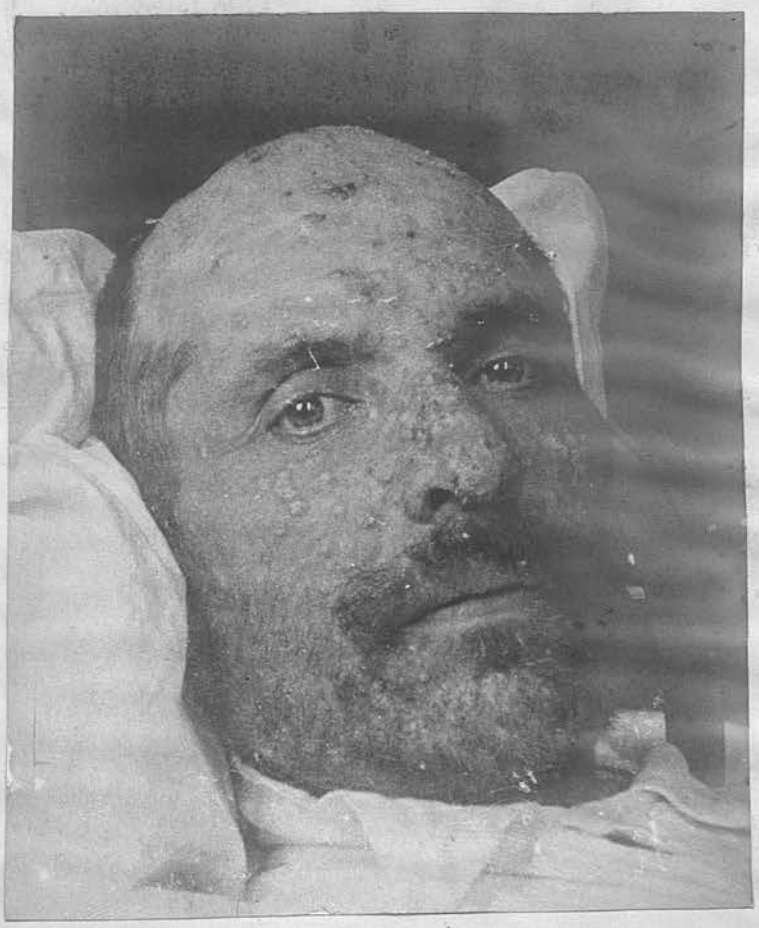
I have two photographs to illustrate these two conditions.

ograph
XXIII.

This first photograph represents the "warty" condition of the skin of the face,which was left, usually after a severe illness. On most occasions it was limited to the alae nasi and adjacent malar surface, but in this case it is of much wider distribution, and much greater prominence. His nose, his cheeks, his chin, his eyebrows and forehead, have all been affected by this warty condition. It is worst just at the angles of the nose, and on the check below the eye. The whole skin surface is one large wart, of a dull morbidezzo tint, very rough, broken up by sulci, easily made bleed, and very slow to subside. It is very disfiguring, but I cannot say whether or not its presence indicates that the patient is still infectious to the unprotected public. Lest it should be,these unfortunate patients were kept inside the hospital for weeks after they were otherwise clean, and they thought it a great hardship. Even if it had been non-infectious, it was not a very sightly condition in which to discharge a patient. This patient was 51 days in hospital, and the dismissal note runs, "Still considerable rough wartiness of the nose, cheeks and forehead. This condition rapidly improved in the last week of residence, and the patient attributed this to his wearing each night a mask of lint with an ointment between it and the skin

of 10 grains Acidi Salicylici to the ounce of Vaseline."

Photograph No. XXIV.



The other condition, which might be left after the cleaning of the face, was that shown in photograph No.XXIV. Here after the mask and the scabs had gone were left on the sites of the original papules round, firm (but not hard) eminences, of a pinkish colour, and to the eye and finger like the soft pads of a kitten's paw. These usually took from 10 days to a fortnight to shrivel down to small

rough areas. I have seen them break down at their summits into pustules, and almost appear like a second crop of a much modified character.

MOUTH AND THROAT IN SMALLPOX.

Turning now to consider the condition of the mouth and throat in smallpox, the first part to engage our attention is the tongue. There was usually little to note about the tongue. In mild cases it was moist and clean almost always. Even in severe cases it might be clean. I have noted six severe cases where it was clean and three where it was moist and clean. It might have a coating on it from a slight fur to a dry brown coat or a very foul wet thick coating. The tongue might show papules or vesicles though not usually many in number. In the most of cases these were situated on the dorsum, but in not a few they were ranged round the edges. In one case they were present under the tongue.

The palate often presented an eruption of spots. These might be papules or even vesicles. Most often the moisture and juices of the mouth had so acted on them as to give them an opaque white or yellow appearance, and to have digested out their centres, leaving a jagged "crater". Sometimes the spots were opaque, yellow, irregular patches of a size about $\frac{1}{8}$ x $\frac{1}{6}$ of an inch. Often the palate itself was very red and much swollen, but in other cases it was of its normal colour, only the bases of the spots were red and inflammed looking. Spots are found on the palate more often than on other areas in the mouth. Sixteen out of 75 severe cases noted showed no eruption on the palate.

The most frequent note about the fauces is that they were red and swollen. Seldom is the presence of vesicles recorded, though small patches like fibrinous exudates are sometimes mentioned.

In 9 severe cases, I have specially noted that the tonsils were not enlarged and showed nothing on their surface. Usually, however, one expected to find tonsillar enlargement in severe cases. Some showed spots on the tonsil surfaces, but many showed a general or a patchy coating which was probably a fibrinous deposit.

The posterior pharyngeal wall often showed spots. Sometimes they were the opaque white or yellow "craters" mentioned. Sometimes it was the small irregular opaque yellow patches which were present. Occasionally the crop was so plentiful as to give the appearance of a thick opaque redundant membrane, which was evidently a confluent patch of vesicles.

In 34% of the mouths noted the palate was the only place to show an eruption, and in 16% it was the palate and pharynx only. In 9% the pharynx was alone affected.

TREATMENT.

In the absence of any specific antitoxic or antimicrobic treatment there is little to be said on the subject of treatment that is new or of note.

The patients should be kept in bed until the pustules are all dry, in a well aired apartment, whose temperature can be easily regulated. While their temperature is raised and the eruption is progressively active, the diet should be restricted to milk, and where there is no diarrhoea, soups. No blankets should be permitted next the skin, as the fluff would stick to the pustules and scabs and irritate them. The soiling of the cotton or linen sheets is so great as to require frequent changing. As the vesicles attempt to ripen, we made it a rule to paint the face at all events with a thick coating of a solution of gutta-percha in chloroform. This relieved the discomfort of the part (though it was usually attended by great oedema of the face in severe cases) and covering the pustules from the air seemed to lead to less destruction of skin, with a result that the scarring was often wonderfully slight. We had no red glass apartment and so were unable to make any observations on that form of treatment.

To obviate the risk of pneumonia and other chest complications it seeme as well in severe cases to put

on a "pneumonia jacket",which is a double fold of gamgee tissue with a hole cut for the head, one fold passing down the back and the other down the front of the chest. This ensures that the patient cannot lie only practically covered by the bedclothes, and exposed to the chances of a chill. As the pustules get full and begin to burst, it is necessary to apply some dressing of a mild antiseptic nature and dry. The kindliest seemed to be to dust the surface with fine powder of Boric Acid and cover with soft white lint, fixing the dressing with gauze bandages. To prevent the eyelids sticking together and to treat the suppuration about them, it is enough to apply wet boric dressings. Douching of the nose is much needed in severe case, for the nasal passages get blocked with dried discharges. Gargles for the throat both antiseptic and soothing are required. The tongue and lips must be frequently, almost hourly, moistened and cleaned in acute cases. Abscesses must be opened when they form, and ulcers treated in the usual way. Crusts should be poulticed off and their bases treated with a mildly antiseptic ointment or dressing. Complications and symptoms may be treated as seems necessary at the time. Morphia seems a sufficient and safe hypnotic in most restless cases, though the dose must often be very large. In

very pronounced delirium I found sulphonal act well. It often occurred, where the hair had not been cut sufficiently close on admission, or had grown subsequently, that great thick scabs formed amongst the hair which were very firm and most difficult to remove. Many plans of softening these were tried, but the one which answered best was that in which the patient rubbed soft soap in amongst them at night, wore a covering over this of gutta-percha tissue held on by a bandage, and in the morning lathered the head up in hot water. This was done on consecutive nights till all had come away. Two or three nights were usually all that were needed. The treatment of the soles of the feet by strong corrosive sublimate lotion has been already described.

TEMPERATURE.

The study of the temperature charts is very interesting. The variety is great. Surprises meet you at each bed. Where you have a severe case you may be astonished at the small rise of temperature, and where the case is evidently mild you may be again perplexed with a higher temperature than would be looked for.

At the same time there is a type which can be seen in part or in whole in very many of the charts. The typical chart is that in which the temperature begins to rise on the day of sickening and rises rapidly till the rash is fully established in the papular stage. At this time the mercury may register 102° to 103°F. There is then usually a very rapid fall to or about 98.4°F. accompanying vesication. As the vesicles begin to ripen and become pustular, the temperature again rises and in 3 or 4 days, when the greatest activity in the pustules has been reached, and they are fully matured, when the temperature may reach a height usually as high as or higher than that of the eruption of papules, and varying from 102° or less to 103° and even 104°F. The temperature usually falls again

after this, though not with the abrupt character of the first fall, and in 5 to 8 days may come to normal, provided uninterrupted drying goes on. Should however any abscess or other septic activity occur, a third elevation of temperature may take place, taking the form of a low morning temperature and a high evening one. As sepsis is overcome this see-sawing of the temperature gradually subsides by smaller and smaller oscillations till it reaches its normal.

I propose now to give a series of copies of temperature charts with some comments upon them.

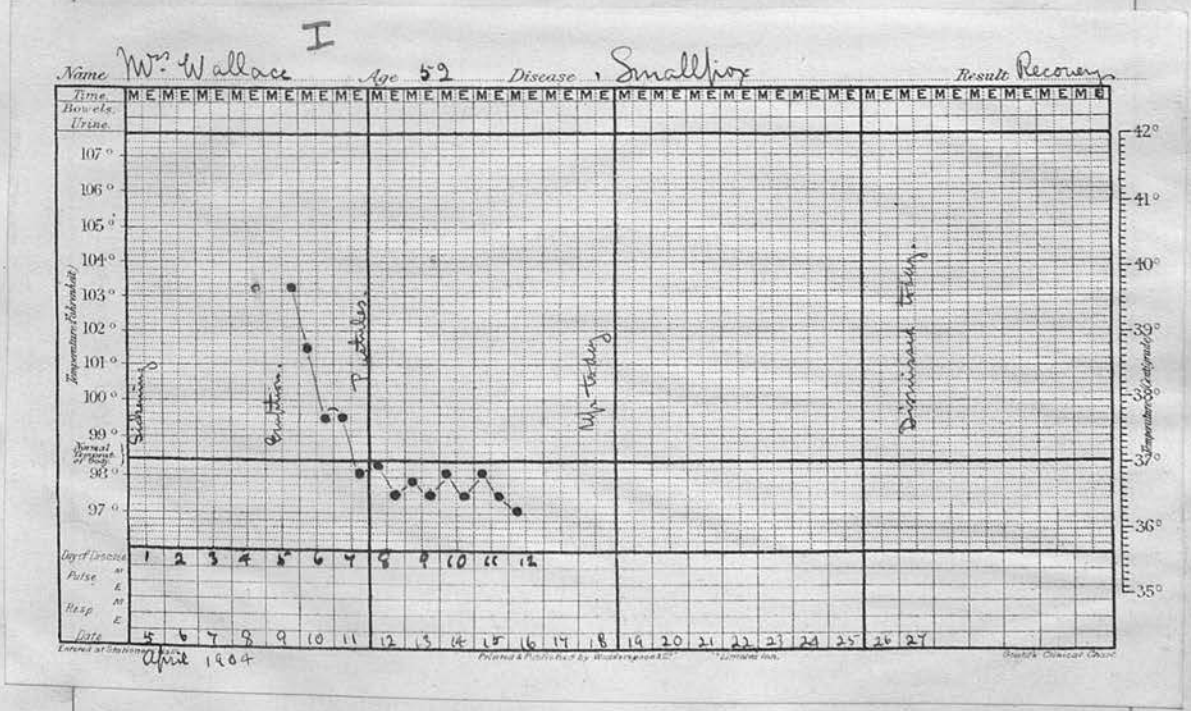


Chart I. shows the eruption occurring on the 5th day of disease, when the evening temperature stood at 103.3°F. It shows the rapid fall to 98° on the 7th day when the eruption was already ripening, and no subsequent rise. This was a mild case.

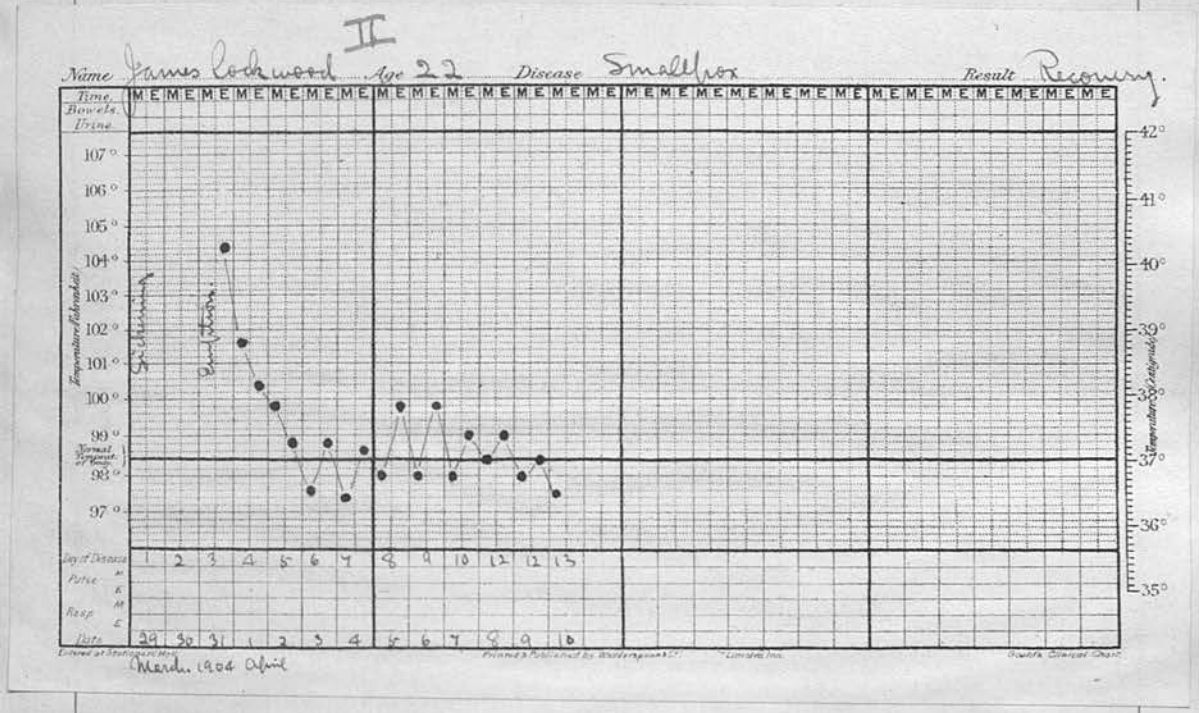
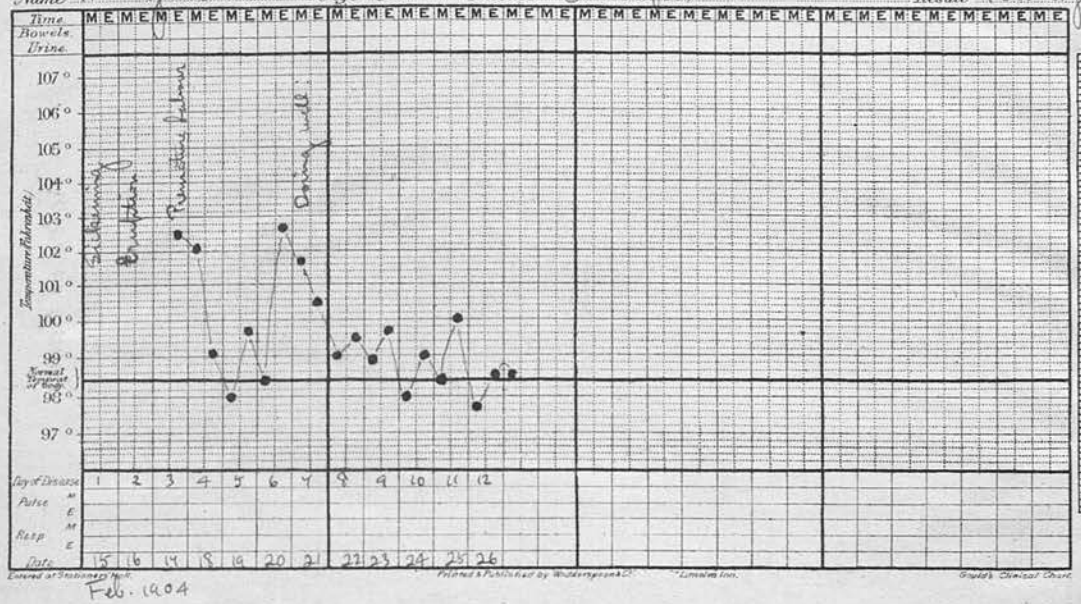


Chart II. shows an eruption occurring on the 3rd day, when the temperature stood at 104.4°F., followed by a similar rapid fall to about normal.

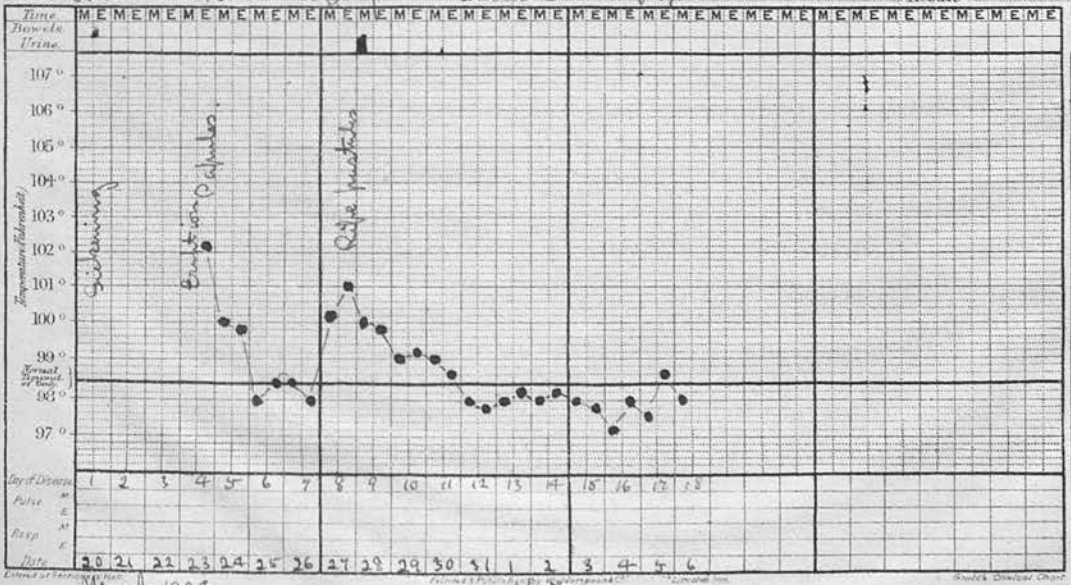
III

Name Wm Galbraith Age 26 Disease Smallpox Result Recovery.

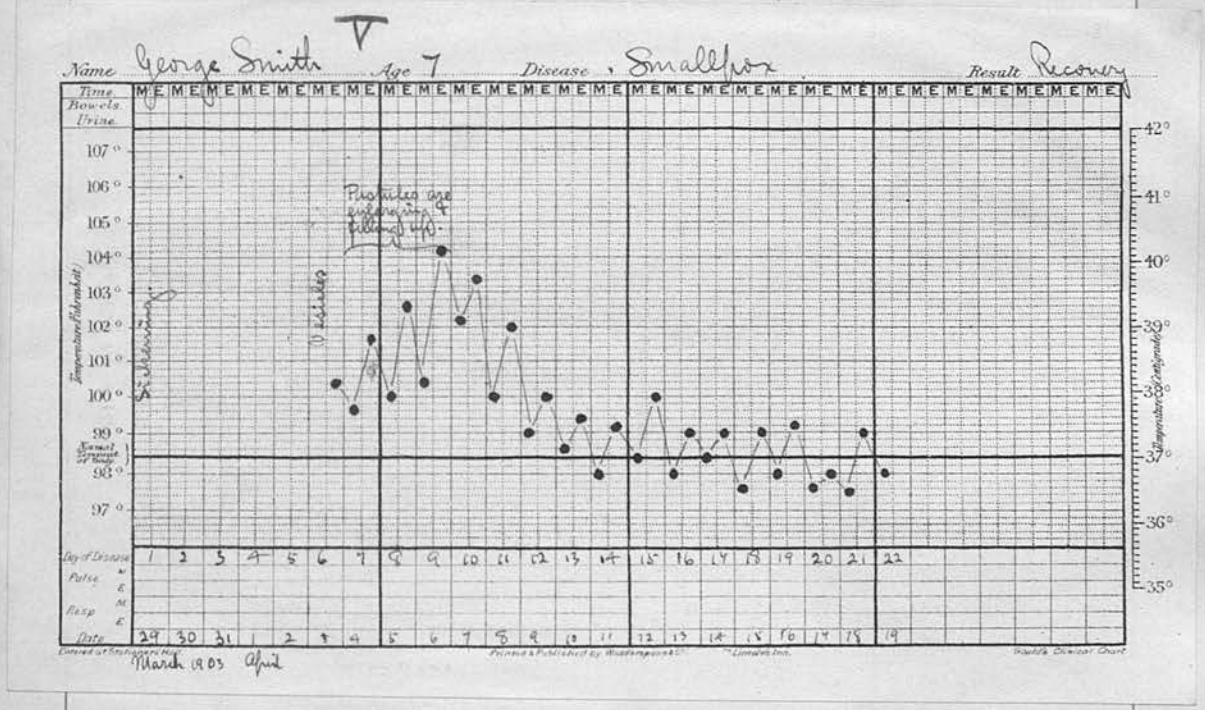


IV

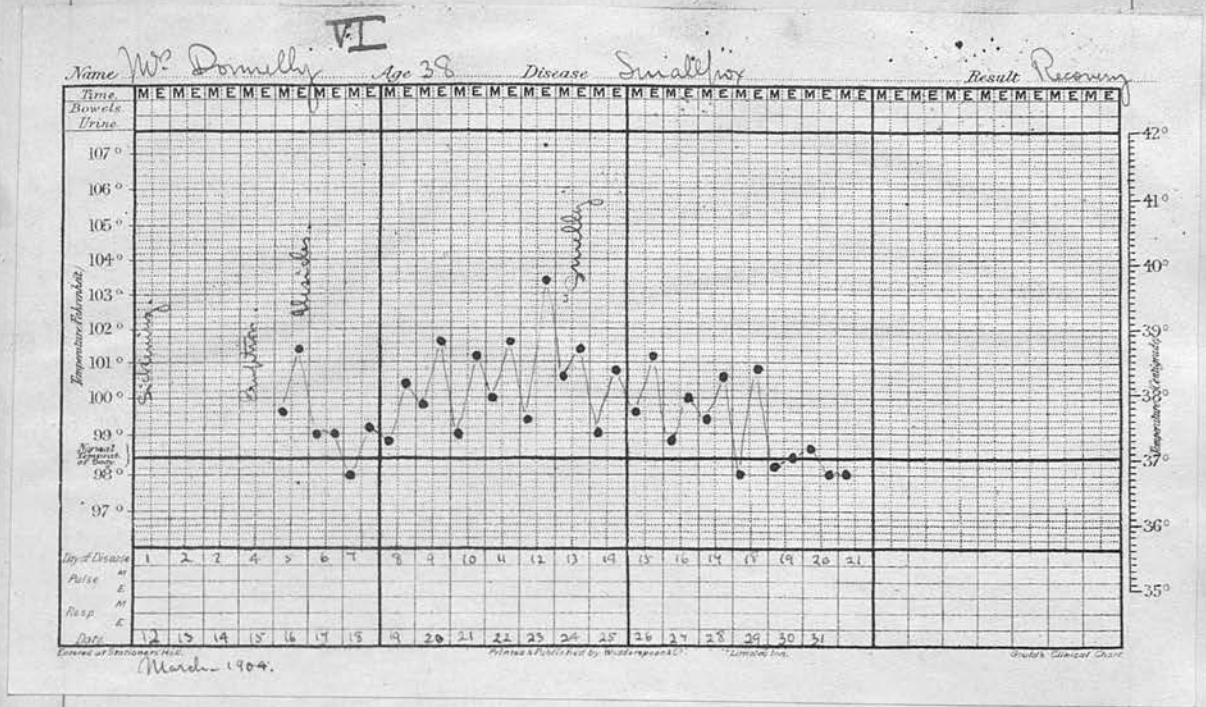
Name Thos. O'Neil Age 9 Disease Smallpox Result Recovery.



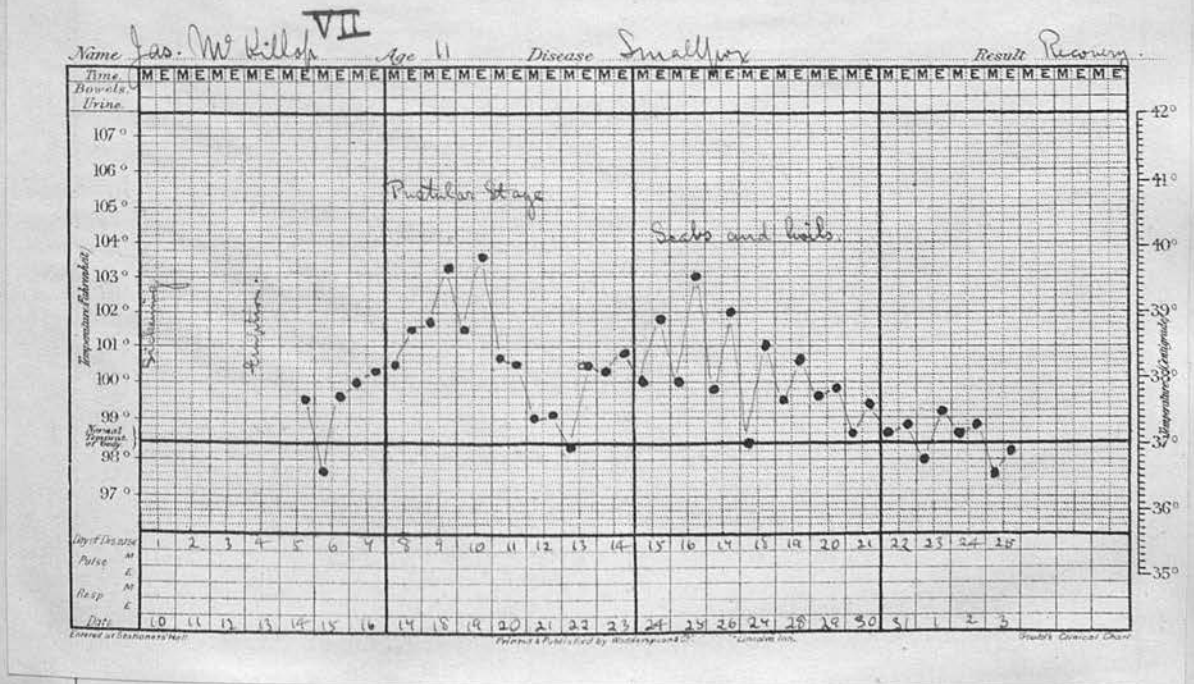
Charts III. and IV. show two elevations of temperature. There is the primary when the papular eruption comes out, followed by an abrupt crisis, and a subsequent rise from the 6th to the 8th day of disease due to maturation and activity in the pustules. The subsequent fall in pretty rapid in III., less so in IV.



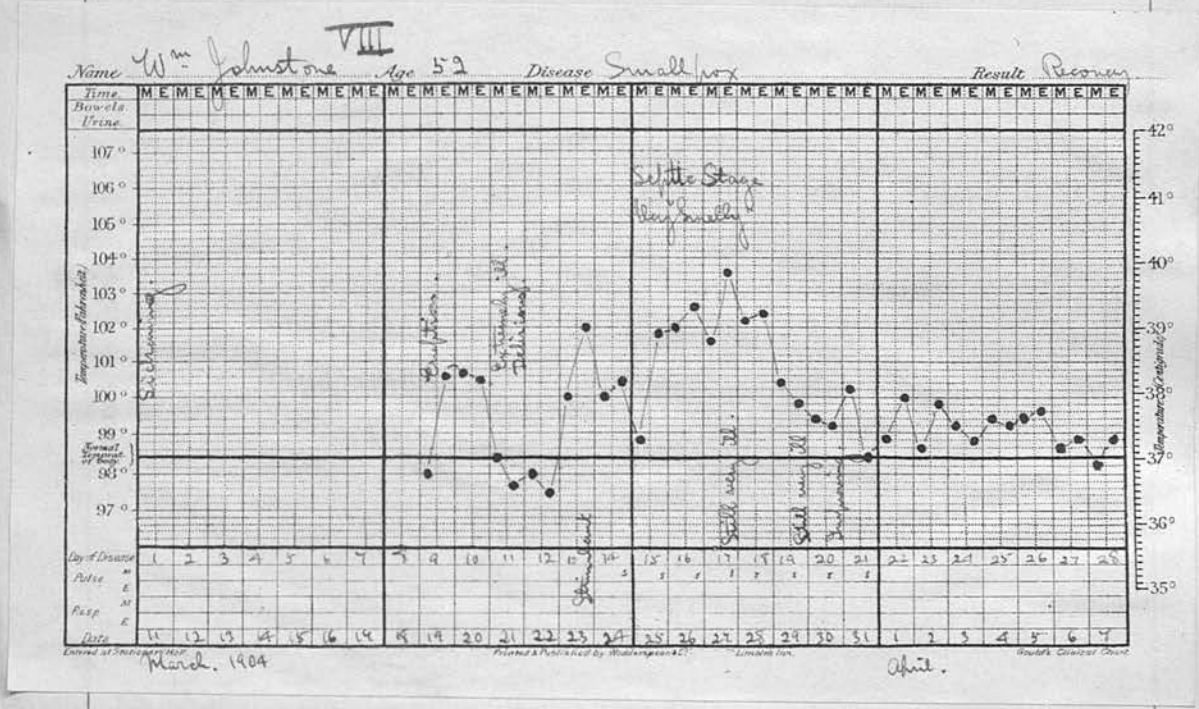
In Chart V. the primary rise and fall have not been obtained. The second elevation however is traceable, reaching a height of 104.2° on the 9th day of disease, and falling gradually to the normal with no subsequent marked elevation.



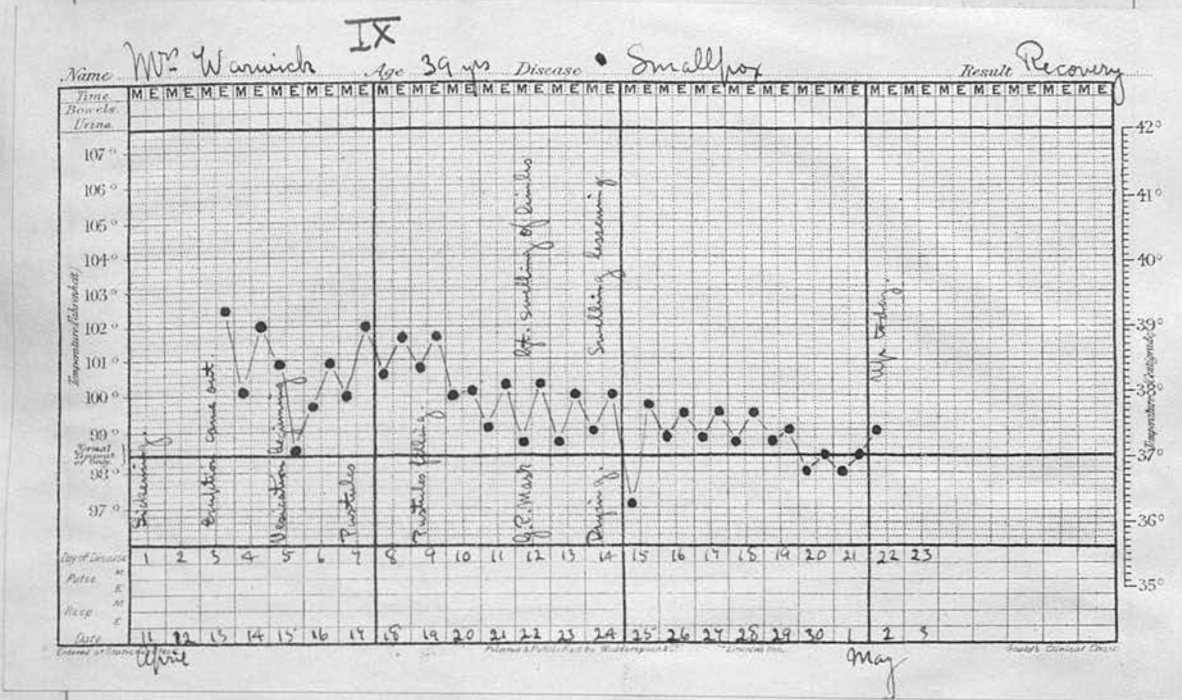
In Chart VI. also the eruption temperature has not been got, though part of the first fall is recorded. The second rise is traceable, but is not great, and its fall in protracted and intermittent.

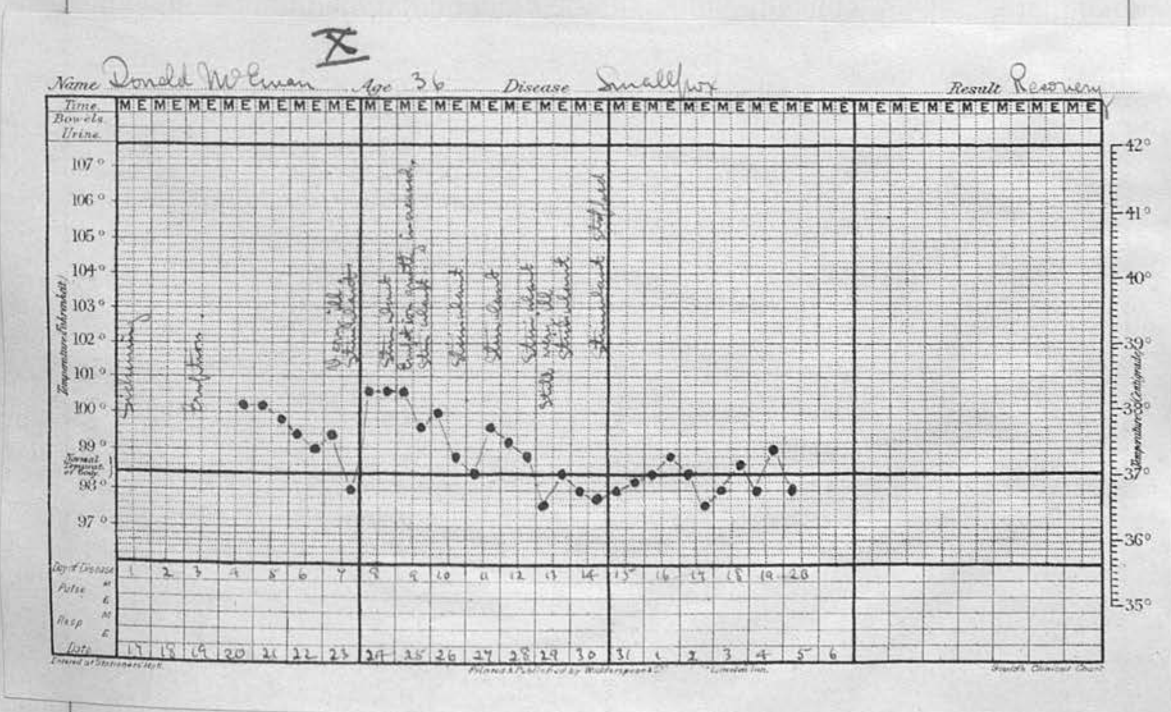


Three elevations are represented in Chart VII. The primary one is only indicated by the tail of its fall. The second rise, that due to maturation, is marked. The third, which commences in this case on the 13th day of disease, is due to septic activity in the shape of scabs and boils.



The same three elevations are indicated on Chart VIII., the eruptive one occurring on the 9th day, the maturation rise beginning on the 12th, and falling again to 98.8°F. on the 15th to rise again for the third time in an elevation due to septic activity.


IX
Name Mr Warwick
Age 39 yrs
Disease Smallpox
Result Recovery
Sickening
Eruption came out
Variation beginning
Pustules
Pustules filling
J.P. Wash
Lt. swelling of limbs
Drying
Swelling lessening
Up today
April
May


X
Name Donald McEwan
Age 36
Disease Smallpox
Result Recovery
Sickening
Eruption

The next two charts, numbers IX. and X., I have introduced here mainly to show how the temperature chart may not indicate the gravity of the case from which it was compiled. Both these cases were very severe, the former being the patient whose photographs were the first given and described when discussing the characters of the smallpox eruption, the latter of a patient who had to be freely stimulated so ill was he. Yet in neither case does the temperature look alarming. The type of the standard chart may be traced here and there in them, but they do not conform at all strikingly.

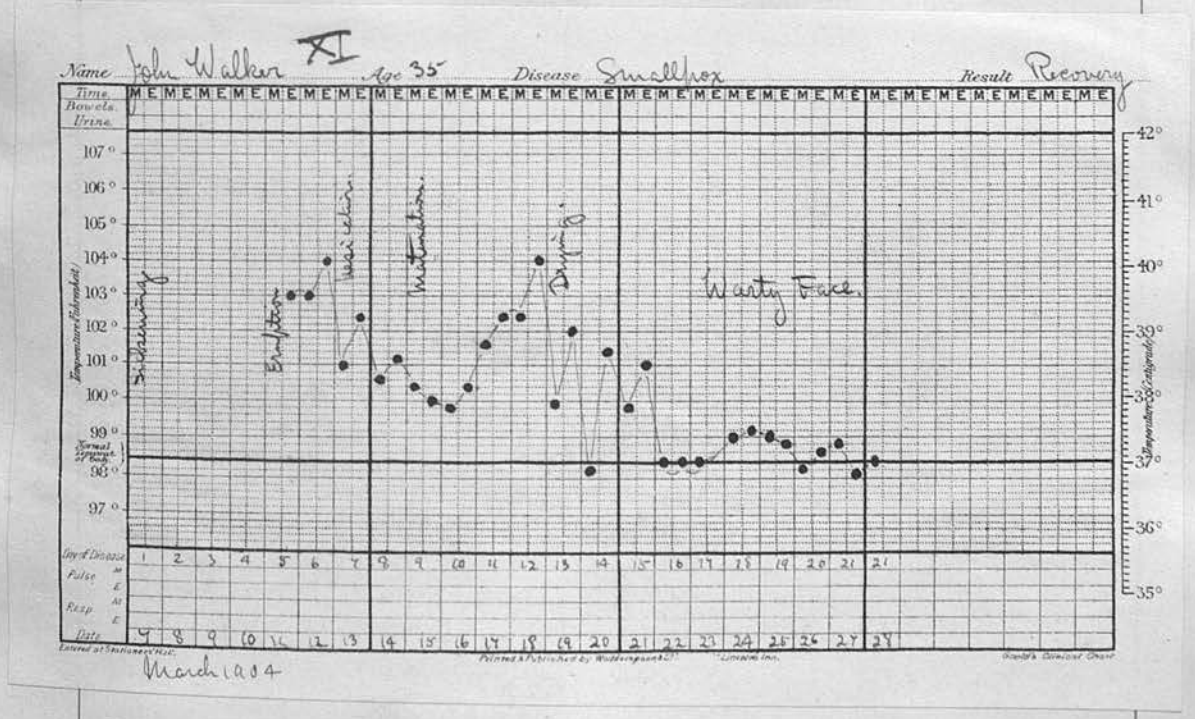
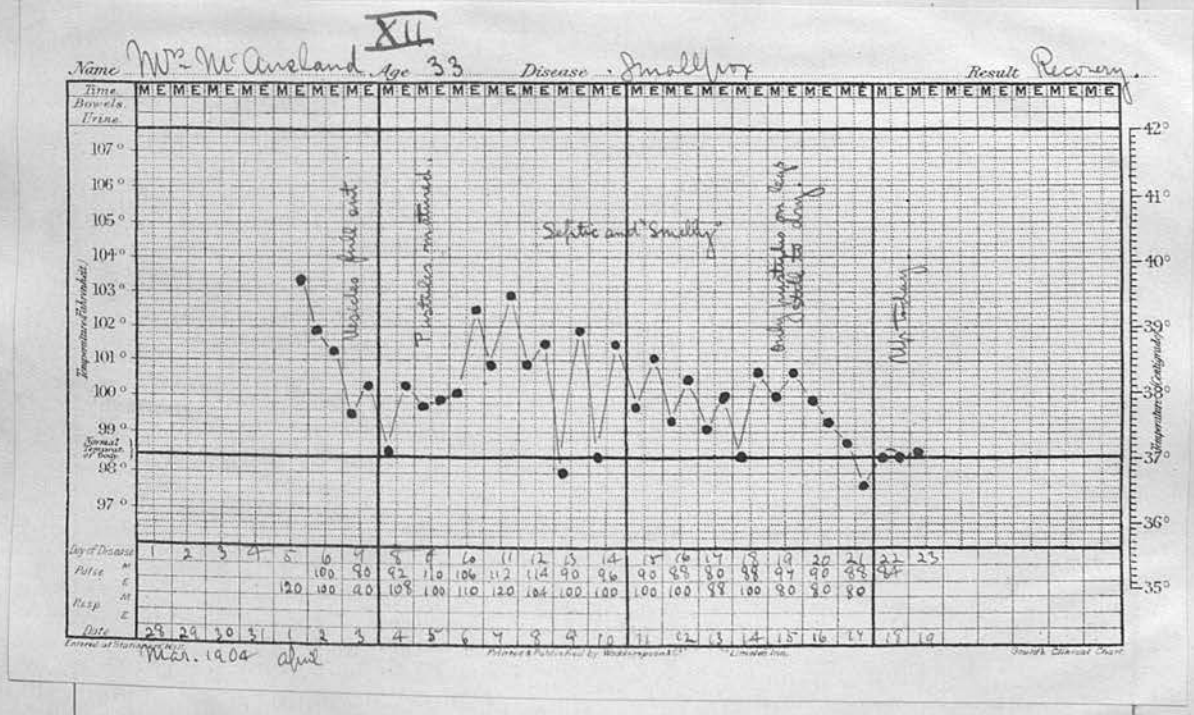
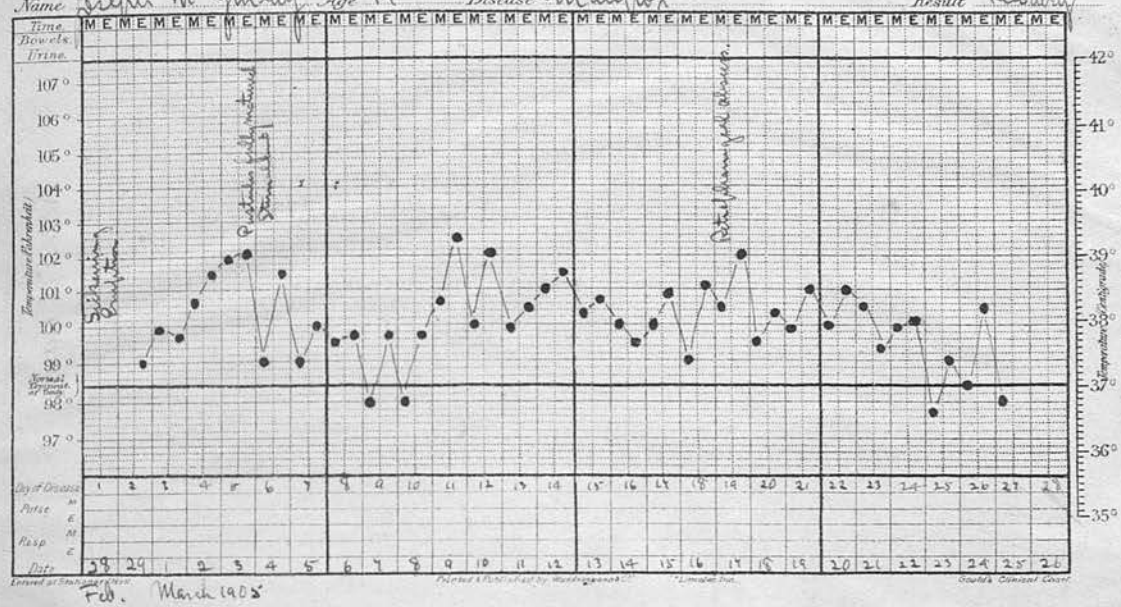


Chart XI. shows how the type may be not only difficult to trace but even reversed. Instead of the expected fall on the day after the eruption there is actually a rise of one degree; and in place of a second rise of temperature as maturation is proceeding there is in fact a fall. This was a severe case whose rash was somewhat of the suppressed type. He was the patient who best showed the warty condition of the face, whose photograph I have given (No.XXIII.)



XIII

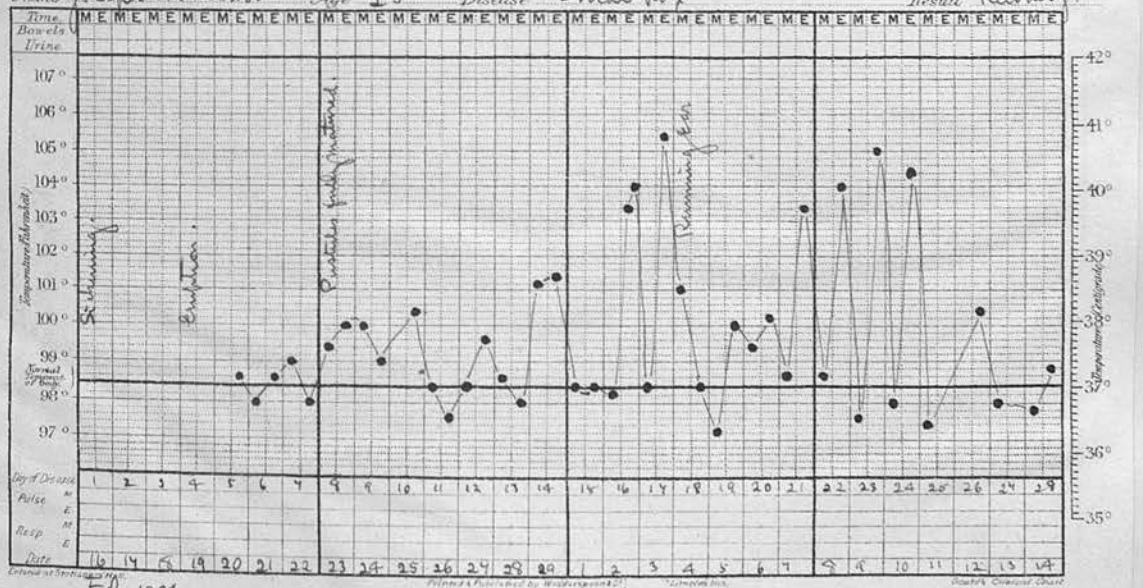
Name Joseph McGinley Age 19 Disease Smallpox Result Recovery



Feb. March 1905

XIV

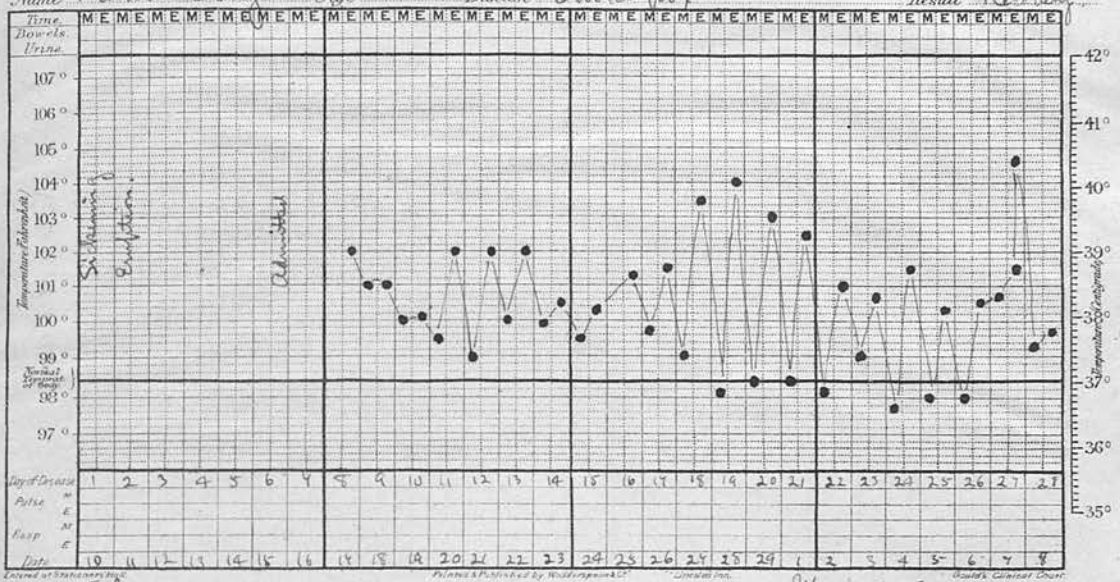
Name Joseph Hoddart Age 23 Disease Smallpox Result Recovery.



Feb. 1904 March

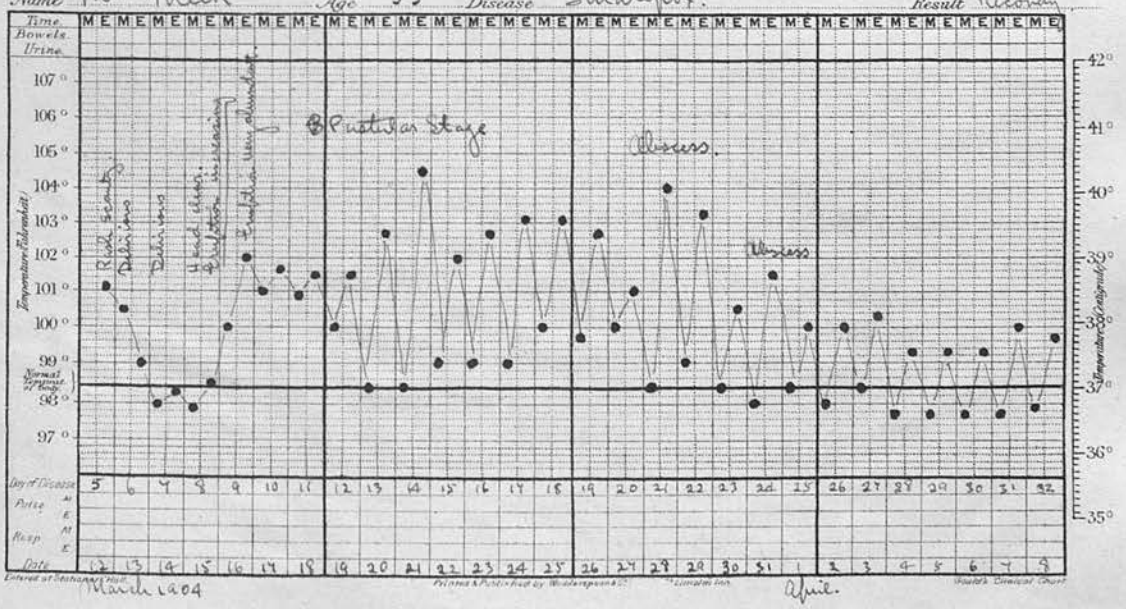
XV

Name Patrick Dougan Age 15 Disease Smallpox Result Recovery



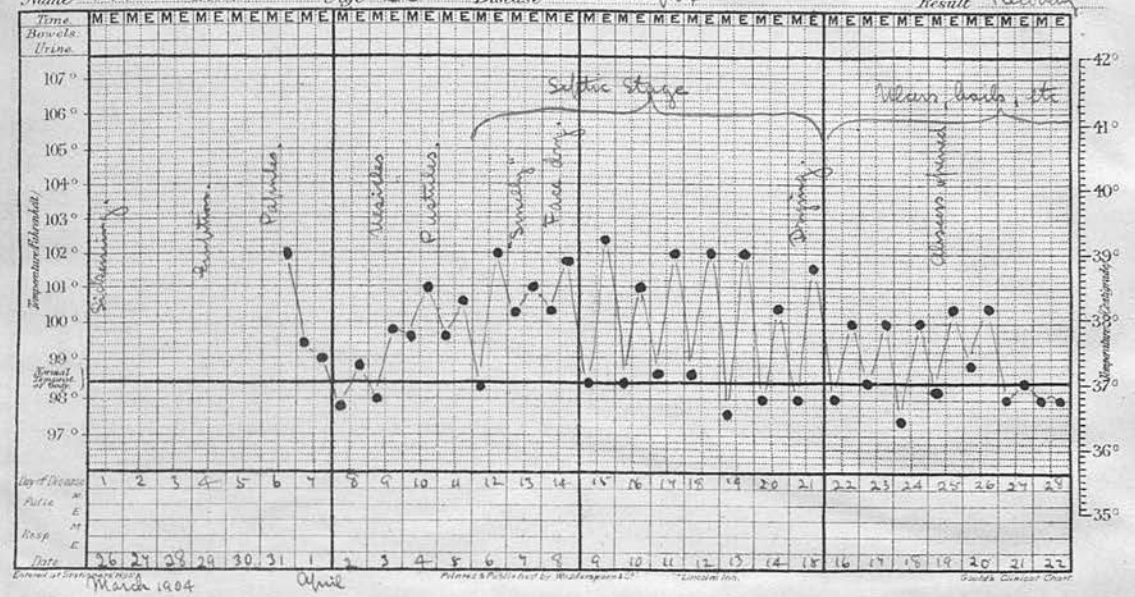
XVI

Name Mr. Mack Age 35 Disease Smallpox. Result Recovery



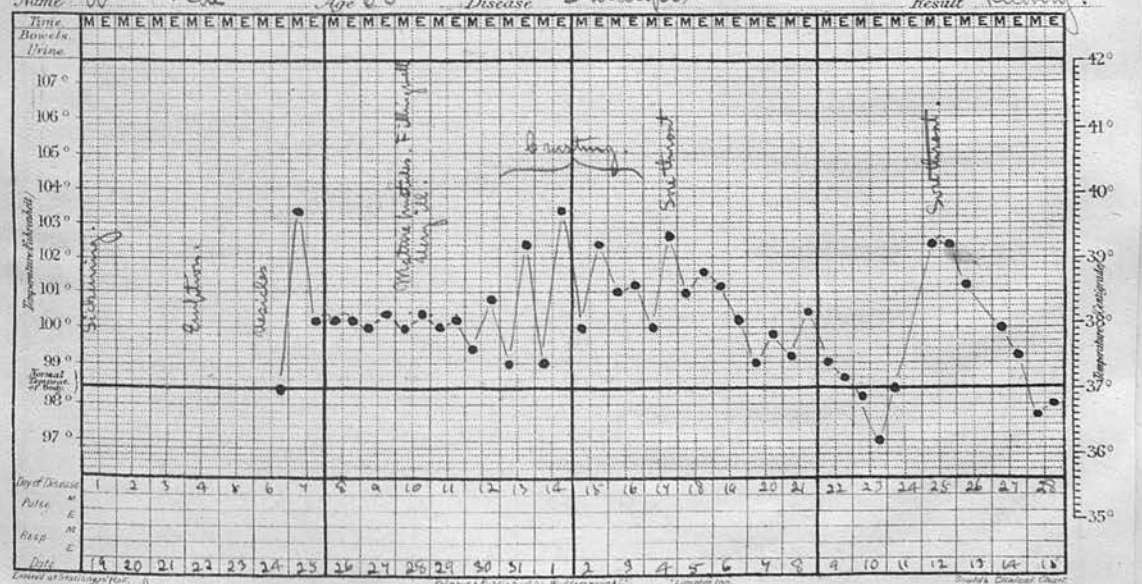
XVII

Name Robt. Rennie Age 26 Disease Smallpox Result Recovery



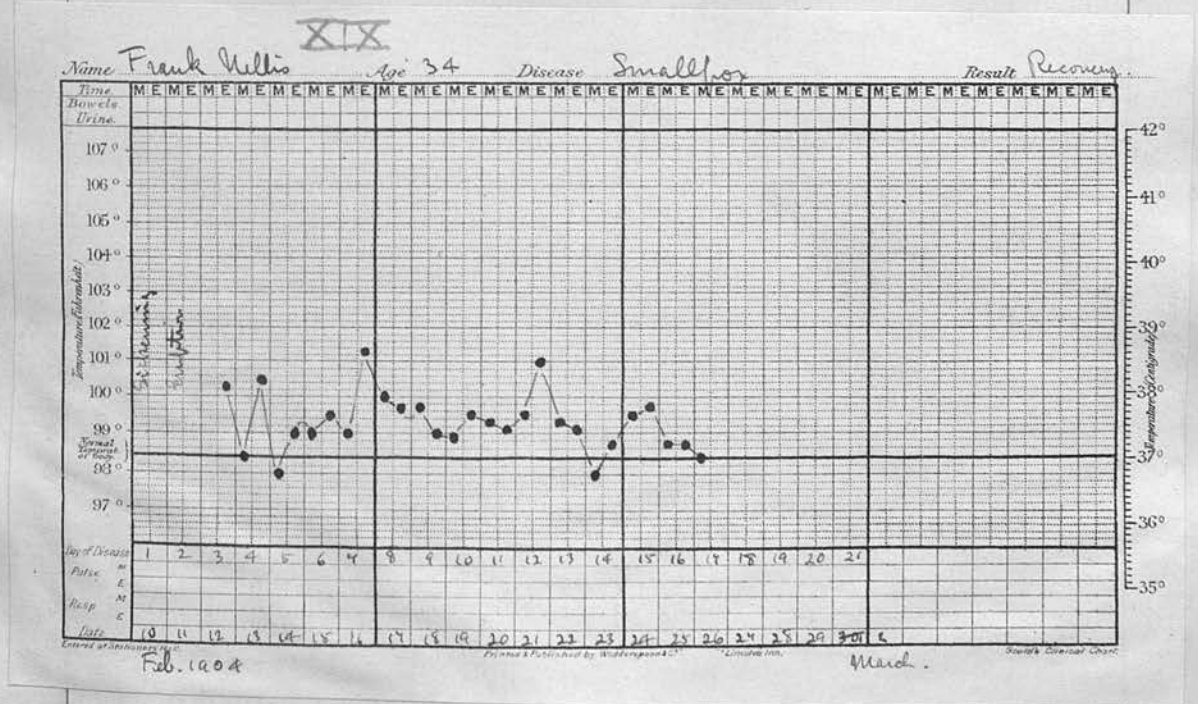
XVIII

Name Wm. Rae Age 60 Disease Smallpox Result Recovery.

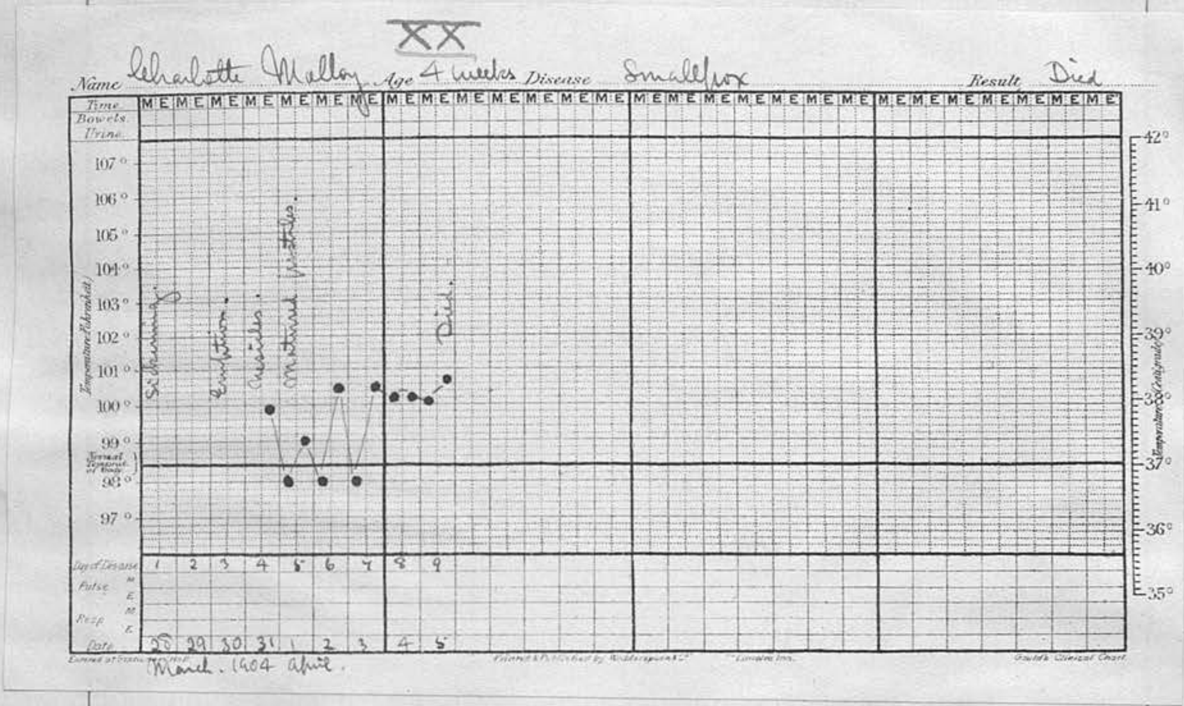


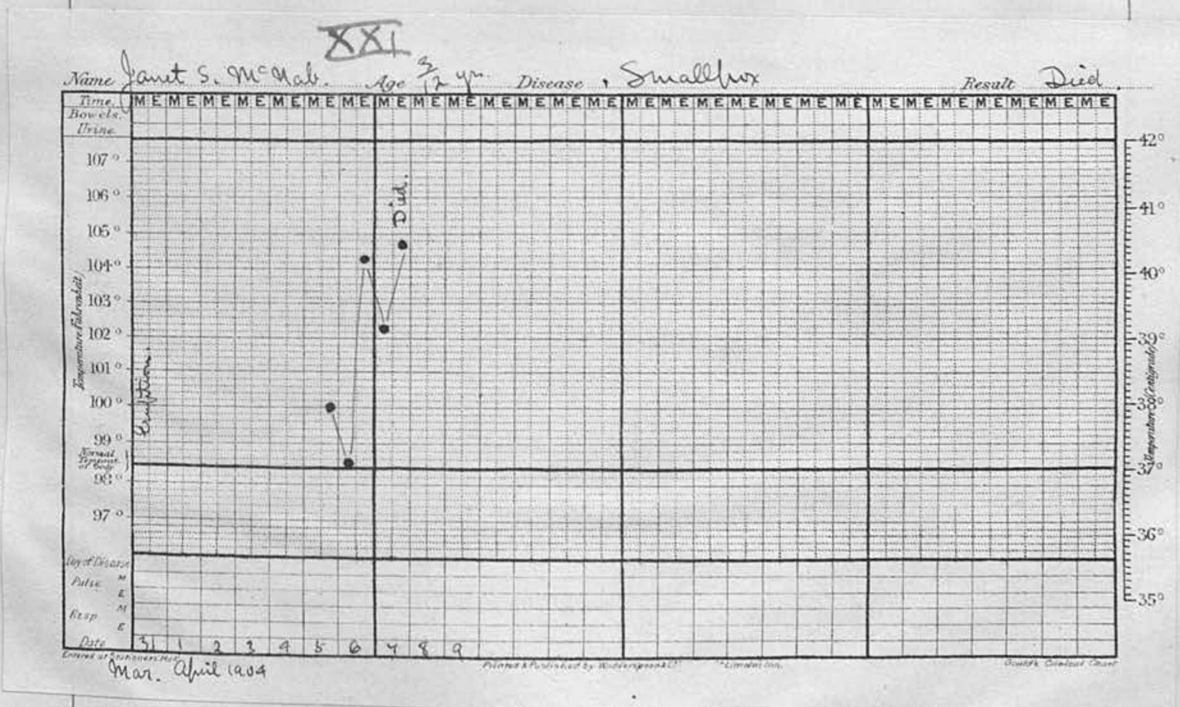
The above seven charts (Nos.12 to 18 inclusive) are of interest in connection with the third wave of elevation, that due to septic activity. The great length, its marked variations, its great oscillations between a morning fall and an evening rise, are well shown in all but number XIII. Sudden abrupt rises are often explained by confinement of pus in some cavity, as in XIII., XIV., XVI., and XVIII.

In contrast to the above I give this one, number XIX, as the chart of a man who was dangerously ill, had a most abundant crop of large pustules, yet showed little reaction as regards his temperature.

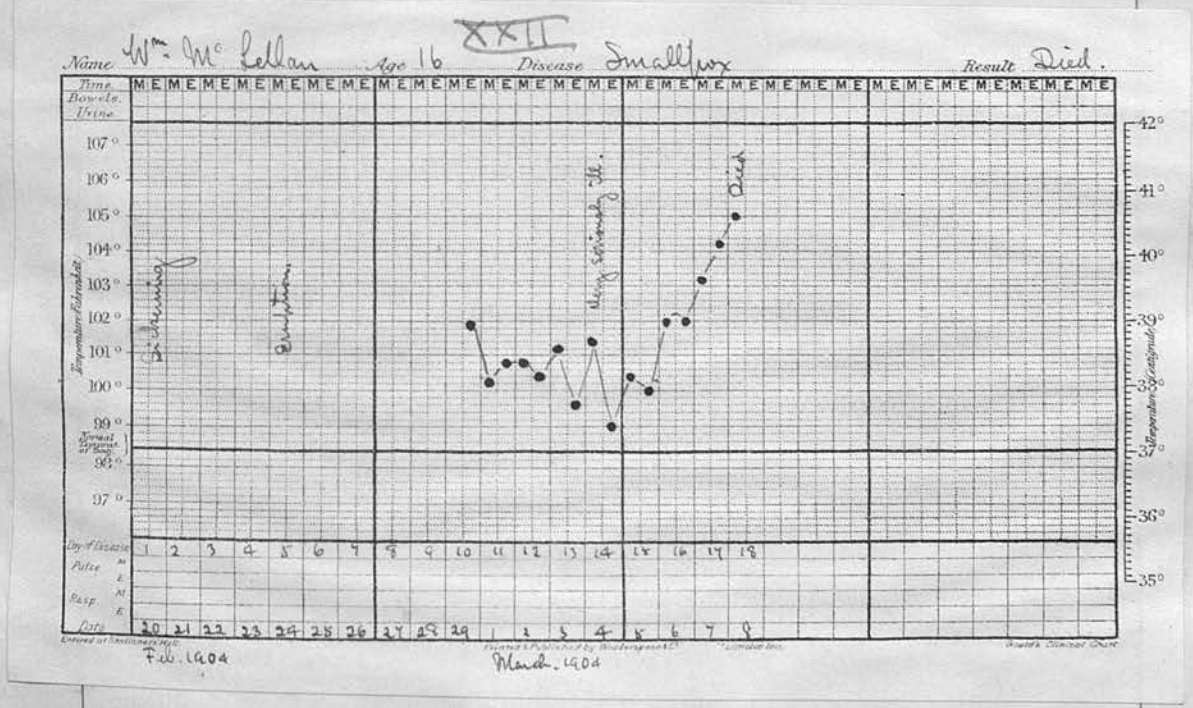


I now come to charts of Fatal Cases:



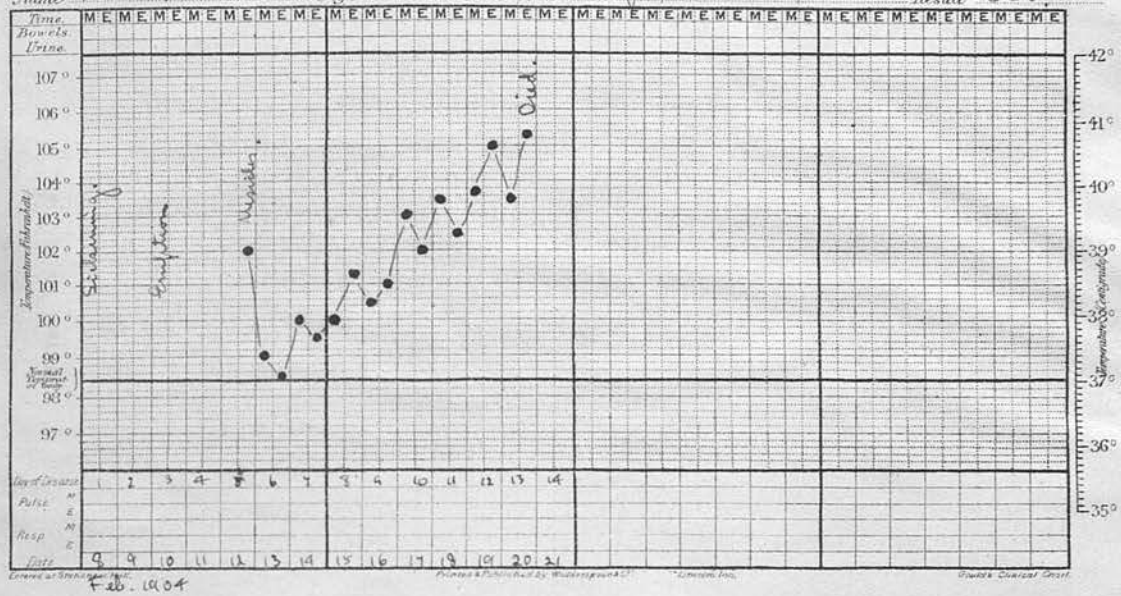


The first two, Nos.XX. and XXI., are those of infants. In chart XX. it will be noticed how quickly the various stages of eruption were run through and how the gravity of the condition was never indicated on the chart. The child died on the 9th day of disease. Chart XXI. is that of a child of 3 months who died on the 7th day of disease. The temperature ran up as it was dying, reaching 104.7°F. just before death.



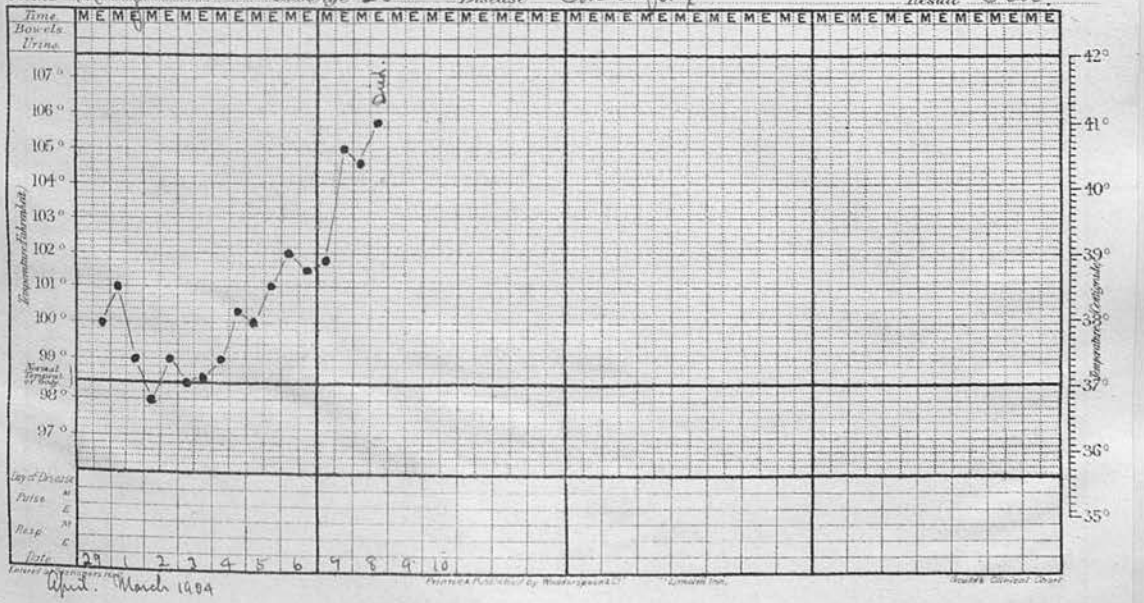
XXIII

Name Matt. McPhail Age 30 Disease Smallpox Result Died.

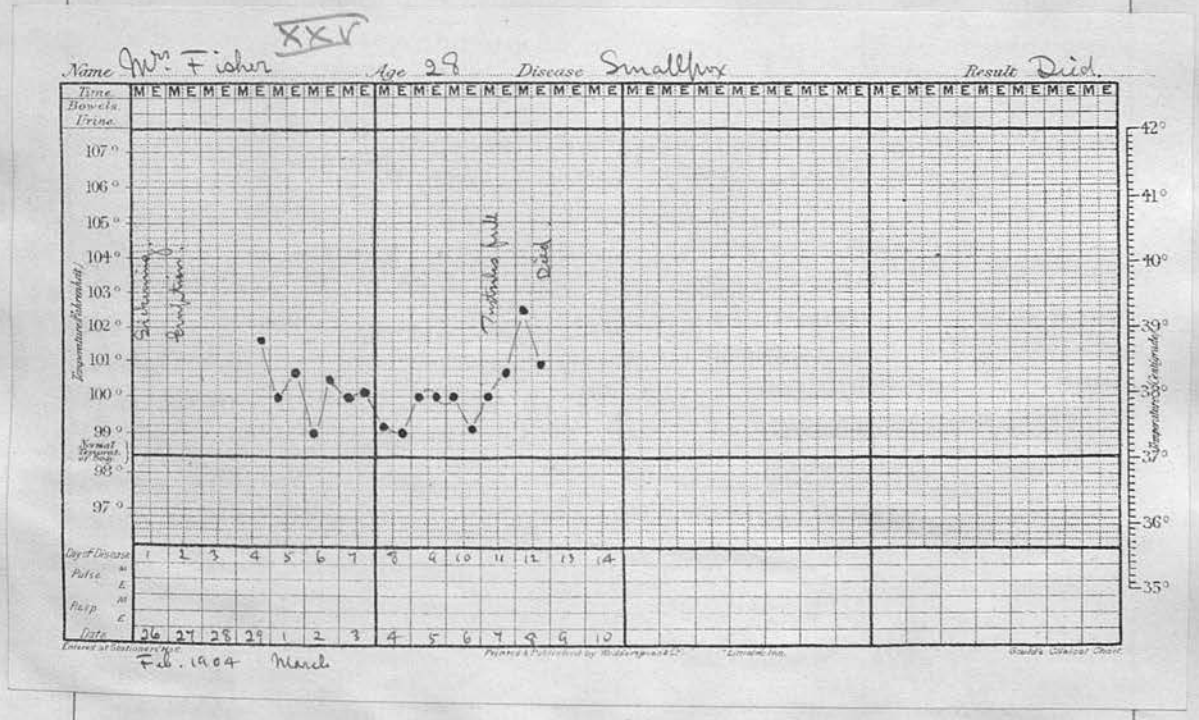


XXIV

Name Mary Ann McWilliams Age 26 Disease Smallpox Result Died.

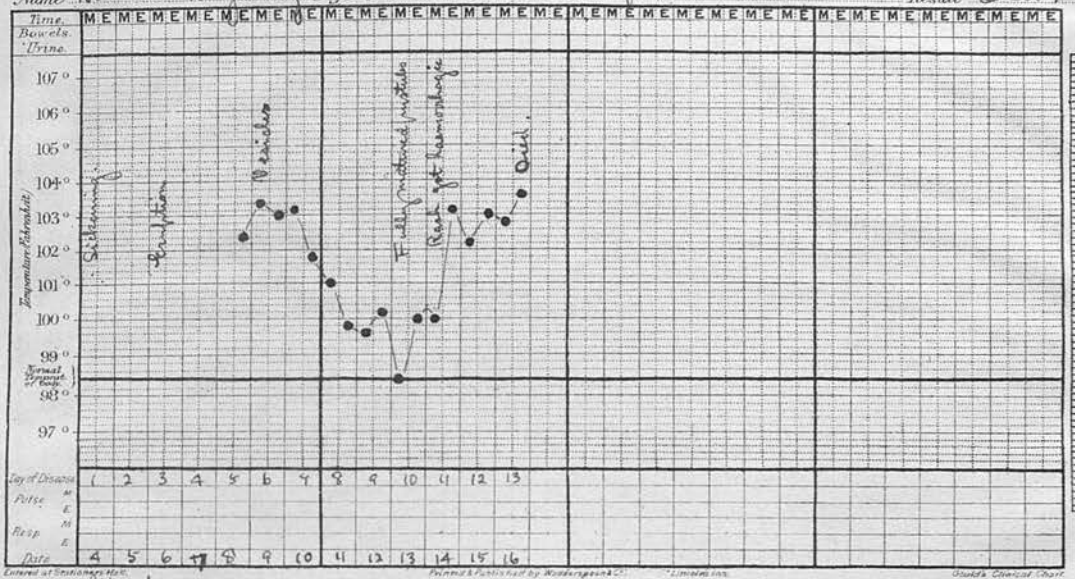


Turning now to the temperature charts of the adult fatal cases, they are found to place themselves in two groups, those in which the temperature runs up before death, and those in which it runs down. Numbers XXII., XXIII., and XXIV. show very markedly this anti-mortem rise, and that the height attained just before death is very high.



XXVI

Name Michael McGarrity Age 29 Disease Smallpox Result Died.



Entered at Stationers Hall March 1904

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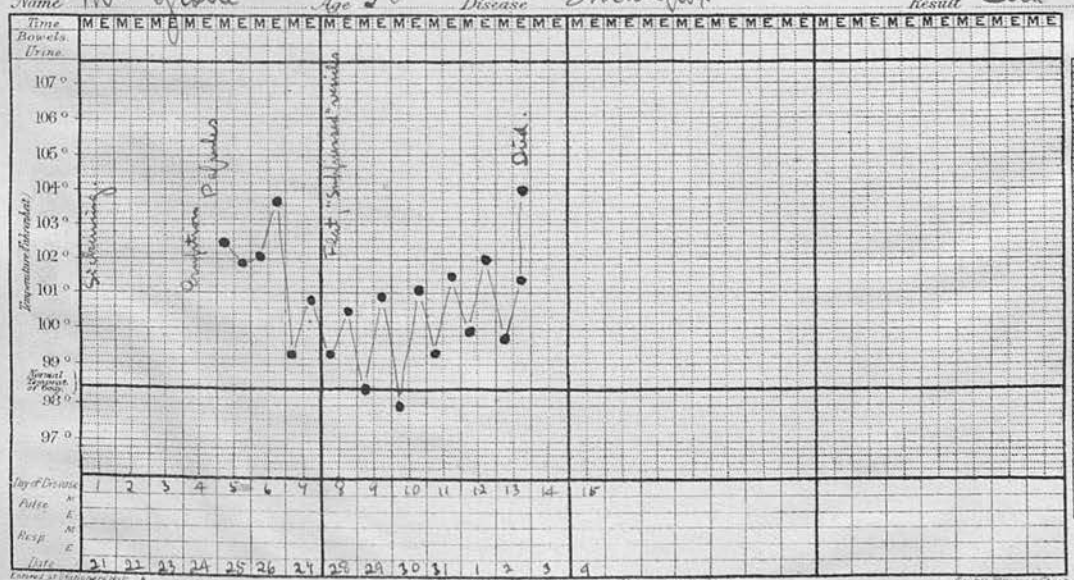
Gould's Clinical Chart

XXVII

Name Mrs. Grotte Age 38 Disease Smallpox Result Died



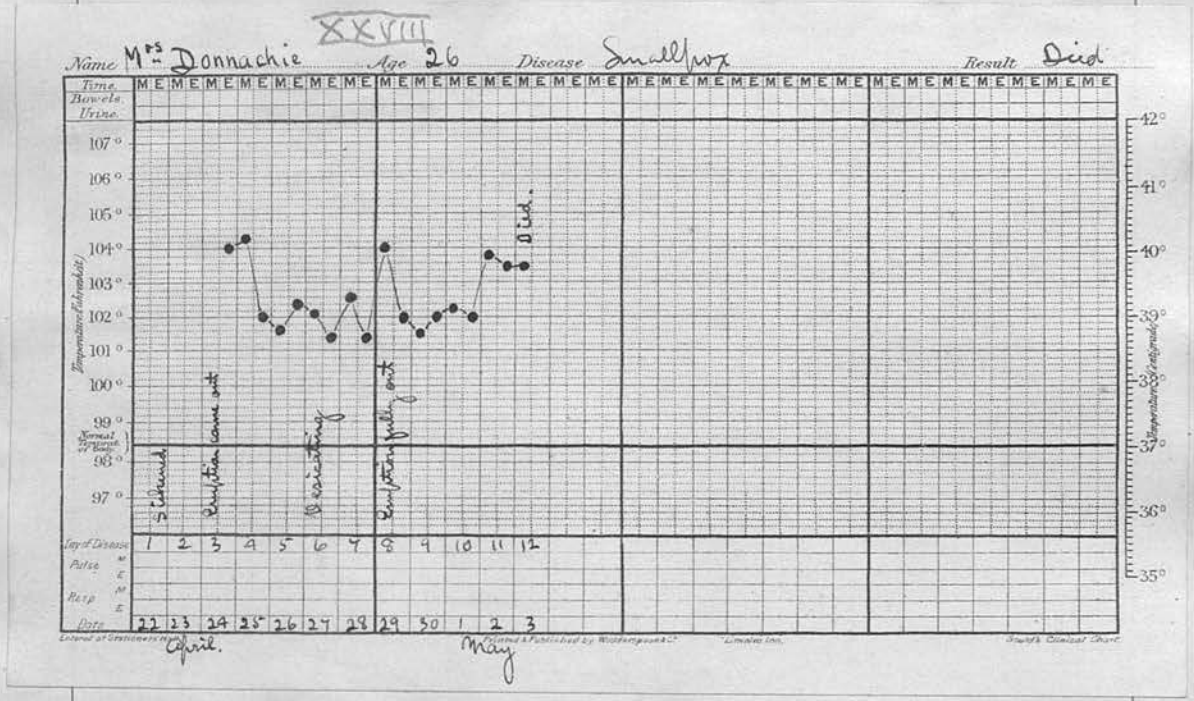
Entered at Stationers Hall March 1904

Printed & Published by Waddington & Co. Limited

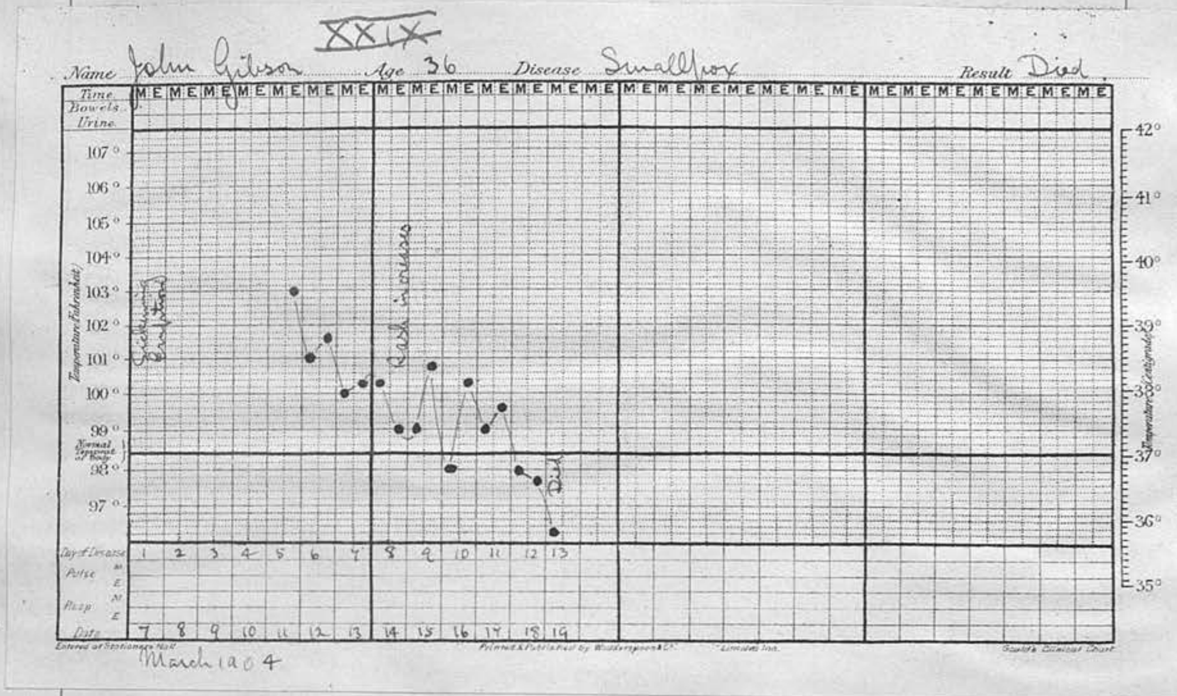
Gould's Clinical Chart

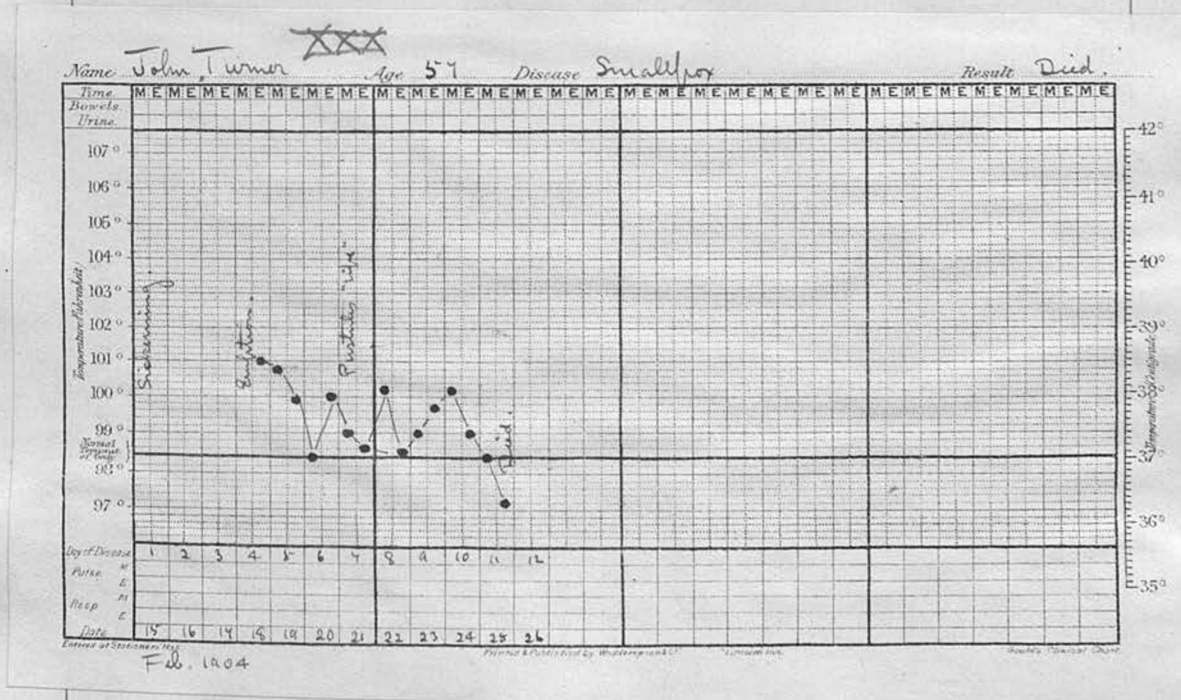
Died.

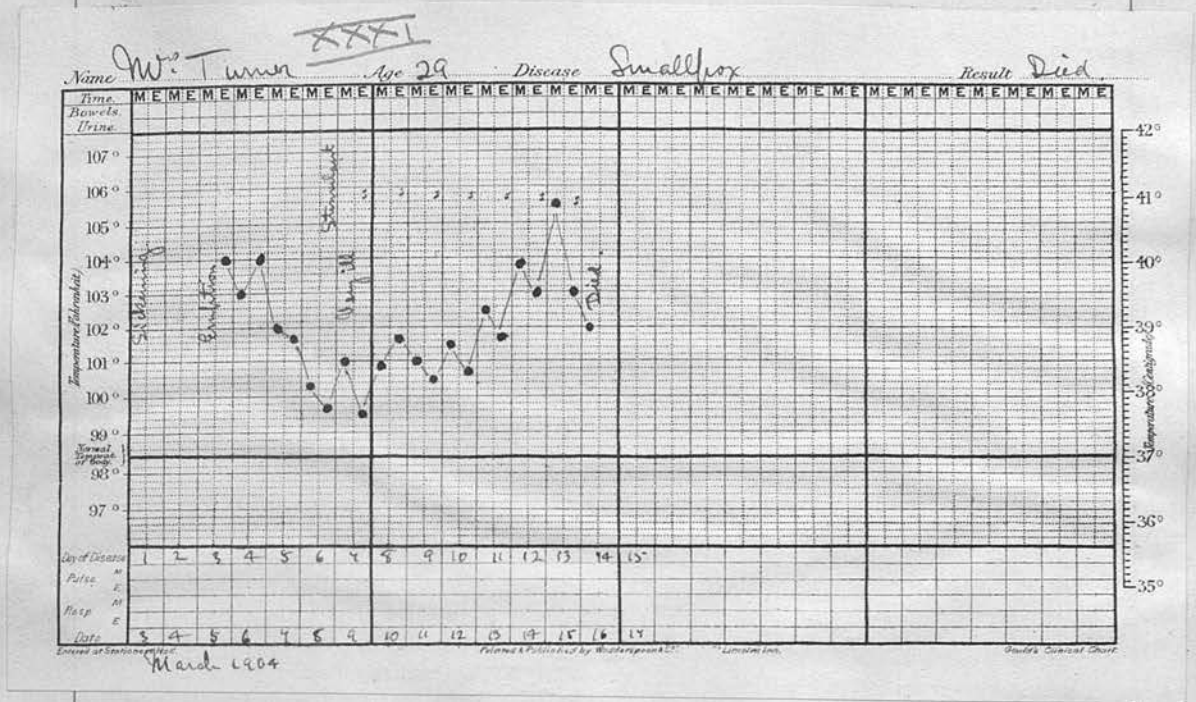
Charts XXV., XXVI. and XXVII show the same tendency to an elevated temperature when a fatal issue is immanent.



The Chart of Mrs Donnachie, No.XXVIII. shows the same feature, but the elevation is no greater than that at maturation. This is the chart of the woman whose photographs are given as Nos.20, 21 and 22. who suffered from a suppressed rash.


XXIX
Name John Gibson Age 36 Disease Smallpox Result Died
Time
Bowels
Urine
107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97°
Normal Temperat. of Body
Temperature Fahrenheit
Rash increases
Died
Day of Disease 1 2 3 4 5 6 7 8 9 10 11 12 13
Pulse M E
Resp M E
Date 7 8 9 10 11 12 13 14 15 16 17 18 19
42° 41° 40° 39° 38° 37° 36° 35°
Temperature Centigrade
Entered at Stationers Hall
March 1904
Printed & Published by Witherspoon & Co.
Lincolns Inn
Gould's Clinical Chart


XXX
Name John Turner Age 57 Disease Smallpox Result Died.
Time
Bowels
Urine
107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97°
Normal Temperat. of Body
Temperature Fahrenheit
Sickening
Eruption.
Pustules "ripe"
Died.
Day of Disease 1 2 3 4 5 6 7 8 9 10 11 12
Pulse M E
Resp M E
Date 15 16 17 18 19 20 21 22 23 24 25 26
42° 41° 40° 39° 38° 37° 36° 35°
Temperature Centigrade
Entered at Stationers Hall
Feb. 1904
Printed & Published by Witherspoon & Co.
Lincolns Inn
Gould's Clinical Chart

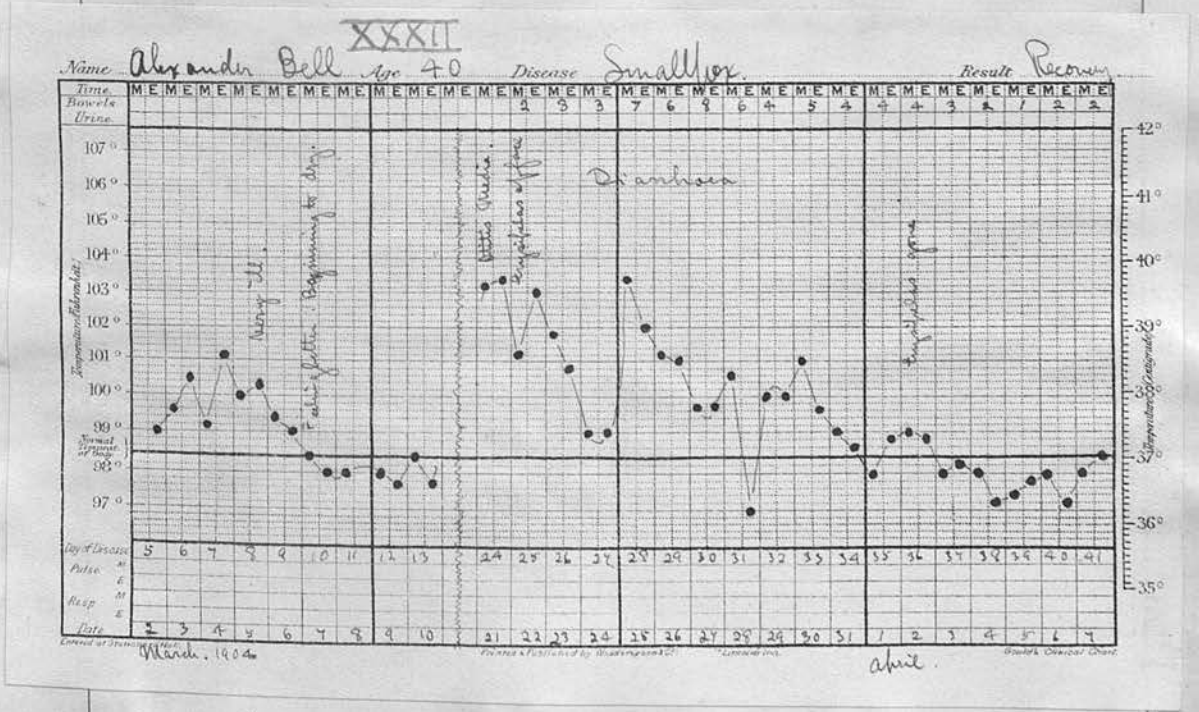


The fall of temperature at or before death is well shown on the three charts above, and is so definite as to form a sharp contrast with charts like XXII., XXIII., and XXIV.

COMPLICATIONS.

The most frequent complications I met with in this epidemic were those due to sepsis, the commonest being ulcers, boils and abscesses. Two cases of corneal ulcer occurred, but these healed without producing any permanent mischief in the eye beyond a small opacity.

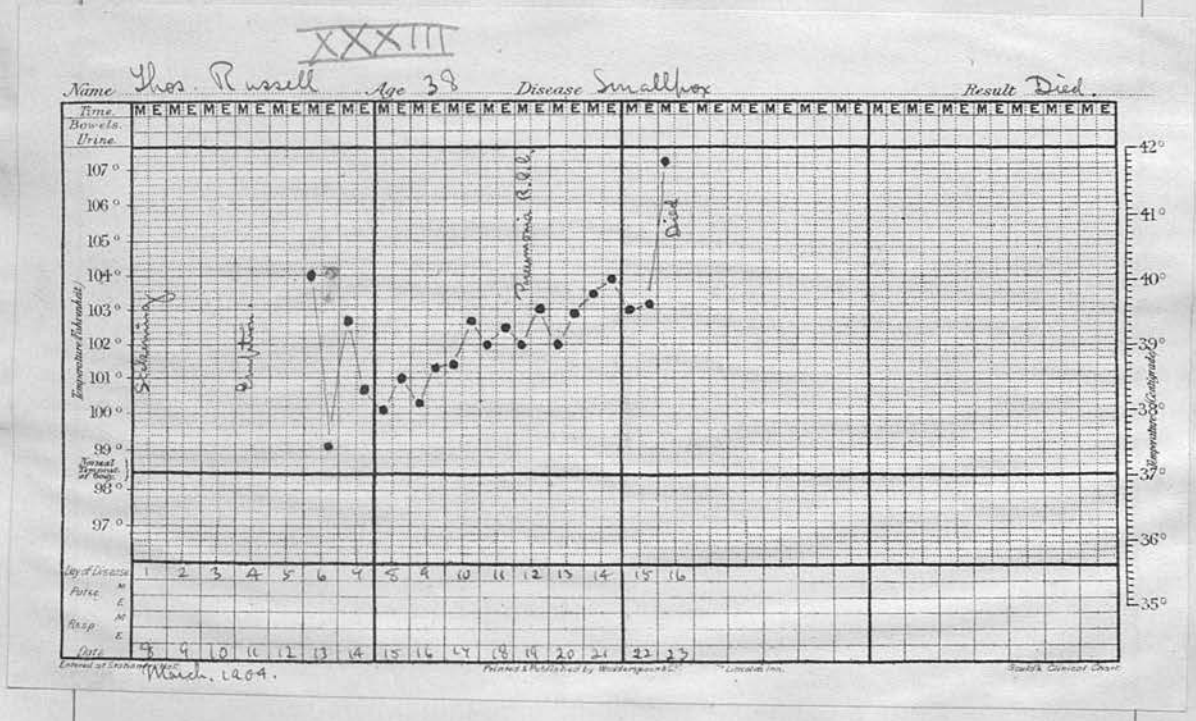
Otitis Media occurred two or three times. Erysipelas and Tonsillitis and Inflamed Throats occurred occasionally in the late stages where the skin surface was scabby and septic. One woman had at the same stage of the disease a very profuse and purulent Leucorrhoea. All these complications were due to the reduced state of resistance in the tissues, and to the presence of great numbers of septic organisms.



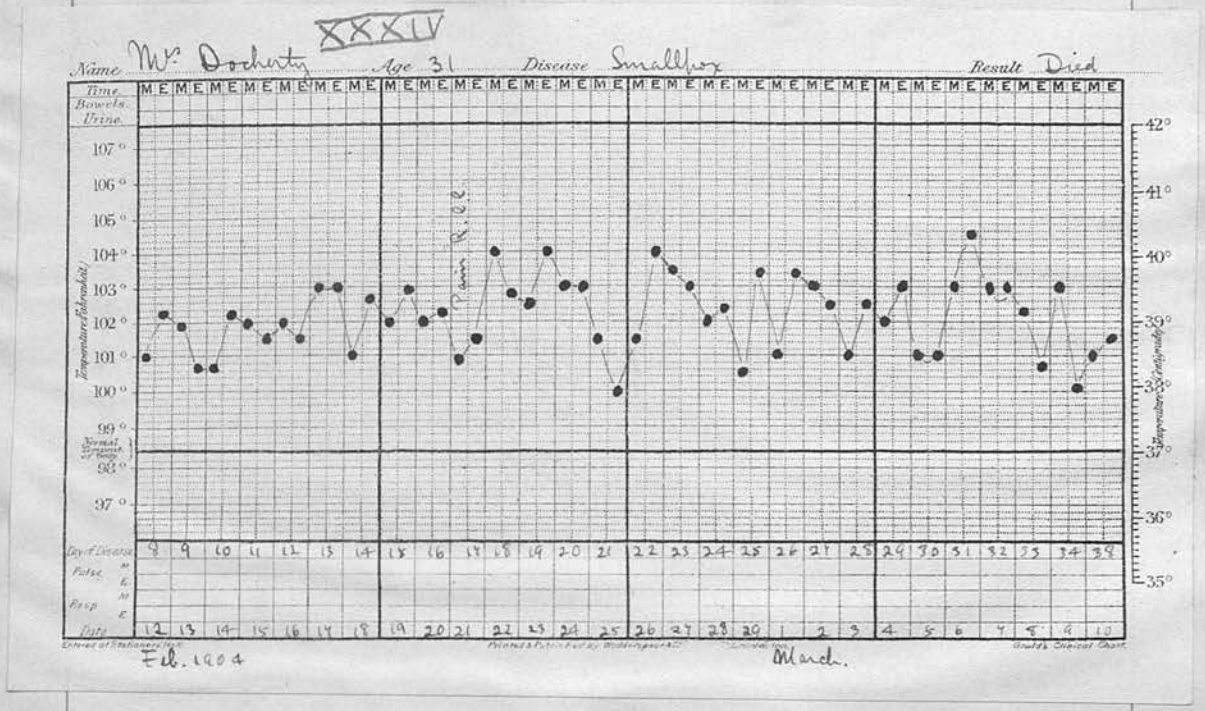
Alexander Bell, whose chart I give above, was a man who suffered from several septic manifestations. As the chart shows,his temperature during the acute stage of smallpox was not high. It fell to normal and the recording of it was discontinued on the 13th day of disease. He never got well enough, however, to get out of bed, and began to suffer from great earache. At length there came a sudden flow of pus from one of the ears on the 24th day of disease, when the temperature stood at 103.2°F. The next day Erysipelas of the face set in, and he bagan to have frequency of bowel evacuation, voiding a very watery, ill-smelling fluid. The variations in his temperature are marked, and it was only about the 34th day of disease that his temperature settled finally in the neighbourhood of normal.

In two or three cases the eruption became haemorrhagic and one bled very much, not only from the outer skin surface, but also from the nose, the mouth, and the bowel. I tried the effect of adrenalin both on the nasal mucous membrane and on the skin, but though it seemed to lessen the flow, it did not stop it. The boy died on the 9th day of his disease.

I found the respiratory system very liable to suffer from complications. Slight catarrh of the respiratory passages occurred occasionally and was usually merely a passing condition. More serious complications however occurred.



Thomas Russel, aged 38 years, who bore a very imperfect mark, sickened on March 8th, 1904, broke out in eruption on March 11th and came into hospital on the 12th. On March 19th, the 12th day of his disease, a part of the lower lobe of his right lung was found to be pneumonic. By the 15th day of disease the whole lobe was affected, and he died on the following day, the thermometer recording a temperature of 107.2°F. just before death.



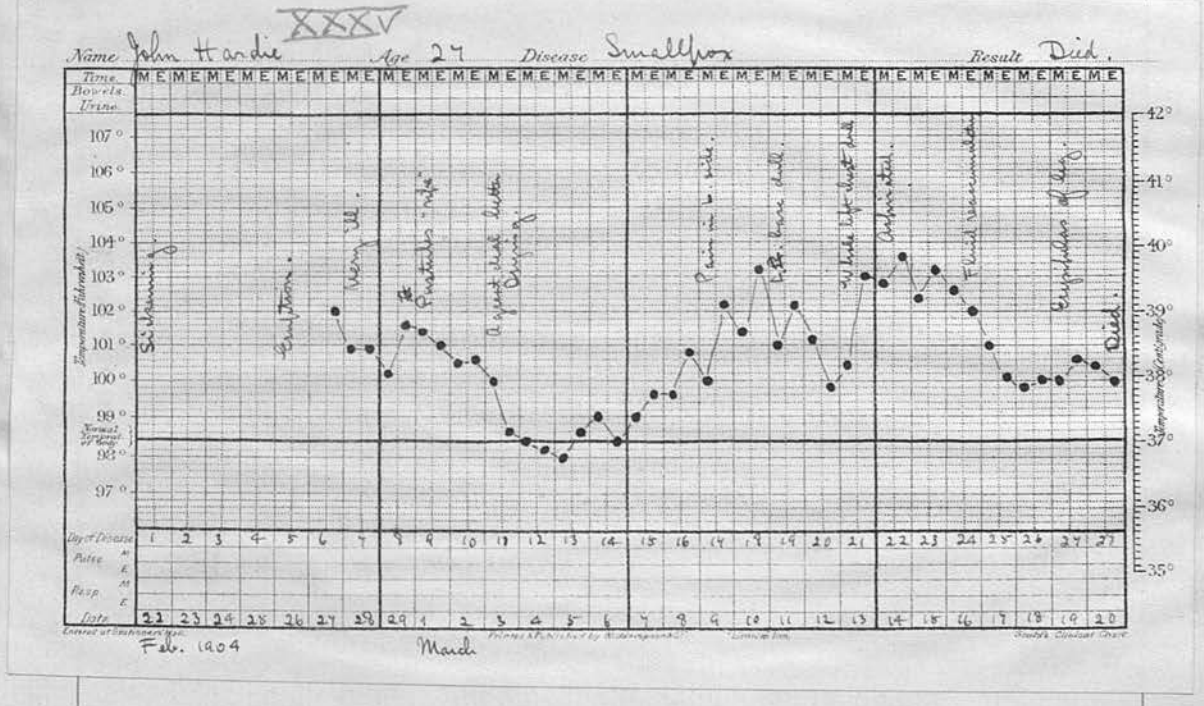
Mrs Docherty, aged 31 years, was admitted on February 9th, 1904. She showed a good vaccination mark on the right arm, had sickened on the 5th and noticed her eruption first on the 9th of February, the 5th day of her disease. The chart does not show either the eruption wave of temperature, nor the maturation wave, but gives four weeks of the third, that due to septic manifestations. The note on February 18th runs, "Now crusting, feeling better and doing well." But on the following day, the 17th of disease, she complained of pain at the base of the right lung. On auscultation some few crepitations were heard and there was a slight emptying of the percussion note. The temperature rose another degree to about 104°F.

On the 18th day of disease there was a cough and expectoration of thin watery mucus with greenish masses in flakes floating in it. There was a more pronounced dulling of the percussion note over the right base. The breath sounds were indeterminate, and certainly not bronchial. There were medium crepitations present.

On the following day she was made to sit in a semi-recumbent posture leaning on a bed rest, and the position aided her expectoration and breathing. She felt easier and rested better. The chest accompaniments seemed less that day.

The next note is a short one taken on March 2nd, the 27th day of disease. The percussion note was a little clearer, but the expectoration was increasing, and she filled a large spittoon - about the size of a mug - during a night. The sputum was very watery. She was ordered to have her skin over the right base painted with Iodine and to have a stimulating expectorant mixture. By the 29th day the sputum was foetid. The tone over the right base continued to improve. On the 34th day, at an area about the size of the palm of the hand the breath sounds were tubular, and the vocal resonance whispered pectoriloquy, and the accompaniments were bubbling

and consonating. The sputum was thick, green, foetid pus, and half a spittoonful was expectorated in the course of a night. She was delirious and evidently dying. Death took place on March 10th, the 38th day of disease. In the absence of a post-mortem examination, the diagnosis made was abscess of the lung.



This chart is that of John Hardie, aged 27, who after recovering from a very severe attack of smallpox and during the cleaning stage, took an acute pleurisy, which went on to great effusion into the left pleura. This occurred on the 16th or 19th day of disease, and he was aspirated on the 22nd.

day , when five pints of purulent effusion were drawn off. After aspiration the note was good all over the left front and behind down to the level of the middle of the interscapular region. He was considered too weak for operation. The fluid began to reaccumulate on the 24th day of disease and he died on the 28th.

These were the three outstanding complications in the respiratory system.

I had little time or opportunity to watch the condition of the urine of patients, but on one or two occasions found a passing albuminuria.

One man had an acute Orchitis. On admission his left testicle was enlarged to the size of a lemon, soft and not very tender. It was placed in a suspensory bandage and the swelling subsided in less than a week. Apart from delirium in the acute stages the only nervous complication which I found was a spastic paralysis of the lower limbs in a little girl of 4 years of age. Both legs were flexed on the abdomen, and the feet were extended at the ankles. This was first noticed during the drying period. The legs could be straightened out fairly well, though it gave her a little pain. She gradually improved, but on leaving hospital was not able

to walk and barely able to stand even with help. She quickly improved at home, and now I frequently see her running about and playing like the other children, and but for the marks on her face, looking none the worse for the small-pox.

Quite a number of women were at one stage or another of pregnancy when admitted. Only two aborted. The first one, Mrs Galbraith, Chart No.III. was by no means a severe case, yet she had a premature labour on the evening of the 3rd day of disease, and was delivered in hospital of a 7-months child. This child was born alive, showed no small-pox eruption, but died in half an hour. The mother did well.

The other, a woman aged 28, and about 3 months pregnant, had recovered from her attack, which was a slight one, and had been up and about the ward for a week when, on the 24th day of her disease, she became much excited on seeing her husband standing on the roadway waving to her. She says she felt "something give way about the womb, and water rush from her." There were no labour pains, yet on examining her I found a foetus about 4 to 5 inches long lying in the vagina.

Strange to say, one woman in her 8th month of pregnancy was admitted, was a very severe case, and was in hospital for 3 weeks, yet carried her child, and was delivered a week after dismissal of a well-developed healthy boy, who lived and showed no signs of smallpox.

INITIAL RASHES.

I have noted 6 cases with initial rashes. These are nearly all of the Scarlatinal type. James Wright, who sickened on February 5th, had a general erythema of the skin on the inner aspect of the left forearm on the 10th and 11th, and on the latter day the papules began to rise through this rash.

Wm.Mills sickened on March 6th, and on the following day discovered a red scarlatinal rash extending from the elbows over the skin of the forearms down to the backs of the hands. Through this the papules appeared. It faded in less than two days.

Mrs Hughes sickened on March 13th, and on admission to hospital on the 15th there was present over

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Mrs Hughes sickened on March 13th, and on admission to hospital on the 15th there was present over

the whole surface of the back, over the thighs as far down as the knees, and over the shoulders and upper arms, a marked scarlatinal rash. Through this rash appeared and were felt some small round vesicles. On the following day this initial rash had almost faded. Two other cases showed similar, but not so extensive scarlatinal rashes.

On admission Mrs Kelly, who had sickened on March 19th and been admitted on the 22nd, presented a peculiar appearance. Over the malar regions of the face, over the extensor surfaces of both arms, and over the fronts of the legs and thighs was distributed a mildly red rash which occurred in irregular patches running together by isthmuses, and by island chains. Some areas were about the size of a five shilling piece, but quite irregular in outline. This condition had all vanished by the following day.

SPLENIC ENLARGEMENT.

Turning now to consider whether or not the spleen is enlarged in Smallpox, I have records of its size in 142 cases. Of these 61 were severe cases, and 81 mild or moderate. Taking first the mild or moderate cases, 96.29% showed no enlargement, and but a slight enlargement was present in 3.71% Of the 61 severe cases, 85.24% showed no enlargement, 6.55% a slight enlargement, 6.55% were enlarged by one half their size, and 1.66% to twice the usual size.

Thus it would appear that enlargement of the spleen in these cases was not common, and when it did occur was not great in amount.

The next point for consideration is the relation of the condition of the patient as to vaccination and their present attacks. Take first the Unvaccinated Cases:

UNVACCINATED CASES.

Children:

I have divided these into two groups, that of children (of 10 years and under) and that of those over 10 years, here reckoned as adults.

The total number of Unvaccinated Children was 20. Of these 5 died - a percentage of 25 - and 17, or 85% were severe cases.

Five of these children were under one year in age. Four out of the five deaths occurred in infants under 3 months of age.

The average number of days in hospital for these unvaccinated children, omitting the fatal cases, was 45.21 days.

The average for the fatal cases was 3.8 days.

Adults:

The total number of Unvaccinated Adults was 22. Of these, 6 or 27.27% died, and 21 or 95.45% were severe. Of the fatal cases one was 57 years of age, and the average age of the others was 16.8 years. Omitting the fatal cases, the average number of days in hospital of the unvaccinated adults was 39.5, the

average for the fatal cases being 9.38 days.

Amongst these cases I have not counted those who, though unvaccinated, had suffered from a previous attack of Smallpox. These I have kept in a class by themselves. The following is a table giving the above numbers in a way which permits of easy comparison:

Table of Unvaccinated Cases

Age	Deaths	Average No.of days in hospital	Average No.of days for Fatal Cases.	Severe Cases.	No.of Cases.
Under 10	5 = 25%	45.21	3.8	17 = 85%	20 = 47.62%
Over 10	6 = 27.27%	39.5	9.83	21 = 95.45%	22 = 52.38%
In all	11 = 26.19%			38 = 90.45%	42 = 100%

VACCINATED CASES.

The Vaccinated Cases I also divided into the same two groups.

Children

Of those of 10 years and under there were only 12, and amongst them there was not a single death, nor even a severe case! These statements are striking.

The youngest vaccinated child which took small-pox was a little girl of four years.

Again, the effect of vaccination is seen in the degree of the cases as evidenced by the average number of days in hospital. This was 18.5 days, as compared with 45.21 amongst the unvaccinated children.

Adults:

The total number of unvaccinated adult cases was 263. Of these 11, or 4.8% died, and 76, or 28.89% were severe cases. The average number of days spent in hospital by the cases which recovered was 23.79, and the average in the case of fatal cases was 11.63.

Again, for purposes of comparison, I have thrown there into a table.

Table of Vaccinated Cases.

Age	Deaths	Average No. of days in hospital.	Average No. of days for Fatal Cases.	Severe Cases	No.of Cases
Under 10	0	18.5	0	0	12. = 4.36%
Over 10	11 = 4.18%	23.79	11.63	76 = 28.89%	263 = 95.64%
In all	11 = 4.18%			76 = 28.89%	275 - 100%

In order to compare the vaccinated and unvaccinated children, I have put the figures side by side in a table:-

Table of Children
(10 years and under.)

	Deaths	Average No. of days in hospital	Average of days for Fatal Cases	Severe Cases	No.of Cases
Vaccinated	0	18.5	0	0	12 = 37.5%
Unvaccinated	5 = 25%	45.21	3.8	17 = 85%	20 = 62.5%
In all	5 = 15.62%			17 = 53.12%	32 = 100%

These numbers have but to be thrown together thus to point out the obvious benefits and advantages of vaccination. There were no deaths amongst the vaccinated, whilst 25% of the unvaccinated died. Eighteen and a half days was the average stay in hospital of the vaccinated, while the average of the unvaccinated is $3\frac{1}{2}$ times that. Amongst the vaccinated there were no severe cases, while 85% of the unvaccinated were in this class. The number of vaccinated children in Greenock must be a great many times greater than that of the unvaccinated, yet from this large section there only came 12 cases, and from the small, 20. The same comparison must be made in the case of the adults.

Table of Adults
(Over 10 years)

	Deaths.	Average No. of days in hospital	Average days for Fatal Cases	Severe Cases	No. of Cases
Vaccinated	11 = 4.18%	23.79	11.63	76 = 28.89%	263 = 92.31%
Unvaccinated	6 = 27.27%	39.50	9.83	21 = 95.45%	22 = 7.7%
In all	17 = 5.96%			97 = 34%	285 = 100%

Comparing the deaths in the above table, 4% of the vaccinated died, but almost 7 times that number died in the case of the unvaccinated.

The average stay in hospital of the vaccinated as compared with the unvaccinated is as 3 to 5.

Again the fatal vaccinated cases made a better fight for life than the unvaccinated, living on an average two days longer.

In the matter too, of the number of severe cases the percentage amongst unvaccinated is $3\frac{1}{4}$ times as great as amongst the vaccinated.

Comparing the total vaccinated and unvaccinated the same effect of vaccination is brought out.

Table of Total Vaccinated and Unvaccinated Cases

	Deaths	Severe Cases	Totals.
Vaccinated	11 = 4%	76 = 27.63%	275
Unvaccinated	11 = 26.19%	38 = 90.47%	42.

It is also of interest to compare the number of severe and of moderate or mild cases in each of the three groups, namely those with indefinite vaccination marks, those with poor marks, those with good marks.

There were 36 cases indefinitely marked. Of these 24 ot 66.6% were severe, and 12 or 33.33% of a moderate or mild type.

There were 28 cases poorly vaccinated, and of these 9, or 32.16% were severe, and 19 or 67.85% were moderate or mild.

The cases which were well marked numbered 206 and 43 or 20.87% were severe, and 163 or 79.12% were moderate or mild.

Putting these figures in tabular form, we have:

Table of Vaccination Marks

	Indefinite	Poor	Good
Moderate or Mild Cases	12 = 33.33%	19 = 67.85%	163 = 79.12%
Severe Cases	24 = 66.66%	9 = 32.16%	43 = 20.87%

The ratio of severe to mild cases is 2 to 1 in the"Indefinite"group, 1 to 2 in the "Poor" group, and 1 to 4 in the "Good" group. In other words amongst those who, though vaccinated in infancy, have never been revaccinated, and have taken Smallpox,

of those who were indefinitely vaccinated, 2 were severe for every one who was mild; of those who were poorly vaccinated, 1 was severe where 2 were mild; of those who were well vaccinated 1 was severe where 4 were mild. Thus as you rise in the scale from an indefinite to a good vaccination mark the chances of suffering severely from smallpox are greatly lessened.

Number of Vaccination Marks:

Turning now to the effect of the number of vaccination marks, I give the following tables:

Adults showing One Mark.

	One good mark	One poor mark	One indefinite mark.
Moderate & Mild Cases	86 = 75.99%	11 = 73.33%	7 = 28%
Severe Cases	27 = 23.89%	4 = 26.66%	18 = 72%
Total	113 = 73.85%	15 = 9.80%	25.= 16.34%

The percentages in the "Total" line are taken on the whole number of one-mark cases.

The total Mild Cases with one mark = 104 or 67.93%
" " Severe " " " " = 49 or 32.02%

Adults showing Two Marks.

	Two good marks	Two poor marks	Two indefinite marks.
Mild Cases	54 = 80.59%	5 = 71.43%	3 = 30%
Severe Cases	13 = 19.40%	2 = 28.57%	7 = 70%
Total	67 = 79.76%	7 = 8.33%	10 = 11.9%

The percentages in the "Total" line are taken on the whole number of two-marked cases.

The total Mild cases with two marks = 62 or 73.81%
" " Severe " " " " = 22 or 26.19%

Adults showing Three Marks.

	Three good marks	Three poor marks	Three Indefinite marks.
Mild Cases	6 = 75%	2 = 66.66%	0
Severe Cases	2 = 25%	1 = 33.33%	0
Total	8	3	0

The total Mild cases with three marks = 8 or 72.72%
" " Severe " " " " = 3 or 27.27%

Adults showing Four or More Marks.

	Four good marks	Four poor marks	Four Indefinite marks.
Mild Cases	7	0	1
Severe Cases	0	1	0
Total	7 = 77.77%	1 = 11.11%	1 = 11.11%

The percentages in the "Total" line are taken on the whole number of cases with four or more marks.

The total Mild Cases with 4 or more marks = 8 or 88.88%
" " Severe " " " " " = 1 or 11.11%

Table Comparing Degree of Severity with Number of Marks.

	One mark	Two marks	Three marks	Four or more marks.
Mild	104	62	8	8
Severe	49	22	3	1

By expressing these numbers as percentages of the total of the mild or of the severe cases we get a table:-

	One mark	Two marks	Three marks	Four or More Marks.
Mild	57.14	34.06	4.39	4.39
Severe	63.33	29.33	4	1.33

From this last table it would seem that when there is only one mark there are more cases severe than are of a mild or moderate character; that when you have two marks the chances are more in favour of the case being milder than of its being severe, and that the same effect is borne out with more than two marks; when you get to four and more marks, the chances of the case being mild are as 4 to 1. Of course it must be borne in mind that too great stress must not be laid on the figures in the three and four mark columns, as they are percentages based on small actual totals.

CONCURRENT CASES

No. of Case	Age	No. of Days before or after Sickening	Degree of Case	Result	State of Primary Vaccination.	
96	6 years	1 before	Severe	Recovery		Concurrent Primary Vaccination
107	7 weeks	7 before	Slight	"		
170	14 years	5 "	Mild	"		
296	40 "	5 "	Severe	"		
343	26 "	1 after	Severe	Died.		
100	40 "	8 before	Slight	Recovery	Good	Concurrent Revaccination.
108	14 "	6 "	Mild	"	"	
111	18 "	6 "	Mild	"	Indefinite	
128	29 "	1 "	"	"	Good	
157	21 "	2 "	"	"	"	
164	33 "	5 "	"	"	"	
211	35 "	6 "	Severe	"	"	
214	34 "	6 "	"	"	"	
222	20 "	5 "	Mild	"	"	
232	31 "	10 "	Slight	"	"	
255	36 "	6 "	Severe	"	"	
257	22 "	5 "	Mild	"	"	
265	42 "	2 after	Severe	"	"	
307	19 "	Same day	Mild	"	"	
317	42 "	6 after	"	"	"	
321	32 "	4 after	"	"	"	
326	52 "	Same Day.	Severe	"	Had smallpox at 2 years.	

This table sets before one all the points of interest of those cases, 21 in number, in whom vaccination ran a concurrent course with Smallpox. It will be noticed that there is no case in which the period between vaccination and the onset of Smallpox is more than 10 days. The incubation period of Smallpox is, taking the average of the great bulk of cases, 10 tp 15 days; but it may very frequently be

more. One can quite well imagine this woman who was vaccinated 10 days before onset receiving her infection quite a number of days prior to her vaccination, with the result that her reaction to vaccination was not soon enough to protect her from smallpox.

One concurrent case died, and it will be noted that her vaccination did not take place till the day following her onset.

Three out of the five cases whose concurrent vaccination was their primary vaccination were severe, while only 3 out of the 15 who showed primary vaccination marks in addition to their concurrent, were severe cases. The numbers to go upon are small, and from these alone it is not safe to draw a conclusion.

These 15 cases showing concurrent vaccination were the only re-vaccinated cases admitted, with one exception, and it is clear that in every case this protection was sought too late, and at a period when already the smallpox virus was incubating in their bodies. The exception to this statement is the case of the bank-porter in Cathcart Street, whom I have mentioned as the second centre from which the epidemic spread. He stated that he had been re-vaccinated 15 years before. I never saw the man

nor his vaccination marks, and have only the statements of the assistants at the Sanitary Office to go by. They state however that the re-vaccination mark was slight. If these be the facts, then this is the only case of the 350 odd cases admitted to hospital who was revaccinated, and in his case it was 15 years before. In other works it would seem that all those in town who had been revaccinated lived practically a charmed life, and walked through infection with perfect immunity.

Thus the case for vaccination and revaccination is most clearly emphasized and defended by the unbiassed statistics of this epidemic. All the hospital staff were efficiently revaccinated and not one of them took the disease, though daily in contact with it. But the joiners, the labourers, the van-driver and others coming into contact with the work, being unprotected by recent vaccination, paid a heavy toll in casualties.

A SECOND ATTACK.

The effect of a Previous Attack of Smallpox is not clear from the four cases admitted, and having no records to go to to find the number of persons in town who have suffered previously from Smallpox,

there is no means of comparing numbers. I record these 4 cases in tabular form:-

Table of Cases who had suffered from a Previous Attack of Smallpox.

	Age	Years since first attack	Degree of First attack	Vaccination Condition.	Degree of present attack	Result
112	49	40	severe	not vaccinated	mild	Recovery
261.	34	33	slight	1 good mark	mild	"
326	52	50	?	Concurrent	severe	"
334.	38	36½	slight	Not vaccinated.	severe	"

FATAL CASES

The last definite class of cases to consider is the Fatal Cases. Of these there were 23 out of the 352 cases in my books, or a case mortality of 1 in 15.3 or 0.033 per 1,000 of the population.

Table of Fatal Cases.

Age	Vaccination	No.of days ill.	No.of cases.	Class.
32	Good	34	11.	Vaccinated adults
30	Imperfect	13		
42	"	about 6		
27	Good	28		
28	Imperfect	12		
28	"	12		
29	"	13		
36	"	13		
24	Good	8		
38	Imperfect	16		
38	Good	13		
$5\frac{1}{2}$ days		12	5	Unvaccinated Children
11		about 4		
wks 4		9		
mos 3		9		
mos. 2		9		
yrs. 20		10	6	Unvaccinated adults.
15		0		
13		19		
57		12		
16		18		
20.		14		
26	not till illness	12	1	Concurrent.

This table is divided into two classes, those who had been vaccinated and those who had never been thus protected. As before stated there were no deaths amongst the vaccinated children, the eleven vaccinated cases being all adults.

As to the condition of vaccination in these fatal cases, 4 showed good vaccination marks, and 7 showed imperfect marks, while 11 had no marks at all, and one which had a concurrent vaccination had not been re-vaccinated till the day after she sickened.

Of the four who had good marks, two died of complications during the stage of cleaning, not from smallpox directly, and might therefore be eliminated, making only two deaths amongst the well vaccinated cases, or about 0.97%. These two who died during the cleaning stage were the woman who died with pulmonary abscess, and the man who died from empyema of the left pleura.

Of the other two one was a malignant case, and died at the age of 24, although well vaccinated in infancy.

Death amongst the adults usually occurred in from 10 to 14 days from the day of the onset, and most

died on the 12th and 13th days. The 1st and 4th and the 10th cases on the table all died of pulmonary complications, and their length of illness is greater than those dying directly from Smallpox. Amongst the last 7 cases in the table, two who were younger and nearer their vaccination than most of the others made a longer fight for life, and lived for 18 and 19 days. The infant of 11 days was ill only about 4 days.

It would seem, therefore, that the critical days in severe cases are from the 10th to the 14th especially the 12th and 13th.

It only remains for me now, in bringing this paper to a close, to give a few notes on some interesting and peculiar cases.

Malignant Cases.

One case of malignant smallpox was admitted to Craigieknowes Hospital, and another case occurred outside, of which I obtained a few notes from the widow, who was admitted afterwards. The case admitted was as follows:-

Hugh Sheriff, aged 24 years, a joiner by trade who had been working at the alterations about the

hospital buildings, had no protection from recent vaccination, though he had a good primary mark, about the size of a shilling on his left arm. The house from which he came was of two apartments which accommodated 5 persons, two of them being less than 10 years of age.

He sickened on March 5th, with a very severe occipital headache which was present every day till after admission. He had some pain in the lumbar region for several days, but on March 11th it became very severe. He had great sickness and vomiting right on till admission, when he was found to be vomiting dark coffee-coloured matter.

On March 10th, the 6th day of his disease, he noticed a few spots, but on the following day he found himself covered with a very dark rash. On that day he was notified, and removed to hospital.

On admission he was very sick and vomited much of the dark matter mentioned. He had great pain in the back and was obviously in great distress. His temperature was 101°F. and his pulse rate 102 per minute, and the wave was small and weak. Breathing was about 30 per minute, very irregular, sighing and sniffing, and his nose looked pinched. He was mentally quite clear, and thought that he would be all right if I would only secure him a good sleep.

His face was slightly flushed and there was some reddening over the eyebrows. The lips were dry and covered with a black coating. The tongue was covered with a thick coat of white "fur" with a brown strip down the centre. The palate and fauces were covered with a white dry deposit. The tonsils were not swollen. On the pharynx were 5 or 6 dark brown spots the size of a lentil. The breath had a very foul odour.

The neck, trunk and upper arms, were of a vivid red colour, mottled with an innumerable number of dark, almost black petechiae, from the size of a pin point to that of a pea. These petechiae were most abundant about the shoulders. There was also a small sprinkling of ill developed vesicles, while, umbilicated, scarcely raised above the surface and very ill-filled. There were besides "scruffy" patches about the size of 6d or 3d. and about 15 in number, on the back. Some of the vesicles while white in themselves had a black centre. The redness faded away on the thighs and upper arms, though the remainder of the skin on these regions was somewhat congested. There was no swelling of the face or limbs. The skin was dry, but not parched, and was not markedly hot to the touch. The redness of the skin was due to hyperaemia, as pres-

sure left the skin blanched and the colour returned but slowly. About the legs and arms were a few (12 to 15) ill-developed vesicles, just visible, and scarcely palpable. The heart and lungs showed no signs of organic disease. The spleen was not enlarged. He had not micturated, so that it was not known if there was any blood in his urine. He looked profoundly influenced by the poison.

On the day after admission, March 12th, his face wore a dusky hue. His feet were cold and, on the whole, pale. He complained that they were cold. He was extremely restless, but quite clear mentally, answering questions quickly and clearly. He died that afternoon at 4.15 o'clock, half an hour after I had been making some notes about him, asking questions and receiving replies. After death he was found to have a slipper between his legs and was evidently trying to pass his water. For the hour or two before death he was visibly getting duskier and duskier in complexion, and the circulatory embarrassment was great and progressive. His temperature was only recorded twice, being 101°F. on the evening of admission and 100°F. on the following morning.

The other malignant case I knew of died at home. From his widow I elicited the following notes.

He came home from work on February 19th, very sick and vomiting, and saying he had been so at his work. He was very sick throughout this and the two following days, and nothing would lie on his stomach. He complained of being "shivery" and could not get warm. He said his head was "splitting" all the time. His face and lips were somewhat swollen. The pain in his back was so severe that he got up on his hands and knees in bed to save his back. He said that he was "sore all over". He could not lie on his left side, as he said it was very sore, and because it made his breath short. On February 22nd a red rash came out all over him, even to the palms of his hands and the soles of his feet. His widow said that his hands felt"velvety" His skin was exceedingly painful. On his back only two vesicles rose. While he was alive the rash remained red, but when he died it was livid and black. There was no bleeding from the nose, but on the day of his death he both coughed and vomited blood. He was mentally clear to the last, two minutes before death talking intelligently about his work. He died on February 22nd, 1904.

The next case I wish to give is one which presented on admission a most peculiar rash, which was later thought to be a vaccinial rash, the patient being sent to the Reception House.

Her name was Mary Walker, a mill girl, who had two fair primary vaccination marks on her left arm, and a large recent vaccination, now a brown crust of $1\frac{3}{4}$" x $1\frac{1}{2}$" which she had received on February 17th. She was admitted on February 29th. The first sentence of my notes on the rash as it was that day was that it almost baffled description. On looking at the face the striking thing was a great oedema of both eyelids of both eyes. They were flabby, not distended. They were red, but not at all vividly so. Her eyes could not bear the light, yet there was no conjunctival injection.

Over the malar regions and cheeks were irregular raised red areas, with defined edges, slightly lighter in colour than the rest of the patch, but not definitely vesicated. Over the knuckles were flattened vesicles, like the marks produced by nettle stings, with very wide bases. They were depressed in the centre and were very itchy.

Over the left elbow was a red patch extending

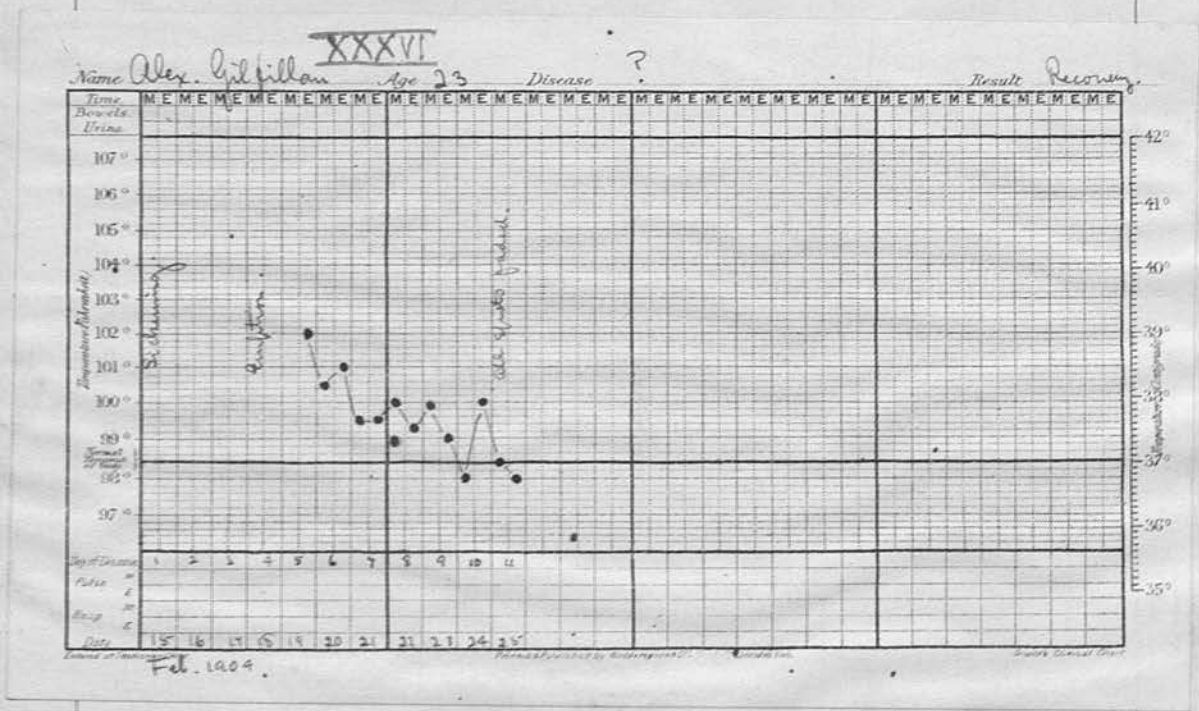
3" above and 3" below the elbow, over the posterior, outer and inner aspects, but leaving the anterior aspect free. The edge of this was wavy and irregular, and was definitely and abruptly raised from the skin surface, being white, like the crest of an advancing wave. Around the edges of the patch were islands with the same white crested edges. It seemed like an urticaria.

Two days later, on March 2nd, she was removed to the Reception House, and her condition then was this. Both cheeks were hard and brawny, the skin red, and raised abruptly at the edges, where the same white ill-filled vesicle-like wave-crest was present. On the surface of this were 2 or 3 small blebs, the size of a threepennypiece or sixpence, not well filled. Islands about the size of half a crown and of the same character were spread out on the skin of brow, chin and neck. The eyelids were much less swollen.

At the knuckles most of the wheals had grown to the size of a shilling or half a crown. The patch at the left elbow had greatly faded, and was scruffy. The skin was not now itchy.

The last case which I shall give was one where the diagnosis of smallpox was never established, yet no other diagnosis was made in its place. The circumstances of the case were these:

Alexander Gilfillan, aged 23 years, sickened on February 15th, with headache and pain in the back, and slight sickness, not actually vomiting, however, till the 18th. He was admitted on February 19th.



This is his chart.

On admission he was very sick and vomiting. He suffered from a remarkable stiffness of all his joints more especially the knees, and could scarcely bend them, and it was difficult even to get them bent passively. Even his neck was very stiff. He had a discrete scanty eruption of spots, mostly on his back, which were of a red colour, raised above the surface, but to the touch soft, not hard and certainly not "shotty".

On the following day, February 20th, there was no attempt at vesication on the part of these spots, on the other hand they were fading. The stiffness, sickness and vomiting were still present. On this day he was isolated and vaccinated.

On the 21st the spots were still fading, and the vomiting continued.

On the 23rd his vomiting and stiffness had gone, and the spots were almost completely faded. His vaccination took well, and on February 26th he was dismissed, having been 7 days in hospital. He did not take smallpox subsequently.

It is difficult to say what the nature of this case was. The symptoms were severe, but the rash was small and abortive, and quite unlike anything I saw during the whole epidemic.

With these notes I bring to a termination this paper in which I have expressed only the facts I have met with in the course of this epidemic, and the inferences which seemed to me to arise from these facts, without reference to works and papers on the subject.

J. KEITH A. ROBERTSON,
M.B.,Ch.B.

Greenock,
April 1905.

NOTE:-

Knowing that the paper was of the nature of a private communication, I have given the full names of the cases detailed, which, of course, I should have suppressed in writing a paper for publication.