ADULT IMMUNE SERUM IN THE PROPHYLAXIS AND ATTENUATION OF MEASLES.

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P R E F A C E.

The value of adult immune serum both in the prophylaxis and attenuation of measles has not hitherto been definitely established. By 'adult serum' is meant the blood serum of adults who have passed through an attack of measles in childhood. The volume of research which has already been done in this field is small, and the conclusions derived by different observers are, to say the least, conflicting. In most of the previous enquiries uninoculated control cases have not been included and the value of the results is thus extremely difficult to estimate.

Convalescent serum is of proven value in measles but its application is distinctly limited by the difficulty of securing adequate quantities, particularly at the beginning of an epidemic. The supply of adult serum is, on the other hand, almost unlimited and its employment eminently practicable; but its value must be placed beyond doubt before subjects will readily offer their blood in the cause, or public health authorities approve its use in the attempt to curtail measles morbidity and mortality.

The present work is a contribution to the assessment of the true value of adult immune serum in measles, both as a prophylactic and as an attenuative, and it has been endeavoured also to present certain aspects of the subject which have not, up to the present, received attention.

I am indebted to Dr.A.S.M.Macgregor, Medical Officer of Health of the City of Glasgow who permitted me to utilize the measles contacts which presented themselves in various institutions under his control, and I am especially beholden to Dr.William Dow, Physician-Superintendent, Knightswood Infectious Diseases Hospital, Glasgow, who

afforded me every facility both clinical and laboratory and whose enthusiasm provided a stimulus to my efforts. Nor must I leave unstated the willing co-operation of the nursing staffs in the several institutions to which I had access, a co-operation without which my work could scarcely have been accomplished.

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ARRANGEMENT OF THESIS.

INTRODUCTION.

SCHEME OF THE INVESTIGATION.

TECHNICAL METHODS.

THE INVESTIGATION.

ANALYSIS OF DATA.

SUMMARY.

CONCLUSIONS.

REFERENCES.

I N T R O D U C T I O N.

The need for some form of treatment which will ameliorate the course of measles in young children, and thereby prevent the disastrous complications which are so apt to follow, is apparent to all workers in the field of infectious diseases. During the last century various methods of prophylactic inoculation against measles were advocated, but the first really successful immunisations were reported in 1918 by Nicolle and Conseil, who used serum from convalescent measles patients as a means of producing passive immunity in susceptible contacts. Since then a large number of workers have attested the value of convalescent measles serum as a prophylactic. Owing to the difficulty of obtaining convalescent serum, attempts have been made to produce measles immune serum from animals, and the necessity for a suitable antigen stimulated research on the aetiology of measles. Several workers notably Tunnicliff, isolated diplococci from the blood and naso-pharyngeal secretions of patients, but these organisms have not generally been accepted as the aetiological agent, and the serum from animals immunised with strains of these organisms has been proved valueless in the prevention or attenuation of measles, as indeed have all animal sera however produced.

Degkwitz, in consideration of the fact that an attack of measles almost invariably confers lifelong immunity, suggested that the blood or serum of adults who had passed through an attack of measles, when given in adequate doses, would contain sufficient antibodies to produce passive immunity. At Pfaundler's clinic in Munich in 1920, Degkwitz inoculated such adult serum into seven children who had been in contact with measles, six receiving 30 c.c. and one 20 c.c.

Four of the children subsequently developed very mild measles. Disappointed in these results he abandoned the idea, on the grounds that the antibody content of adult blood was too low to be of any value. During the next five years research on the subject was confined to Germany. Reitschel (1921), Salomon (1923), von Torday (1923), Kutter (1923), Gerlach (1924), Goebel (1924), Hilsinger (1925), and Kovacs (1925), reported varying results on the inoculation of adult whole blood or serum into small numbers of measles contacts.

Little work seems to have been done on the subject in France, but in 1925, Debré, an authority on convalescent measles serum, suggested that good results could be obtained by the use of adult serum, and W.S.C.Copeman who was then "Assistant Étranger" in the Faculty of Medicine of the University of Paris, successfully used adult serum in four children exposed to measles infection by familial contact.

In America, a certain amount of research has been carried out, but again the numbers immunised are small, as most of the workers considered that convalescent serum was much more effective. Zingher in 1924 noted that adult serum was of value in the attenuation of measles, but did not report any cases where it had been used. In 1927 Karelitz and Levin, and Bivings and Dickson in America, Pasani-Casa in Italy, and Zoepffel in Germany, reported favourably on series of measles contacts who had been immunised with adult serum. Two years later, Bader in America, and Morales and Mandry in Porto-Rico, reported results showing that adult serum was more successful in the attenuation than in the prevention of measles, and in 1930 Barenberg, Lewis, and Messer in America reported similar results.

In Britain, the use of adult serum was first reported in 1930 by E.H.R.Harries then Medical Superintendent

of the Birmingham Infectious Diseases Hospital, and later (1932), by M.Burn of the Birmingham Public Health Department. The latter claims excellent results both in prophylaxis and attenuation, but unfortunately these are not substantiated by details of the investigation.

The amount of research which has been carried out on adult serum is relatively small, and only some twenty-five reports of its use are to be found in literature. A careful study of the literature of the subject reveals the fact that the vast majority of the investigators neglected entirely to provide uninoculated controls, thereby rendering their results valueless. It is evident that the interpretation of results must depend on a comparison of the behaviour of inoculated contacts with that of uninoculated controls who have been exposed to the same source of infection. The results of previous investigations are conflicting, some indicating that adult serum is an effective agent in the prevention of measles, others that it is almost useless as a prophylactic but is successful in modifying or attenuating the attack. Moreover there are certain important aspects of the subject which have not previously been explored. City-bred adults who have never had an attack of measles rarely contract the infection; their immunity has probably been built up gradually by the reception of sub-infective doses from intermittent contact with the disease. Is the blood-serum of such persons of value in the prophylaxis and attenuation of measles? When the serum is stored does its potency rapidly become impaired? Does the interval between the measles attack and the donation of blood have any influence on the potency of the serum? These are questions which previous investigators have left unanswered, and it is to these aspects of the subject that particular attention has been directed in the present work.

SCHEME OF THE INVESTIGATION.

Measles is perhaps the only infectious disease prevalent in temperate climates which shows marked epidemic periodicity. In most of the urban populations of Great Britain biennial epidemics recur with unfailing regularity, and preparations for these can be made well in advance.

In order to have a store of adult serum on hand at the beginning of the 1934 measles epidemic, and also to enable the keeping properties to be proved, the collection of serum was begun at Knightswood Hospital, Glasgow, during the winter of 1932-1933, and carried on, as donors became available, right up to & during the epidemic. Owing to the unusually late appearance of the epidemic in the spring of 1934, batches of serum of different ages up to eighteen months old were available.

The donors were recruited from patients who were convalescing from a mild attack of an infectious disease such as pneumonia, scarlet fever, or diphtheria. Well-nourished adults whose histories for tuberculosis, malaria and syphilis were negative, alone were selected. The pneumonia wards furnished by far the largest number of donors, as many of the cases admitted to these wards were very mild or abortive in character, and many subsequently proved to be suffering not from pneumonia, but only from a transient febrile illness. The serum was collected under aseptic conditions and stored in an ice-chest.

Sixteen thousand cubic centimetres of blood were collected from one hundred and thirty-seven donors, and yielded eight thousand and three cubic centimetres of serum. The average amount of blood from each donor was 116.8 c.c. and the average amount of serum 58.4 c.c. A sample of the

serum from each donor was subjected to the Wassermann and Kahn tests by the staff of the Glasgow Public Health Laboratory. In 15 (11.0 per cent.) of the donors, the blood serum was positive to either the Wassermann or Kahn reactions or to both, and the serum from these donors amounting in all to 955 c.c., was rejected. This waste of serum could readily have been avoided by drawing a small quantity of blood from each prospective donor, and subjecting the serum to the Wassermann and Kahn reactions before taking the blood.

Twenty-two (16 per cent.) of the donors who were all city-bred, denied any history of measles, and from them 1368 c.c. of serum were collected.

The measles contacts made use of in the investigation were those who presented themselves in the wards of Municipal general and fever hospitals and in children's homes. In all there were thirty-one separate groups of children exposed to measles infection. The history of each child with regard to a previous attack of measles was very carefully enquired into, and those children who had not had measles were presumed to be susceptible.

The serum was given intramuscularly, the usual dose being 20 c.c. In a large number of the groups, a proportion of the susceptible contacts did not receive serum and these acted as controls. The contacts were kept under close observation until the twenty-first day after exposure to infection, and during that time their temperatures were taken four-hourly.

The type of measles attack which occurred in the contacts immunised with adult serum varied very considerably. There were a very few abortive cases in which after the usual incubation period, slight or moderate pyrexia, headache, and slight eye suffusion occurred, without the appearance of a

rash or of Koplik's spots, and without injection of the buccal mucosa. Recovery was very rapid in these cases, the whole illness lasting not much longer than twenty-four hours. A large number of the cases were attenuated. In these, catarrhal symptoms and Koplik's spots were entirely absent; the rash was faint, sparse, usually discrete, but sometimes confluent in isolated patches. Pyrexia was either absent or slight, and there were no constitutional symptoms and no complications. An attack of this kind did not appear to differ in any way from an extremely mild attack of measles such as occasionally occurs in children who have not been given measles serum. In a considerable number of cases the attack was distinctly modified but hardly warranted the term attenuated, which is here applied only to attacks of the very mildest possible nature. In these 'modified' cases, the catarrhal symptoms were either very slight or absent, Koplik's spots were absent, and the first indication of the infection was the appearance of the rash which was fairly bright and generalised, morbilliform in character and sometimes confluent. Pyrexia was slight or moderate in degree, and persisted for two to four days. The objective signs were those of a mild or moderate attack of measles, but the constitutional symptoms usually associated with such an attack were entirely lacking, and the catarrhal symptoms were slight or absent. From the onset, the children were bright and alert; they playfully sat up or stood up in their cots and they ate well and slept well. The whole illness was not unlike rubella. There were no complications. The doctors and nurses in attendance were impressed by the difference between these 'modified' cases and the classical cases. The character of the rash might be the same in both but the difference in the well-being of the children was

marked. Barenberg, Lewis and Messer, in America noted this type of modification in a small group of measles contacts immunised with adult whole blood. A number of immunised contacts developed classical measles with catarrhal symptoms, Koplik's spots, typical rash, moderate or high and sometimes prolonged pyrexia, and characteristic toxaemia. When measles occurred in an immunised contact the type of attack was classified in one of the above categories, i.e. either (a) abortive, (b) attenuated, (c) modified or (d) classical.

Cases of measles which occurred in the uninoculated or control series, were classified as very mild, mild or classical. In general, cases admitted to these categories corresponded respectively to the attenuated, modified, and classical types occurring amongst the immunised children, thus allowing a comparison of the severity of the attack in immunised and non-immunised contacts.

Immunised contacts and controls who developed measles after a second exposure to infection by an attenuated or classical case, were classified as above and in addition labelled 'secondary'.

The unusually late onset and consequent short duration of the epidemic added much to the difficulties of the investigation. In former years, measles in Glasgow has reached epidemic proportions in October or November, and the case incidence has remained high till the following April or May. Through the courtesy of Dr.A.S.M.Macgregor, Medical Officer of Health of the City of Glasgow, the Superintendents of all municipal hospitals, and the matrons of all municipal children's homes, were notified in September 1933, that supplies of adult immune serum were available at Knightswood Hospital, and that in the event of measles occurring in the institution, the susceptible contacts should be immunised at

the earliest possible moment. From the very beginning of the epidemic, every available opportunity of using the serum was utilized. Several hospitals without the city boundaries also knew of and asked for the serum. The first demand for the serum in Glasgow was made on the 16th.of March, 1934, and the last on the 17th. of June, 1934. Had the epidemic been of the usual duration, the investigation would have been much more extensive, as the supply of serum was more than adequate. The type of infection however was severe and the incidence of complicating broncho-pneumonia was high.

The work of administering the serum and of observing and recording those contacts who developed measles, was carried out personally, and necessitated repeated visits to each institution. Children who were exposed to measles infection and who were dismissed within the incubation period, were visited in their own homes. The amount of travelling involved was considerable and proved quite an arduous task especially during the height of the epidemic.

TECHNICAL METHODS.

The difficulty of collecting blood and of separating and storing the serum is commonly underestimated, but actually neither the bleeding and separation of the serum, nor the maintenance of strict asepsis from the moment of collection of the blood to the moment of injection of the serum, is in any way an easy task. From personal experience, the writer is of the opinion that the technique involved in the aseptic collection of blood, and separation and storage of the serum, is quite as difficult and demands just as much skill as that required in blood transfusion. Many pitfalls strew the path of the unwary. It is an easy matter to obtain the 5 c.c. or 10 c.c. of blood required for many of the serological, biochemical or bacteriological tests, such as the Wassermann, Widal, blood sugar estimations, blood culture etc. even although the only available vein is very small; it is also a comparatively easy matter to inject intravenously, fluids in small quantities as in the case of drugs, or in large quantities as in the case of isotonic solutions required to increase the volume of circulating blood. Of such operations the writer has had a comparatively large experience. It is however an entirely different matter to remove upwards of 100 c.c. of blood without resorting to the operation of venesection. The reason for this is obvious. The viscosity and coagulability of the blood demand that a needle of large bore be used. An ordinary serum needle, which can hardly be called small, cannot be relied upon to withdraw much more than 20 c.c. of blood without blocking due to coagulation of the blood. A needle of sufficient bore, when thrust into a small vein, instead of entering the lumen, simply causes a local rupture of the entire wall, and results

in a subcutaneous haematoma without letting of blood. The same size of needle thrust into a larger vein, causes a considerable rent in the wall, and if the needle and vein be not in perfect alignment, the vein is pierced not entered and again a haematoma results and the blood flow from the needle is small or absent. In blood letting by venepuncture without venesection, the choice of the needle is the most vital consideration. Experience gained in the investigation reported, has shown that a stout needle, number 17 in diameter and two and a quarter inches long gives the best results. The cutting edge of the needle must be keen, and it is well to sharpen the needle on an Arkansas stone at each time of use.

In many persons the coagulation time of the blood is shorter than average and when such is the case in a donor, bloodletting is rendered more difficult.

For the purposes of this investigation an attempt was made to withdraw 160 c.c. of blood from each donor. In 74 of the 137 donors, the blood flow stopped before this quantity had been obtained. From 46 per cent. only of the donors could 160 c.c. of blood or more be collected by venepuncture. Such an experience shows that it is not easy, even for one practised in the art of venepuncture, to obtain by this method large quantities or even moderate quantities of blood from every donor.

The maintenance of strict asepsis from start to finish is a major problem of serum collection. It must be borne in mind that the preparation of serum is a responsible task, for great risk attends the injection, if the serum be contaminated; intramuscular abscesses and worse have been reported.

Technique of Blood Collection. The method of blood

collection employed a needle conforming to the above description, a two-way tap, and a 20 c.c. syringe of 'Record' pattern. The syringe chosen was a well used one, the piston of which was a perfect sliding-fit in the barrel. It was found that in a suitable syringe, if the barrel were held vertically, the piston placed at the upper end, would slowly travel by the force of its own weight to the lower end of the barrel. A ward sister instructed in the technique, placed these instruments - needle, two-way tap, and syringe (dismantled) together with two pairs of dissecting forceps, in a fish-kettle sterilizer, and boiled them for half an hour or longer in the side-room of the ward. After sterilizing her hands by scrubbing with a nail brush and soap in warm running water, she placed two sterile towels, the one superimposed upon the other, on a tray. By means of a pair of large forceps, the lower ends of which were in the water and therefore sterilized, and the upper or 'handle' ends out, she lifted the instruments out of the boiling water and placed them on the sterile towels. Using the same forceps, she carefully folded the upper towel over the instruments, and then folded the lower or outer towel over the inner towel. The tray was placed near the bed or couch on which the donor was lying, and in a few minutes the instruments were cool, dry, and ready for use. The sister covered part of the side of the bed or couch with sterile towels, and the donor was instructed to rest the arm on these, and to place the hand with the palm upwards. By means of gauze sponges held in sterile forceps, the sister sterilized the skin over the antecubital fossa, by swabbing with ether followed by methylated spirit; she then applied a light

tourniquet of the Foulis pattern to the upper arm, and the donor was instructed to clench and unclench the hand several times, and finally to hold the hand tightly clenched. Meanwhile the writer had sterilized his hands by scrubbing with a nail brush and soap in warm running water. The sister unfolded the towels, and the writer, using the sterile forceps, assembled the syringe, two-way tap and needle and performed the venepuncture. The skin over the antecubital fossa was drawn taut by traction exerted by the thumb of the left hand placed lower down on the donor's forearm. The direction of any convenient vein was noted, and the syringe was held so that its axis was in line with the vein, the needle resting on the skin directly above it. Keeping the needle as horizontal and as close to the skin as possible, the point was gently but firmly insinuated for about a quarter of an inch into the subcutaneous tissue between the skin and the upper surface of the vein. The needle was then directed downwards by slightly raising the barrel of the syringe, and by a short sharp forward movement, the wall of the vein was pierced, giving a sudden characteristic 'yielding' sensation; the barrel of the syringe was immediately lowered, rendering the needle as nearly parallel with the vein as possible, while the point of the needle, now in the vein, was advanced about quarter of an inch into the lumen, by means of a forward movement. This technique of venepuncture proved very reliable; much more so than the usual method of thrusting the needle directly into the vein which resulted too often in transfixion of the vessel.

The first few cubic centimetres of blood were ejected into a small sterile test tube which was

subsequently transmitted to the Public Health Laboratory, where the blood-serum was subjected to the Wassermann and Kahn tests. Thereafter each syringeful of blood (20 c.c.) was received into a separate test tube containing 1 c.c. of 7.5 per cent. sodium citrate solution. These citrate tubes prior to sterilization had been fitted with cotton wool plugs and wrapped in Kraft paper. While the syringe was being charged with blood, the sister unwrapped a citrate tube, removed the plug which she held in the left hand, and placed the mouth of the tube under the outlet nozzle of the two-way tap. When the syringe was full, the tap was turned, and the blood ejected into the citrate tube; the cotton wool plug was immediately replaced by the sister who proceeded to unwrap another citrate tube while the syringe was being refilled.

The time taken to collect 160 c.c. of blood by this method was less than three minutes, and the mental upset sustained by the donor was little more than that occasioned ordinarily by the taking of blood for a Wassermann test.

In the above technique, the syringe and needle for withdrawing the blood were dry when used - an important factor in the maintenance of absolute sterility. In a large series of blood cultures recently carried out at Knightswood Hospital by this method, not one was contaminated. In a previous series in which the syringe and needle were lifted out of the water in which they had been boiled, and were consequently used 'wet', a number of the blood cultures were contaminated, even although every possible care was taken to ensure sterility.

Laboratory Technique. After the venepuncture had been performed, the tubes of citrated blood were taken to the hospital laboratory, where the work of separating

and storing the serum was carried out immediately, or within a few hours after the withdrawal of the blood. Occasionally in a very few of the tubes partial clotting occurred within a few minutes. When this happened the tubes were placed in the ice chest for two hours or longer, after which time the clot had contracted sufficiently to allow the plasma to be decanted.

From each citrate tube in turn, the cotton wool plug was removed, and after the mouth of the tube had been carefully sterilized in a bunsen flame, the blood was poured over the lip into sterile centrifuge tubes, each of which held 10 c.c. and had a graduation mark at this level. Prior to sterilization, each centrifuge tube had been fitted with a cotton-wool plug, and the latter had been transfixed by a piece of wire slightly longer than the diameter of the tube, the purpose of which was to prevent the plug from being driven into the tube during centrifugalisation. The cotton-wool plugs were immediately replaced after the introduction of the blood. The tubes were placed in an electric centrifuge and rotated at 4000 revolutions per minute for about ten minutes. After centrifugalisation the upper half of the contents of the tubes was clear straw-coloured plasma, and the lower half, red blood corpuscles, while at the line of separation there was a thin white film of leucocytes. The plasma was separated by means of a sterile 20 c.c. syringe and wide bore canula. This syringe and canula, together with a one cubic centimetre syringe and a long needle required for the addition of the antiseptic tricresol, had been sterilized in the same fashion as were the blood collecting syringe and instruments, i.e. they had been boiled for half an hour or

longer and wrapped in two sterile towels. The outer towel was carefully opened out without touching the inner towel, and then the writer, after sterilizing the hands by scrubbing with a nail brush and soap in warm running water, uncovered and assembled the 20 c.c. syringe, and proceeded to aspirate the plasma from the centrifuge tubes. The task of drawing up the plasma into the syringe proved to be rather a delicate one, because if a few drops of plasma were allowed to flow back from the syringe into the tube, the blood corpuscles were disturbed and were dispersed throughout the plasma. By means of the graduated 20 c.c. syringe the plasma was measured into sterile bottles holding 10 c.c. or 20 c.c. After the whole of the plasma of the batch had been apportioned to the various containers, the 1 c.c. syringe was removed from the sterile towels, assembled by means of the sterile forceps, and used to measure and add the antiseptic tricresol. One cubic centimetre of a 2.5 per cent. solution of tricresol in water was added to each 5 c.c. of plasma, so that the ultimate concentration was 0.4 per cent. Immediately after the introduction of the plasma or tricresol, the cotton wool plugs were replaced in the mouths of the bottles.

Before commencing the separation of the serum, a sufficient quantity of rubber stoppers together with a pair of dissecting forceps, had been placed in a beaker of water over a bunsen flame. By the time the stoppers were required, they had been boiled for more than half an hour. The cotton wool plug was removed from each bottle of serum in turn, the neck flamed, and a rubber stopper held in sterile forceps was lifted out of the boiling water, passed through a bunsen flame to remove moisture,

and then fitted firmly into the mouth of the bottle. The bottles containing each batch of serum were appropriately labelled, and stored in an ice-chest. A cultural sterility test was carried out on each batch by inoculating a tube of Hartley's broth and a blood-agar slope with plasma, and incubating them at 37°C. for twenty four hours. In no case was a bacterial growth obtained.

The average time required in the laboratory to deal with the blood from each donor was about two hours.

The plasma when separated was clear and straw-coloured, but after standing for twenty-four hours it became somewhat cloudy, owing to the precipitation of fibrin in a very finely divided state. When the plasma had been kept for weeks or months in the ice-chest, the precipitate usually collected on the surface of the serum which was clear and straw coloured: more rarely the precipitate settled to the bottom of the container, and in a few of the batches it remained uniformly distributed throughout the serum. In all cases the precipitate was extremely finely divided, and by shaking was easily dispersed throughout the serum which it rendered slightly cloudy.

Preparation and sterilization of Materials. The tubes used for collecting blood were $\frac{7}{8}$ of an inch in diameter and $5\frac{1}{2}$ inches long: when containing 20 c.c. they were about three-quarters full. A lip was drawn out at one point in the circumference of the mouth of each tube, to facilitate the pouring of the blood into the centrifuge tubes. The tubes were carefully washed and dried, fitted with cotton wool plugs, and sterilized in the hot air oven for one hour at 160°F. By means of a sterile pipette one cubic centimetre of a sterile 7.5

per cent. solution of sodium citrate was added to each tube. The tubes were wrapped in Kraft paper and steamed for one hour in the Koch to ensure absolute sterility; thereafter they were stored in an upright position in a covered glass jar.

The centrifuge tubes were $\frac{5}{8}$ of an inch in diameter and $3\frac{1}{2}$ inches long. A graduation mark was filed on the tubes at the 10 c.c. level, so that an equal quantity of blood could be placed in each thereby ensuring balance in the centrifuge. Each tube was carefully washed and dried, and fitted with a cotton wool plug, and the latter was transfixed with a piece of wire slightly longer than the diameter of the tube. The function of the wire was to prevent the plug from being driven into the tube by centrifugal force, during centrifugalisation. The tubes complete with plugs and pins were wrapped in Kraft paper and sterilized in the hot air oven for one hour at 160°F.: thereafter they were stored ready for use in a covered glass jar.

The bottles used were empty serum bottles of 10-20 c.c. capacity. They were carefully washed and dried, and each was fitted with a cotton wool plug and wrapped in Kraft paper. Sterilization was effected in the hot air oven by maintaining a temperature of 160°F. for one hour. They were stored ready for use in a covered glass jar. The covering papers were not removed from the tubes and bottles until immediately before they were used.

The entire work of collecting the blood and separating and storing the serum, was carried out in the wards and laboratory at Knightswood Hospital.

THE INVESTIGATION.

In this section a brief report is given of each group of susceptible children exposed to measles infection. Each report is prefaced by a table containing the relevant data, and most are preceded by a series of temperature charts for the attenuated and modified, and many of the classical and control cases which occurred in the group. On each temperature chart the salient clinical features of the illness are recorded. The reports terminate with summaries of the results obtained.

In estimating the interval of time between the beginning of the exposure to infection and the injection of the serum, or the number of days after the beginning of the exposure to infection on which the serum was given, it has been assumed - following the method of Zingher - that the infecting measles case had been actively disseminating the causal agent for four days prior to the appearance of the rash.

MEASLES CONTACTS - GROUP I.

Contacts from Kilmarnock Fever Hospital Ward 2.

Illness from which contacts were suffering - Scarlet Fever.

Particulars of the Eleven Cases of Measles who exposed the Contacts to Infection.	Admitted to Ward between 29/10/33 and 3/11/33. Catarrh appeared? Rash appeared in 10 cases on 12/11/33: in one, 14/11/33. Removed to Side-room same ward when rash appeared.

Date when Contacts were immunised - 14/11/33.

Day after exposure when Contacts were immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
1.	E.McC.	3	10	74	194	40	-	-	-
2.	M.A.	5	10	74	194	40	10	Attenuated	22/11/33.
3.	J.R.	5	10	74	194	40	15	Modified	27/11/33.
4.	J.H.	6	10	74	194	40	-	-	-
5.	J.M.	3	10	74	194	40	-	-	-
6.	J.B.	3	10	74	194	40	11	Classical	23/11/33.
7.	J.McP.	5	10	75	193	22	-	-	-
8.	J.B.	8/12	10	75	193	22	-	-	-
9.	A.S.	4	10	75	193	22	-	-	-
10.	J.McC.	6	10	75	193	22	-	-	-
11.	W.M.	3	10	75	193	22	-	-	-
x12.	W.H.	6	15	75	193	22	-	Classical	16/11/33.
x13.	E.R.	6	15	78	188	27	-	Mild	18/11/33.
14.	M.G.	5	15	78	188	27	-	-	-
x15.	A.D.	4	15	78	188	27	-	Classical	16/11/33.
16.	S.McC.	6	15	78	188	27	-	-	-
17.	J.L.	5	15	78	188	27	-	-	-
18.	H.McA.	4	15	80	170	18	-	-	-
19.	L.C.	8	No Serum	C O N T R O L			-	-	-
20.	J.B.	10	No Serum	C O N T R O L			-	-	-
21.	J.O'C.	10	No Serum	C O N T R O L			-	-	-

x Contacts who proved to have been in pre-eruptive stage Measles when inoculated.

Commentary Group I.

The first group of children exposed to measles infection were patients in a scarlet fever ward in Kilmarnock Infectious Diseases Hospital. Ten cases of measles occurred in the ward on 12/11/33, and one case two days later; they were transferred to the side-room of the same ward when the rash appeared.

Twenty-one children had not had measles and were exposed to infection. Dr.Nisbet, Medical Officer of Health of Kilmarnock, was most anxious that as many as possible of these presumably susceptible children should be immunised, and for that reason, three only did not receive serum and served as controls. The serum was given on 14/11/33, the sixth day after exposure. Twelve of the immunised contacts did not contract infection. Three developed a measles rash within four days after the injection of the serum; they had therefore been in the pre-eruptive stage of measles when the serum was given, and the source of their infection had not been the cases which occurred in the ward on 12/11/33 and 14/11/33. These cases are not comparable with the other contacts and are, for this reason, not included in the results. One immunised susceptible contact developed attenuated measles, one showed modified measles, and one classical measles. None of the uninoculated controls contracted the infection.

An interesting example of the effect of human serum in the treatment of psoriasis, was observed in one of the susceptible children in this group. From a very early age the child, (W.M.No.11) now three years old, had suffered from a severe and intractable form of psoriasis which had resisted all the usual therapeutic measures.

He had recently been under treatment in hospital for a period of six months, with but very little improvement. When the injection of human serum was given, the whole of the child's skin was so severely affected that it was hardly possible to find a suitable area of healthy skin through which to administer the serum. After the injection of the serum, rapid improvement in the condition of the skin was observed; the lesions healed and within a week the child was discharged from hospital, not altogether cured but very markedly improved.

The intractable nature of psoriasis is well recognised, and reference to the literature shows that many fields of investigation have been explored in search of effective treatment, including protein shock and serum therapy. Autogenous serum and normal horse serum have been used from time to time with varying success.

Conclusions and generalisations based on a single case are always dangerous; but in view of the rapidity and dramatic nature of the improvement following upon the injection of the human serum, it is probable that in this child the improvement was really due to the serum.

G R O U P I.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, 18

Inoculated in Pre-eruptive stage of Measles, 3

Available Immunised Contacts, 15

No Measles	12
Attenuated Measles	1
Modified Measles	1
Classical Measles	1

Controls - 3 Uninoculated presumably susceptible contacts did not contract Measles.

MEASLES CONTACTS - GROUP 2.

Contacts from Scotstoun House Home.

Illness from which contacts were suffering - General Debility.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	3/3/34.
	Catarrh appeared	15/3/34.
	Rash appeared	17/3/34.
	Removed from Ward	16/3/34.

Date when Contacts immunised - 16/3/34.

Day after exposure when Contacts immunised - 3rd.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
22.	L.B.	1 2/12	15	72	323	19	17	Attenuated	3/4/34.
x23.	D.W.	3	15	72	323	19	14	Classical	31/3/34.
x24.	G.O'N.	2½	15	71	324	20	15	Classical	1/4/34.
25.	A.F.	3 11/12	15	71	324	20	14	Attenuated	31/3/34.
26.	A.R.	3 7/12	15	70	331	22	13	Classical	30/3/34.
27.	A.McK.	3 3/12	15	79	294	32	9	Attenuated	26/3/34.
28.	E.M.	4 8/12	15	70	331	22	14	Modified	31/3/34.
29.	S.McE.	1 2/12	No Serum	C O N T R O L			10	Classical	27/3/34.
30.	M.Q.	1 8/12	No Serum	C O N T R O L			9	Classical	26/3/34.
x31.	A.M.	1	No Serum	C O N T R O L			-	Secondary Classical	12/4/34.
x32.	R.G.	1 4/12	No Serum	C O N T R O L			10	Classical	27/3/34.
x33.	A.D.	1 7/12	No Serum	C O N T R O L			10	Classical	27/3/34.
x34.	W.H.	1 6/12	No Serum	C O N T R O L			13	Classical	30/3/34.

Contacts marked x died from Broncho-Pneumonia.

MARCH 31 | 1 | 2 | 3 | 4 | 5 | 6

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RASH

DATE.....

DAY OF ILLNESS.....

NAME.....

AGE.....

WARD.....

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PAGE.....

NAME L.B. (SERIAL Nº 22).

AGE 1 YEAR AND 3 MONTHS.

15 CC. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

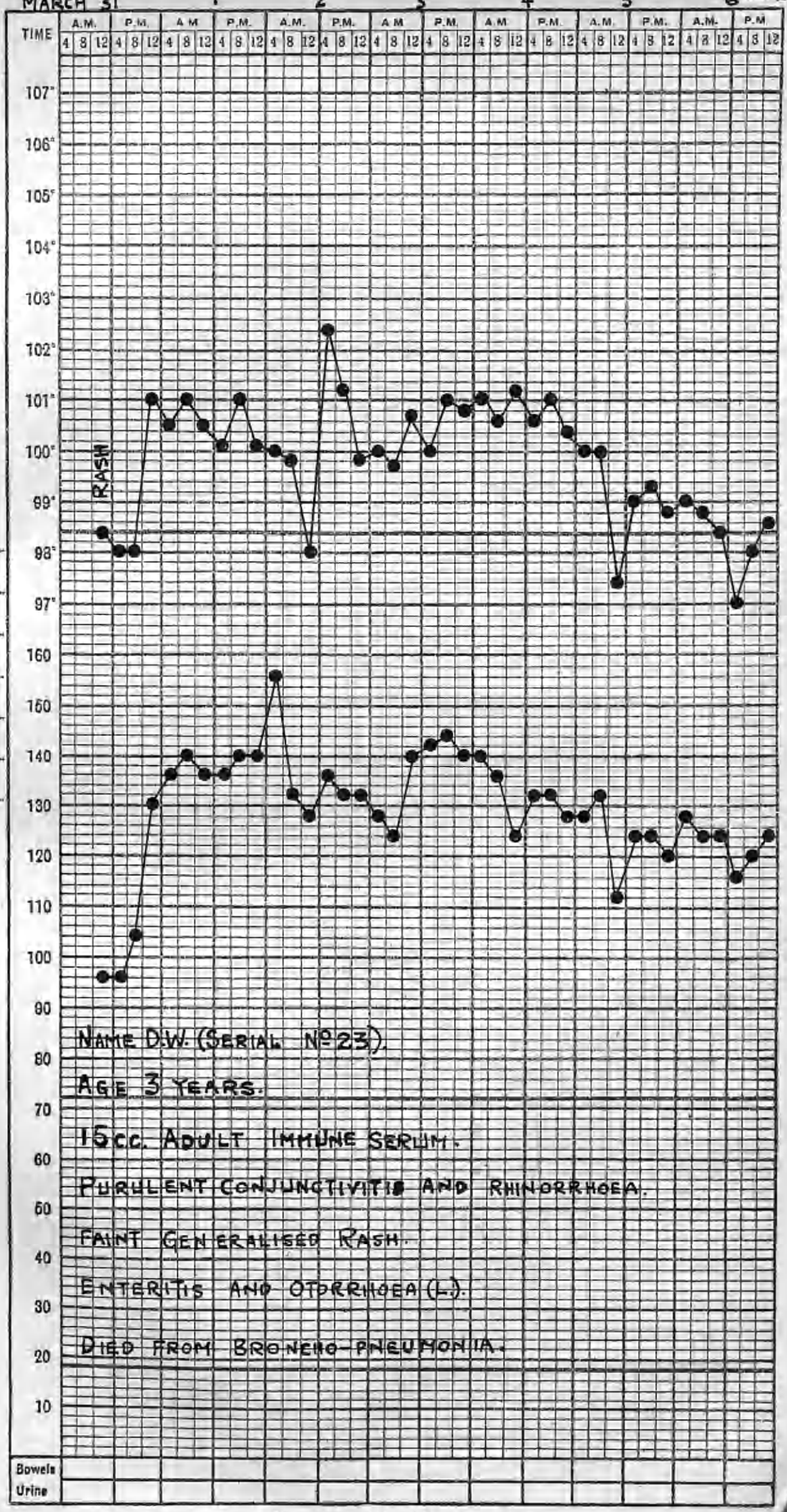
NO CATARRH.

RASH - DISCRETE MACULES ON TRUNK ONLY.

Bowels

Urine

ATTENUATED MEASLES.



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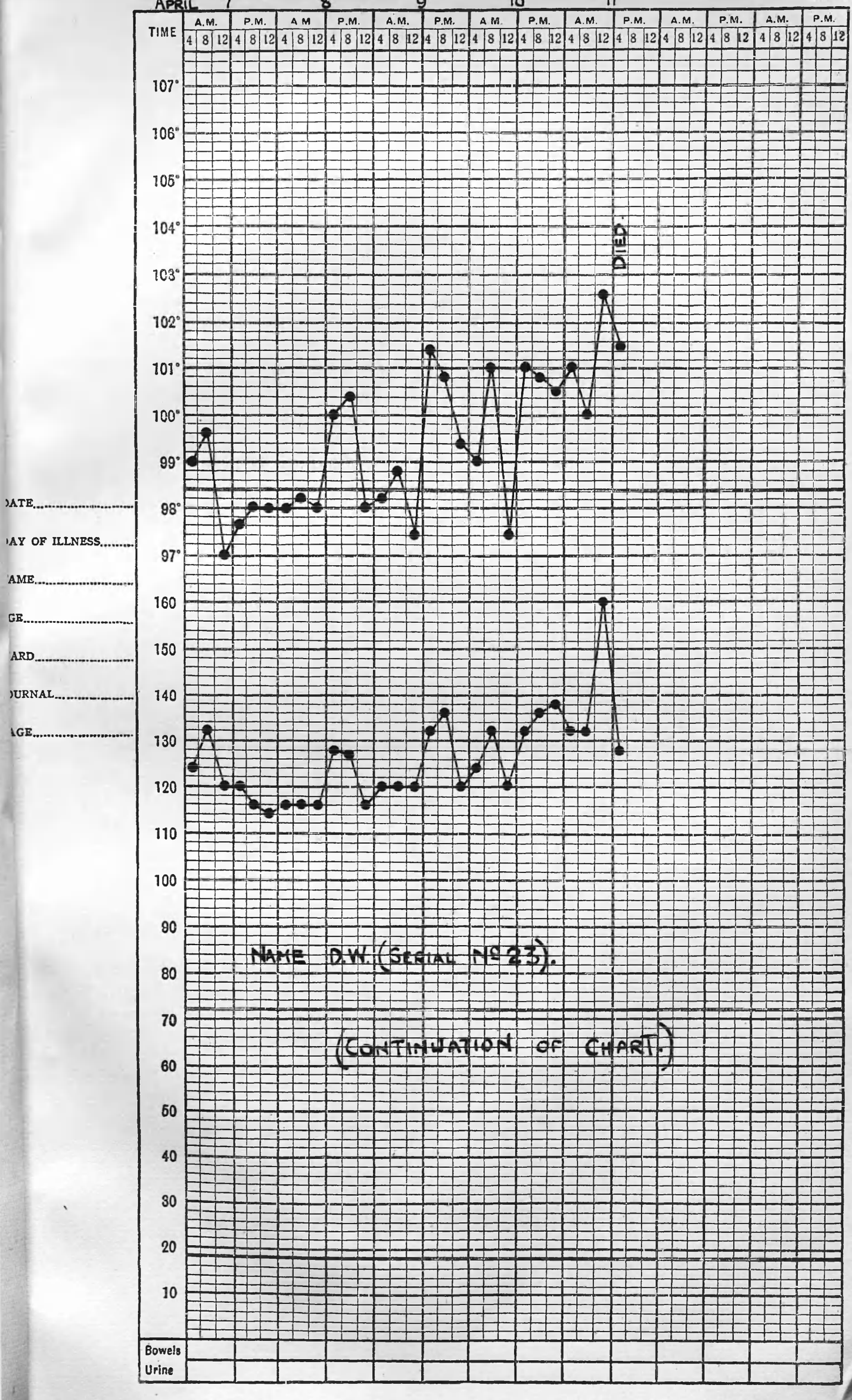
CLASSICAL MEASLES.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NAME D.W. (SERIAL Nº 23).
(CONTINUATION OF CHART.)
Bowels
Urine

MARCH 31 1 2 3 4 5 6

TIME

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RASH.

DIED.

DATE.....

DAY OF ILLNESS.....

NAME.....

AGE.....

WARD.....

JOURNAL.....

PAGE.....

NAME G.O'N (No 24).

AGE 2½ YEARS.

15 c.c. ADULT IMMUNE SERUM.

KOPLIK'S SPOTS PRESENT.

LACHRYMATION: PHOTOPHOBIA: RHINORRHOEA.

TYPICAL BRIGHT RASH.

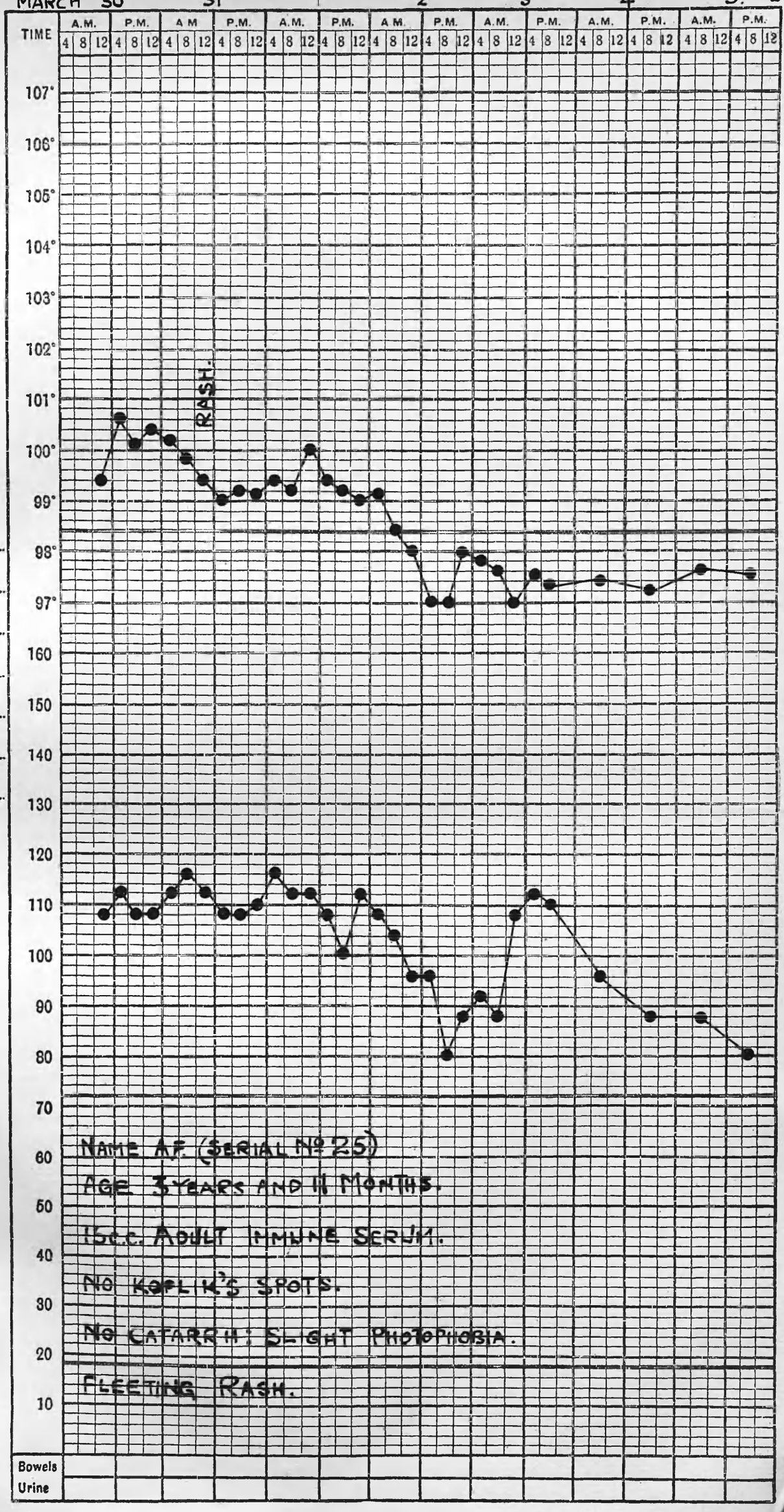
ENTERITIS: BRONCHO-PNEUMONIA.

DIED.

Bowels

Urine

CLASSICAL MEASLES.



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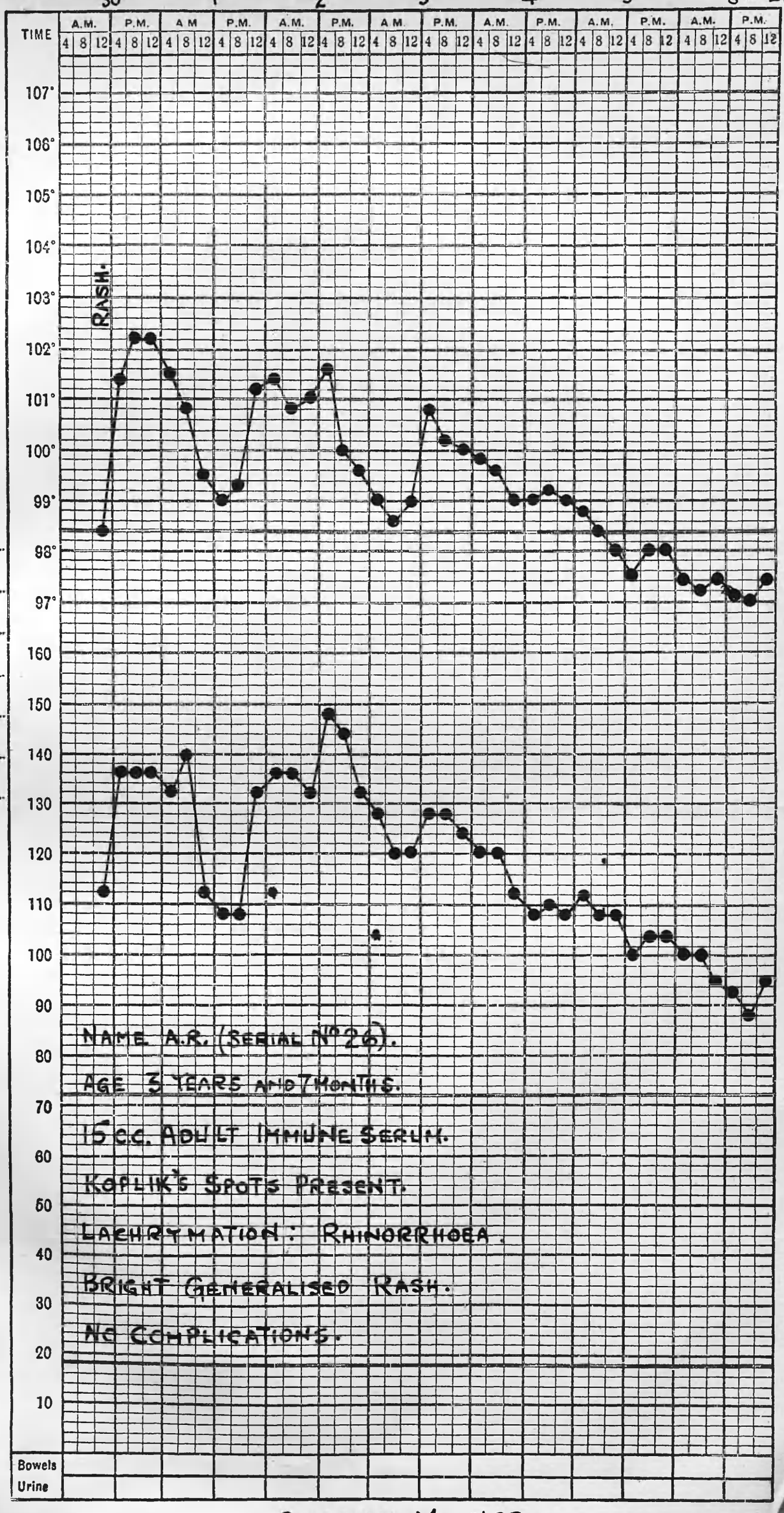
ATTENUATED MEASLES.



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CLASSICAL MEASLES.

MARCH. 25 26 27 28 29 30

TIME

A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M.

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RASH

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AY OF ILLNESS.....

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URNAL.....

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10

NAME A.M^cK. (SERIAL N^o 27).

AGE 3 YEARS AND 3 MONTHS.

1 D.C.C. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

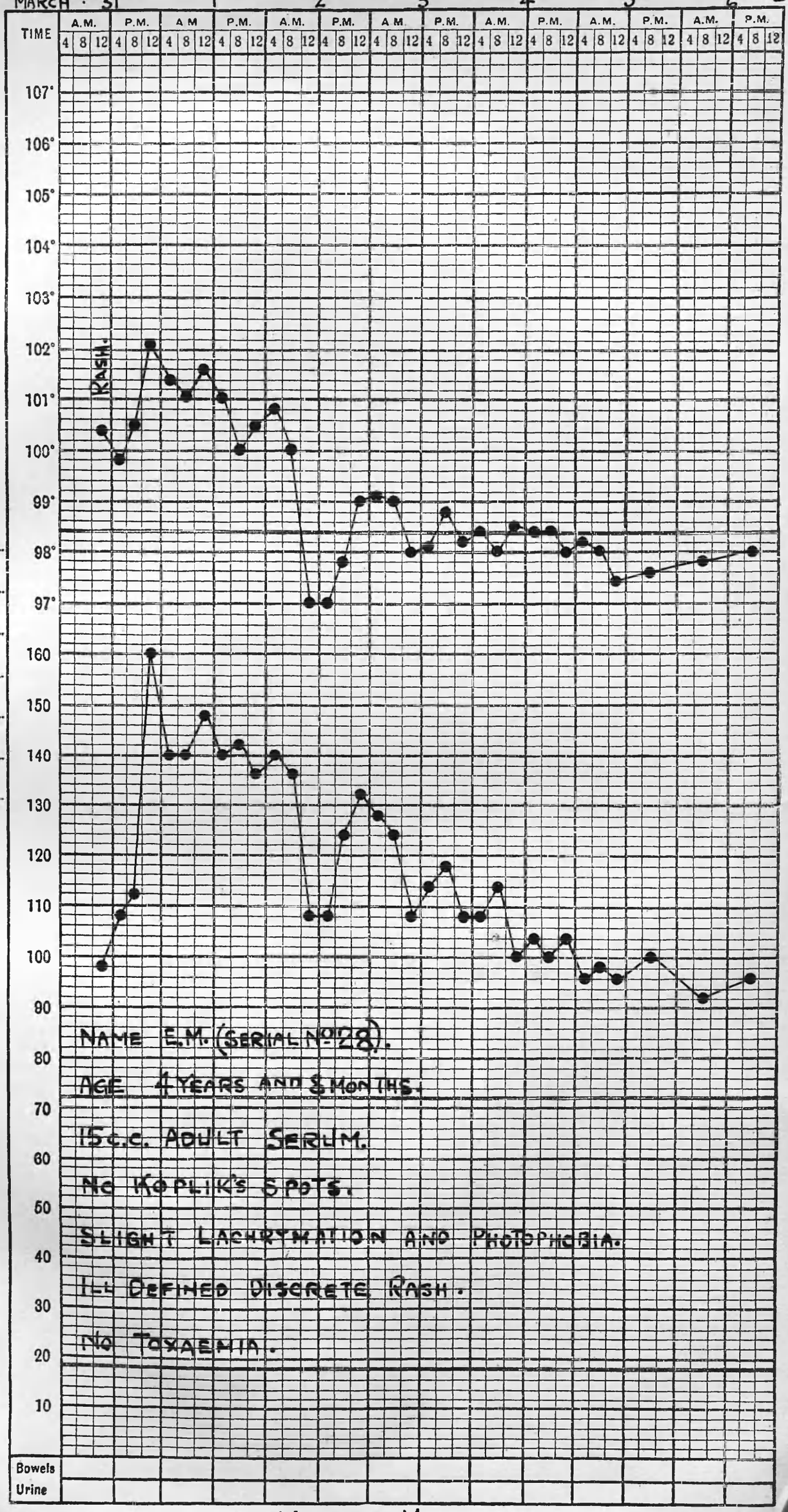
NO CATARRH.

FAINT GENERALISED RASH.

Bowels

Urine

ATTENUATED MEASLES.



MODIFIED MEASLES.

Commentary Group 2.

The second group included the children in Scotstoun House, a home for debilitated children of pre-school age.

On 15/3/34, a child who had been admitted twelve days previously, showed Koplik's spots and the catarrhal symptoms of measles. He was removed to hospital on the following day and developed a typical rash on 17/3/34. Fifteen children were exposed to infection. Of these, thirteen had not had measles and were presumably susceptible. On 16/3/34, the third day after exposure to infection, seven of the presumably susceptible children were each given 15 c.c. of adult immune serum, and six did not receive serum so acting as controls. All the susceptible children contracted measles. Three of the seven immunised contacts developed attenuated attacks, one showed modified measles, and three the classical disease. Two of the classical cases died as a result of complicating broncho-pneumonia and enteritis. All of the six non-immunised controls showed classical attacks, and four of them died from broncho-pneumonia.

One of the non-immunised controls, (A.M.No.31) developed measles twenty-six days after the first exposure to infection - a length of time beyond the recognised limits of the incubation period. In all probability the source of this infection was not the original or first case of measles, but was the cases arising as a result of contact with the original infection; if so, the incubation period would be between nine and seventeen days. It is likely that this child possessed partial natural immunity to measles which was only overcome after a

second long continued exposure to infection.

In this group two children who had had adult immune serum died. It is apparent then, that in some cases there is a fatal termination in spite of the exhibition of adult immune serum.

G R O U P 2.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	7	(Attenuated (Measles	3
		(Modified (Measles	1
		(Classical (Measles (2 died.)	3

Controls - 6 Uninoculated Contacts contracted Classical Measles and 4 of them died.

MEASLES CONTACTS - GROUP 3.

Contacts from Southern General Hospital Ward 74.

Illness from which contacts were suffering - Primary Pneumonia.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	23/3/34.
	Catarrh appeared	25/3/34.
	Rash appeared	26/3/34.
	Removed from Ward	26/3/34.

A Nurse on duty in the Ward contracted Measles, the Rash appearing 5/4/34.

Date when Contacts were immunised - 28/3/34.

Day after exposure when Contacts were immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
35.	S.H.	7/12	10	65	354	26	-	-	-
36.	I.McD.	6/12	10	64	351	33	-	-	-
37.	E.R.	7/12	10	69	345	48	-	-	-
38.	S.W.	4/12	10	68	347	25	-	-	-
39.	P.K.	3 6/12	10	68	347	25	-	-	-
40.	P.S.	2 10/12	10	68	347	25	8	Attenuated	13/4/34.
41.	T.B.	3	10	65	354	26	-	-	-
42.	E.H.	3	10	65	354	26	-	-	-
43.	J.N.	3 5/12	10	65	354	26	-	-	-
44.	C.McG.	3	10	65	354	26	-	-	-
45.	S.R.	3	10	67	350	20	-	-	-
46.	P.F.	3/12	No Serum	C O N T R O L			-	-	-
47.	M.O'N.	4/12	No Serum	C O N T R O L			-	-	-
48.	J.K.	7/12	No Serum	C O N T R O L			9	Very mild Measles.	14/4/34.
49.	J.McC.	9/12	No Serum	C O N T R O L			-	-	-
50.	J.McB.	2	No Serum	C O N T R O L			-	-	-

Commentary Group 3.

In a ward in the Southern General Hospital containing children suffering from primary pneumonia, one showed a measles rash on 26/3/34. A nurse on duty developed a measles rash on 5/4/34: she was twenty-two years of age and was born in Skye: it is likely that she contracted the infection from the child.

Sixteen children who had not had measles were exposed to infection: eleven of these were each given 10 c.c. of adult immune serum on 28/3/34, the sixth day after exposure, while five, the controls, did not receive serum.

Two only of the presumably susceptible children contracted measles; one an immunised child and one an uninoculated control. In both the attack was exceedingly mild. Koplik's spots, catarrhal symptoms and pyrexia were entirely absent. The rash was faint, sparse and discrete, but morbilliform in character, and appeared on face, abdomen, and limbs. In the immunised contact the attack which is regarded as being attenuated by the serum, did not appear to differ in any way from the exceedingly mild attack in the non-immunised control.

Throughout the catarrhal stage of her illness, the nurse was engaged in attending to the children: she went off duty only when the rash appeared: yet only one of the five presumably susceptible children who were not immunised contracted measles. It is highly probably that these children possessed a considerable degree of natural immunity.

G R O U P 3.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	11	(No Measles	10
		(Attenuated Measles	1
Uninoculated Presumably Susceptible Contacts, (Controls)	5	(No Measles	4
		(Very Mild Measles	1

MEASLES CONTACTS - GROUP 4.

Contacts from Blawarthill Fever Hospital Ward 3.

Illness from which contacts were suffering - Scarlet Fever.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	18/3/34.
	Catarrh appeared	27/3/34.
	Rash appeared	27/3/34.
	Removed from Ward	27/3/34.

Date when Contacts were immunised - 28/3/34.

Day after exposure when Contacts were immunised - 5th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
51.	A.M.	4	10	65	354	26	13	Classical	9/4/34.
52.	L.R.	3	10	67	350	20	13	Classical	9/4/34.
53.	J.McD.	3	10	67	350	20	14	Classical	10/4/34.
54.	A.R.	8	No Serum	C O N T R O L			-	-	-
55.	E.K.	3	No Serum	C O N T R O L			14	Classical	10/4/34.

Commentary Group 4.

The fourth group of measles contacts was composed of children in a scarlet fever ward in Blawarthill Hospital, Clydebank. A child in the Ward showed a typical rash on 27/3/34. Five presumably susceptible children were exposed to infection: three of them were each given 10 c.c. of adult immune serum on 28/3/34, the fifth day after exposure; two controls did not receive serum.

One of the uninoculated controls escaped infection, but all the other susceptible children developed classical measles.

G R O U P 4.

SUMMARY OF RESULTS.

3 Immunised Presumably Susceptible Contacts Contracted Classical Measles.

Uninoculated Presumably Susceptible Contacts, (Controls)	2	(No Measles	1
		(Classical	
		(Measles	1

MEASLES CONTACTS - GROUP 5.

Contacts from Moffat Street Reception House.

Illness from which Contacts were suffering - Scabies.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	18/3/34.
	Catarrh appeared	24/3/34.
	Rash appeared	28/3/34.
	Removed from Ward	29/3/34.

Date when Contacts were immunised - 30/3/34.

Day after exposure when Contacts were immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
56.	H.McI.	9	10	70	345	22	-	-	-
57.	P.McI.	3	10	70	345	22	-	-	-
58.	D.K.	9/212	No Serum	C O N T R O L			-	-	-

Commentary Group 5.

Several children were receiving indoor treatment for scabies in Moffat Street Reception House, when one of them contracted measles, the rash appearing on 28/3/34. Three presumably susceptible children were exposed to infection; two of these were given 10 c.c. of adult immune serum on 30/3/34, the sixth day after exposure, and one did not receive serum and acted as a control.

None of the contacts developed measles.

G R O U P 5.

SUMMARY OF RESULTS.

2 Immunised Presumably Susceptible

Contacts did not contract measles.

One Uninoculated Control escaped Infection.

MEASLES CONTACTS - GROUP 6.

Contacts from Victoria Infirmary Ward 12 (Septics).

Illness from which Contacts were suffering - Septic Infections.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	20/3/34.
	Catarrh appeared	27/3/34.
	Rash appeared	28/3/34.
	Removed from Ward	28/3/34.

Date when Contacts were immunised - 30/3/34.

Day after exposure when Contacts were immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
59.	A.McK.	3	10	70	345	22	-	-	-
60.	A.P.	4 6/12	10	70	345	22	-	-	-
61.	F.J.	3	No Serum	C O N T R O L			-	-	-
62.	D.M.	6	No Serum.	C O N T R O L			-	-	-

Commentary Group 6.

While under treatment in the Septic Ward of the Victoria Infirmary, a child contracted measles and exposed to infection four children in the ward who had not had measles.

Two of the presumably susceptible contacts were each given 10 c.c. of adult immune serum on the sixth day after exposure, and two who were chosen as controls did not receive serum.

None of the contacts developed measles.

G R O U P 6.

SUMMARY OF RESULTS.

2 Immunised Presumably Susceptible

Contacts did not contract Measles.

Controls - 2 Uninoculated Presumably Susceptible

Contacts did not contract Measles.

MEASLES CONTACTS - GROUP 7.

Contacts from Knightswood Hospital Ward 7.

Illness from which Contacts were suffering - Primary Pneumonia.

Particulars of the Case of Measles who exposed the Contacts to Infection.

(Admitted to Ward 12/3/34.
(Catarrh appeared 26/3/34.
(Rash appeared 28/3/34.
(Removed from Ward 28/3/34.

Date when Contacts were immunised - 30/3/34.

Day after exposure when Contacts were immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
63.	G.G.	4	10	3	536	18	-	-	-
64.	J.H.	2 6/12	10	3	536	18	-	-	-
65.	W.H.	3	10	3	536	18	-	-	-
66.	W.S.	3	No Serum	C O N T R O L			-	-	-
67.	E.C.	4	No Serum	C O N T R O L			-	-	-

Commentary Group 7.

Patients in a children's ward for primary pneumonia in Knightswood Hospital, formed the seventh group. One of the children contracted measles and exposed five presumably susceptible contacts to infection: three of these were each immunised with 10 c.c. of adult immune serum on the sixth day after exposure, and two did not receive serum and acted as controls.

None of the contacts developed measles.

G R O U P 7.

SUMMARY OF RESULTS.

3 Immunised Presumably Susceptible Contacts

did not contract Measles.

Controls - 2 Uninoculated Presumably Susceptible

Contacts did not contract Measles.

MEASLES CONTACTS - GROUP 8.

Contacts from Shieldhall Hospital Ward 5.

Illness from which Contacts were suffering - Scarlet Fever.

Particulars of the Two Cases of Measles who exposed the Contacts to Infection.	Case 1.	Case 2.
Admitted to Ward	18/3/34.	21/3/34.
Catarrh appeared	31/3/34.	30/3/34.
Rash appeared	2/4/34.	2/4/34.
Removed from Ward	3/4/34.	3/4/34.

Date when Contacts were immunised - 1/4/34.

Day after exposure when Contacts were immunised - 3rd.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
68.	J.O'N.	3	15	68	351	25	-	-	-
69.	J.A.	7	15	68	351	25	-	-	-
70.	C.D.	6	15	65	358	26	-	-	-
71.	A.D.	5	15	48	419	20	14	Classical	16/4/34.
72.	H.McL.	10	No Serum	C O N T R O L			-	-	-

Commentary Group 8.

Two patients in a scarlet fever ward in Shieldhall Hospital contracted measles. Five presumably susceptible contacts were exposed to infection: four of these each received 15 c.c. of adult immune serum on the third day after exposure, and one who was not given serum acted as a control.

One of the immunised contacts developed a classical attack and three did not contract measles. The uninoculated control remained free from infection.

G R O U P 8.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	4	(No Measles	3
		(Classical Measles	1

One Uninoculated Control escaped Infection.

MEASLES CONTACTS - GROUP 9.

Contacts from Shieldhall Hospital Ward 4.

Illness from which Contacts were suffering - Scarlet Fever.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	21/3/34.
	Catarrh appeared	?
	Rash appeared	30/3/34.
	Removed from Ward	3/4/34.

Date when Contacts immunised - 1/4/34.

Day after exposure when Contacts immunised - 6th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
73.	J.R.	4	15	67	354	20	-	-	-
74.	A.B.	6½	15	67	354	20	17	Modified.	16/4/34.
75.	A.K.	5	No Serum	C O N T R O L			11	Classical	10/4/34.

Commentary Group 9.

This group was formed by patients in another scarlet fever ward in Shieldhall Hospital; they were exposed to measles infection from a case which showed a typical rash on 30/3/34. Two presumably susceptible contacts were each given 15 c.c. of adult immune serum on 1/4/34, the sixth day after exposure, and one did not receive serum and acted as a control.

One of the immunised contacts who was suffering from post-scarlatinal cervical adenitis accompanied by remittent pyrexia, contracted measles in a modified form. The pyrexia remained rather high for a few days, owing, probably, to the adenitis; Koplik's spots were absent, catarrhal symptoms were slight, and the rash was faint, generalised and morbilliform in character. Fortunately the measles attack did not increase the severity of the illness.

The uninoculated control developed a classical attack.

G R O U P 9.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	2	(No Measles	1
		(Modified Measles	1

One Uninoculated Control contracted Classical Measles.

MEASLES CONTACTS - GROUP 10.

Contacts from Knightswood Hospital Ward 1.

Illness from which Contacts were suffering - Diphtheria.

Particulars of the Two Cases of Measles who exposed the Contacts to Infection.	Case 1.	Case 2.
(Admitted to Ward	15/3/34.	17/3/34.
(Catarrh appeared	?	?
(Rash appeared	1/4/34.	2/4/34.
(Removed from Ward	1/4/34.	2/4/34.

Date when Contacts were immunised - 1/4/34.

Day after exposure when Contacts were immunised - 4th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
76.	E.D.	1½	10	69	349	45	13	Attenuated	14/4/34.
77.	E.T.	3	10	69	349	45	-	-	-
78.	W.T.	6½	No Serum	C O N T R O L			11	Classical	12/4/34.

APRIL 13 14 15 16 17 18 19

TIME

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RASH.

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NAME E.D. (SERIAL No 76).

AGE 1½ YEARS.

10 c.c. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

NO CATARRH.

FAINT DISCRETE RASH ON FACE TRUNK AND THIGHS.

Bowels

Urine

ATTENUATED MEASLES.

APRIL 11 12 13 14 15 16 17

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RASH

DIED.

DATE.....

DAY OF ILLNESS.....

NAME.....

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NAME W.T. (SERIAL No 78).

AGE 6½ YEARS.

CONTROL (NO SERUM).

NO KOPLIK'S SPOTS.

LACHRYMATION : RHINORRHOEA.

HAEMORRHAGIC RASH.

ENTERITIS

DIED.

Bowels
Urine

MALIGNANT MEASLES.

Commentary Group 10.

Patients in a diphtheria ward in Knightswood Hospital formed the group. On 1/4/34, one of the children showed a measles rash, and on the following day another child was found to have a typical rash also. Three presumably susceptible children were exposed to infection. Two of these were immunised with 10 c.c. of adult immune serum on 1/4/34, the fourth day after exposure, and one did not receive serum and acted as a control.

One of the immunised contacts developed an attenuated attack which was so mild that the child was not in the least upset. The uninoculated contact or control developed measles. The rash appeared on 12/4/34, and catarrhal symptoms were in evidence. Grave toxaemia was soon apparent. On 14/4/34 the rash was almost confluent, and was haemorrhagic in character; profuse rhinorrhoea and gastro-enteritis were present, and the child died on the following day. Signs of broncho-pneumonia or bronchitis were not present during the short illness. Although the possibility of diphtheritic cardiac paralysis cannot altogether be ruled out, death was regarded as due to malignant measles.

G R O U P 10.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	2	(No Measles	1
		(Attenuated Measles	1

One Uninoculated Control contracted

Classical Measles.

MEASLES CONTACTS - GROUP 11.

Contacts from Stobhill Hospital Ward 42B, Section 4.

Illness from which Contacts were suffering - Primary Pneumonia.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Ward	1/4/34.
	Catarrh Appeared	-
	Rash appeared	2/4/34.
	Removed from Ward	2/4/34.

Date when Contacts were immunised - 4/4/34.

Day after exposure when Contacts were immunised - 3rd.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
79.	M.McD.	6/12	15	115	86	39	-	-	-
80.	M.N.	6/12	15	115	86	39	-	-	-
81.	J.K.	10/12	15	115	86	39	-	Secondary Attenuated	24/4/34.
82.	J.B.	1	15	115	86	39	-	Secondary Attenuated	24/4/34.
83.	J.G.	9/12	15	117	83	21	-	-	-
84.	H.McL.	3	15	116	84	18	-	-	-
85.	J.L.	1 2/12	15	116	84	18	8	Modified	10/4/34.
86.	H.M.	3/12	15	116	84	18	-	-	-
87.	J.H.	2 3/12	15	116	84	18	-	-	-
88.	J.L.	6/12	No Serum	C O N T R O L			-	-	-
89.	J.Q.	1 4/12	No Serum	C O N T R O L			-	Secondary Classical	28/4/34.
90.	D.McG.	2 3/12	No Serum	C O N T R O L			11	Classical	13/4/34.
91.	J.G.	2 3/12	No Serum	C O N T R O L			15	Classical	17/4/34.

APRIL 23 24 25 26 27 28 29

TIME

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Rash.

NAME J.K. (SERIAL Nº 81).

AGE 10 MONTHS.

15 cc ADULT IMMUNE SERUM.

No KOPLIK'S SPOTS.

No CATARRH.

FAINT SPARSE RASH ON TRUNK AND LIMBS.

DATE.....

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NAME.....

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Bowels

Urine

ATTENUATED MEASLES.

APRIL 23 24 25 26 27 28

TIME

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NAME J.B. (SERIAL No 82).

AGE 1 YEAR.

15 c.c. ADULT IMMUNE SERUM.

No KOPLIK'S SPOTS.

No CATARRH.

FAINT SPARSE RASH ON NECK TRUNK AND LIMBS.

Bowels

Urine

ATTENUATED MEASLES.

APRIL 9 10 11 12 13 14 15

TIME

A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M.

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NAME J.L. (SERIAL Nº 85).

AGE 1 YEAR AND 2 MONTHS.

15 c.c. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

LACHRYMATION.

FAINT GENERALISED MORBILLIFORM RASH.

NO TOXAEMIA.

NO COMPLICATIONS.

Bowels

Urine

MODIFIED MEASLES.

APRIL 25 26 27 28 29 30 1

TIME	A.M.			P.M.			A.M.			P.M.			A.M.			P.M.			A.M.			P.M.			A.M.			P.M.			A.M.			P.M.		
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NAME. J.Q. (SERIAL N° 89.)

AGE 1 YEAR AND 4 MONTHS.

CONTROL - NO SERUM.

NO KOPLIK'S SPOTS.

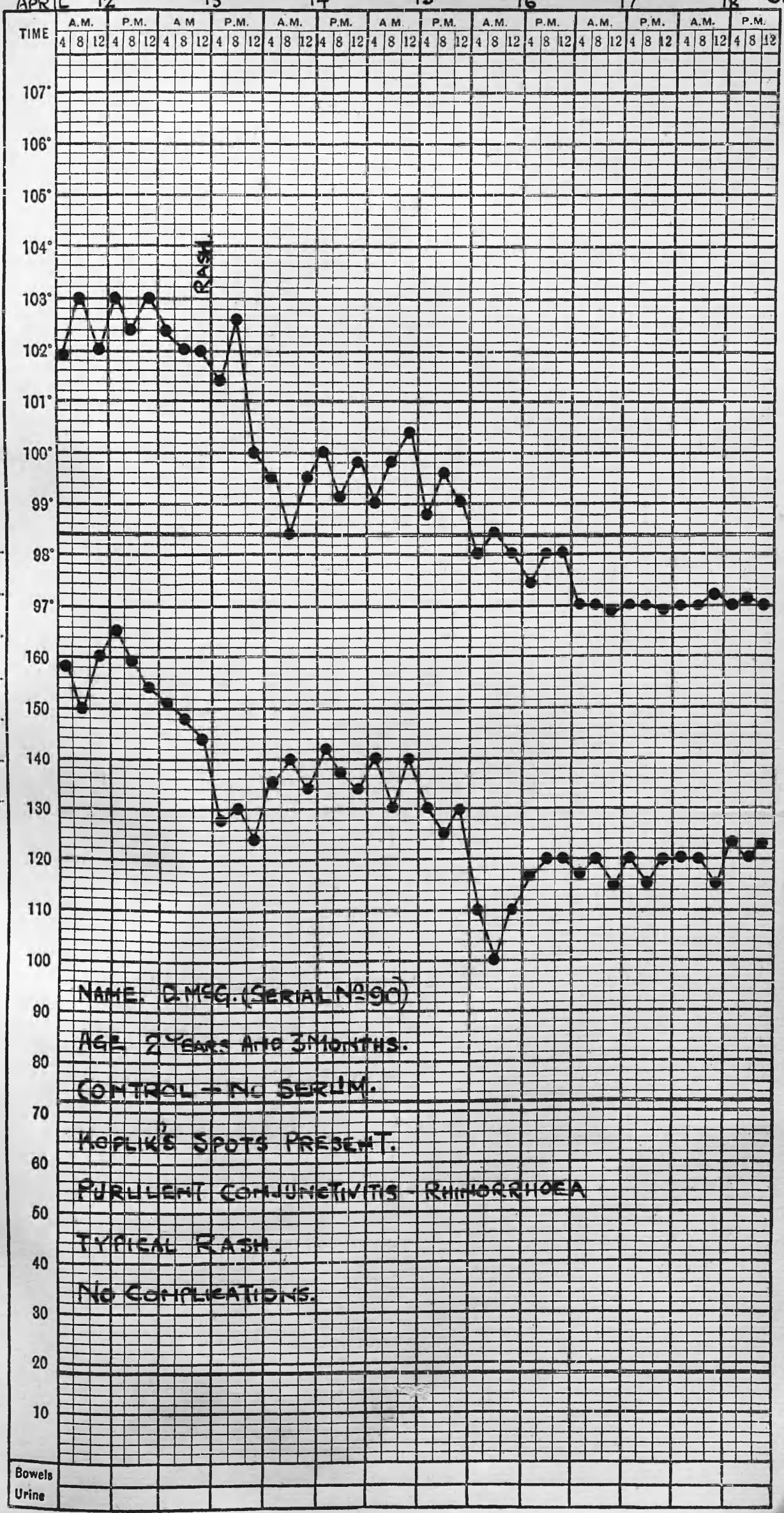
PURULENT CONJUNCTIVITIS - RHINORRHOEA.

WELL MARKED GENERALISED RASH.

LETHARGIC.

NO COMPLICATIONS

CLASSICAL MEASLES.



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CLASSICAL MEASLES.

APRIL 16 17 18 19 20 21 22

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NAME J.G. (SERIAL N° 91).

AGE 2 YEARS AND 3 MONTHS.

CONTROL - NO SERUM.

KOPLIK'S SPOTS PRESENT.

PURULENT CONJUNCTIVITIS - RHINORRHOEA.

TYPICAL RASH.

BRONCHO-PNEUMONIA

DIED.

CLASSICAL MEASLES.

Commentary Group 11.

The children who formed the eleventh group were patients in Stobhill Hospital suffering from primary pneumonia. A child who had been admitted to the ward on the previous day showed a measles rash on 2/4/34, and on 4/4/34, the third day after exposure to infection, nine of the presumably susceptible children each received 15 c.c. of adult immune serum, and four were not given serum and acted as controls.

One of the immunised contacts (J.L.No.85) developed a modified attack of measles (rash 10/4/34), and two of the uninoculated controls (D.McG. and J.G. Nos.90 and 91) showed classical attacks (rashes 13/4/34 and 17/4/34). These cases were the source of infection of two inoculated contacts (J.K. and J.B. Nos.81 and 82) who contracted attenuated attacks (rashes 24/4/34), and also of one uninoculated control (J.Q. No.89) who showed a classical attack (rash 28/4/34). Since the latter cases developed only after a second exposure to infection, they are designated "secondary" attacks. It is noteworthy that the secondary attacks in the immunised contacts were attenuated, whereas in the uninoculated control the secondary attack was classical.

G R O U P 11.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts,	9	(No Measles	6
		(Secondary Attenuated (Measles	2
		(Modified (Measles	1
Uninoculated Presumably Susceptible Contacts (Controls)	4	(No Measles	1
		(Classical (Measles	3

MEASLES CONTACTS - GROUP 12.

Contacts from Stobhill Hospital Ward 42B (Isolation Cubicle).

Illness from which Contacts were suffering - Primary Pneumonia.

Particulars of the Case of Measles who exposed the Contacts to Infection.	Admitted to Cubicle	18/3/34.
	Catarrh Appeared	-
	Rash Appeared	2/4/34.
	Case remained in Cubicle during attack.	

Date when Contacts immunised - 3/4/34.

Day after exposure when Contacts immunised - 5th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incub-ation Period in Days.	Type of Attack.	Date when Rash Appeared.
92.	R.McL.	6/12	20	111	96	17	11	Attenuated Secondary	14/4/34.
93.	I.M.	7/12	20	111	96	17	-	Classical	25/4/34.

Commentary Group 12.

Three infants occupied a small cubicle which was part of a pneumonia ward in Stobhill Hospital. One of them contracted measles (rash 2/4/34) but was not removed from the cubicle owing to lack of isolation accommodation. Each of the two contacts, neither of whom had had measles, was given 20 c.c. of adult immune serum on 3/4/34, the fifth day after exposure.

One infant who was suffering from primary broncho-pneumonia and pyelitis, was so gravely ill that it was feared he would die if he contracted measles. He did not escape infection, but the attack was so much attenuated that his condition did not become any worse, and finally he made a good recovery.

The other infant although continuously in contact with the first case of measles, resisted infection from that source, but later developed a classical attack, having derived the infection from the second case.

G R O U P 12.

SUMMARY OF RESULTS.

Immunised Presumably		(Attenuated (Measles	1
Susceptible Contacts,	2	(Classical (Measles	1

MEASLES CONTACTS - GROUP 13.

Contacts from Scotstoun House Home.

Illness from which Contacts were suffering - General Debility.

Particulars of the Four Cases of Measles who exposed the Contacts to Infection.	Admitted to Home on or before	3/3/34.
	Catarrh appeared in each	10/4/34.
	Rash appeared in each	11/4/34.
	Cases remained in Home during attack.	

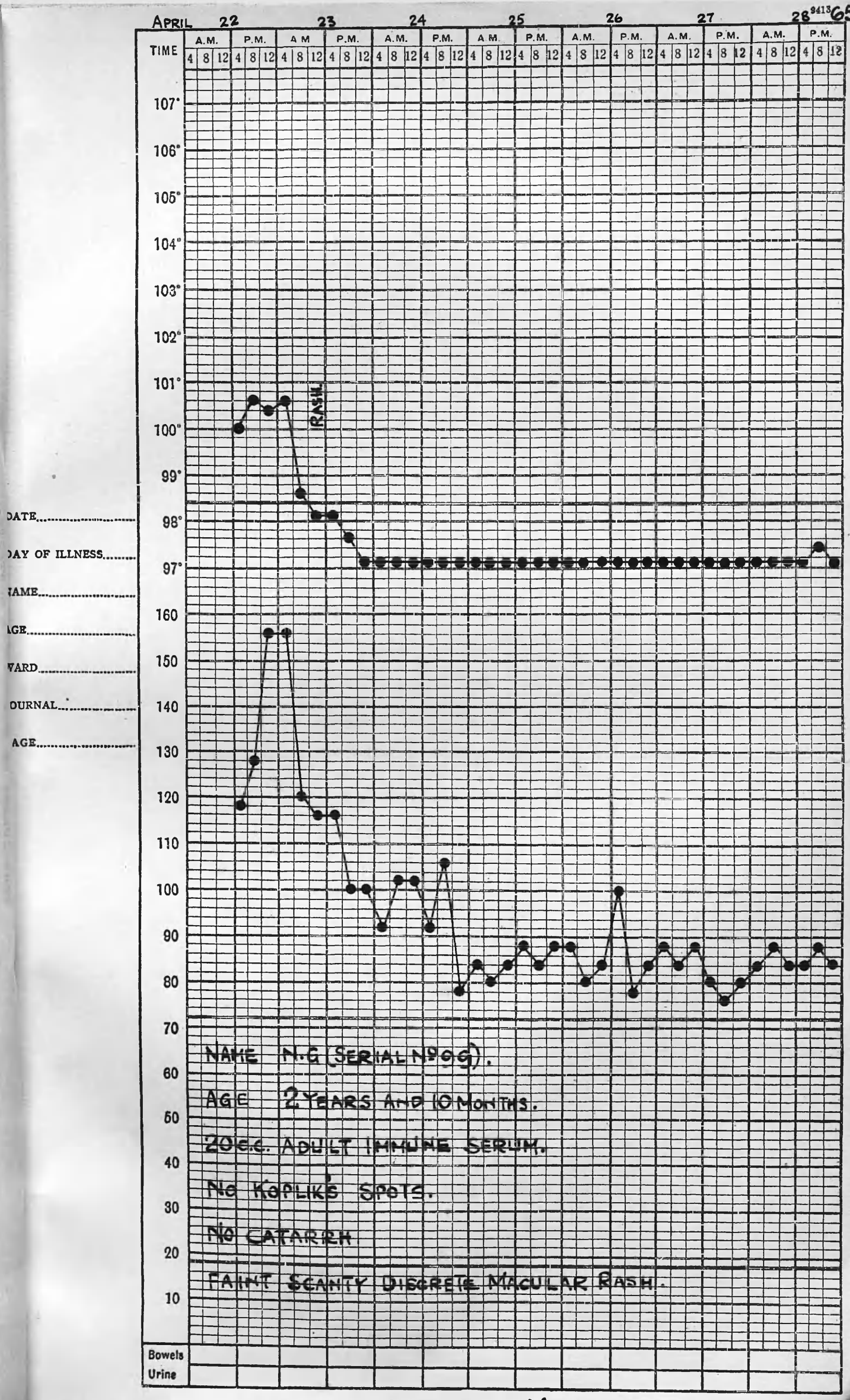
Date when Contacts were immunised - 10/4/34.

Day after exposure when Contacts were immunised - 3rd.day.

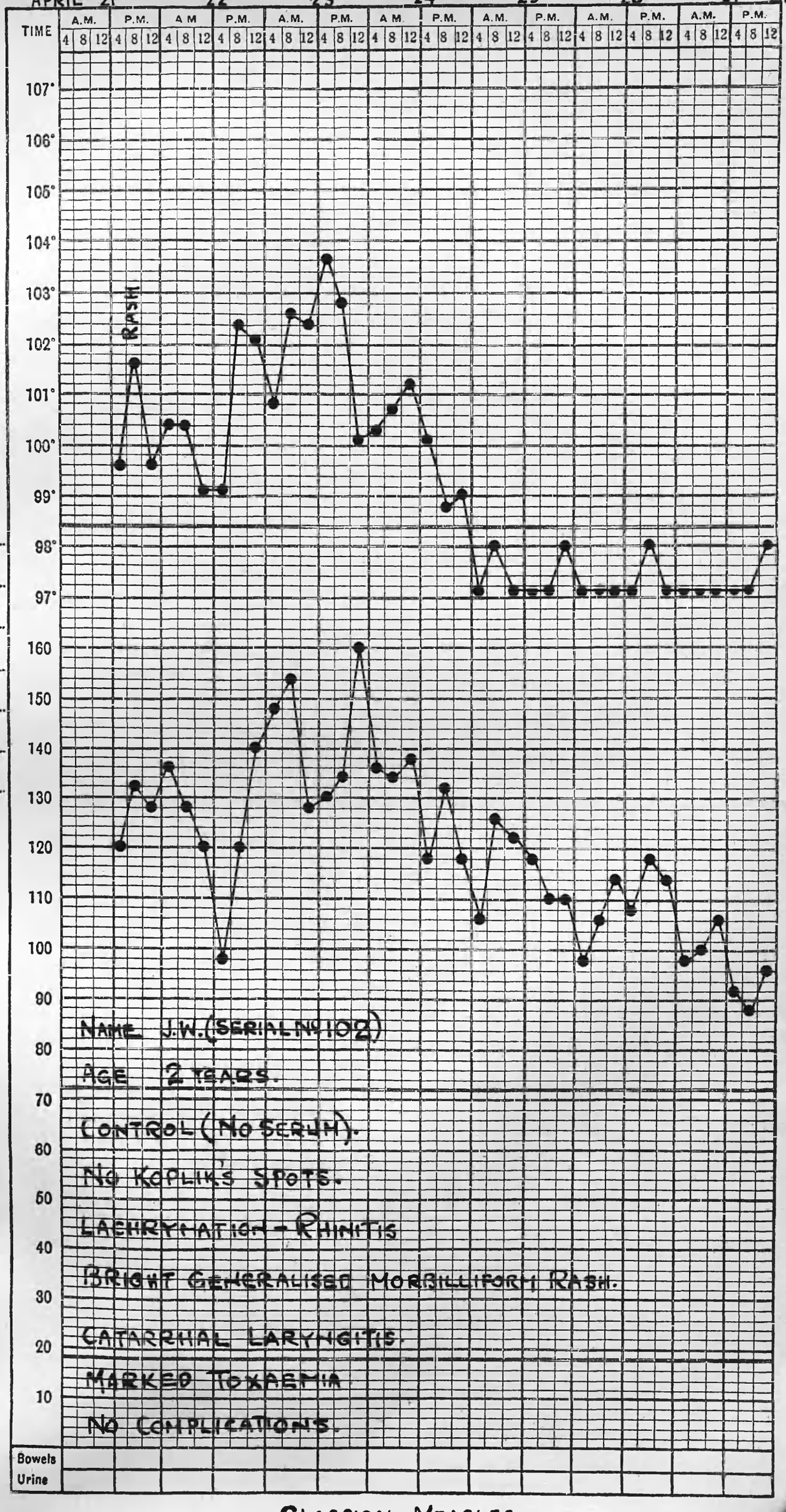
PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial No.	Name.	Age in Years.	Dose in C.C.	Serum Batch Number.	Age of Serum in Days.	Age of Donor in Years.	Incubation Period in Days.	Type of Attack.	Date when Rash Appeared.
x94.	W.S.	1½	20	120	83	25	-	Classical	15/4/34.
95.	W.W.	1 9/12	20	120	83	25	-	-	-
96.	W.McL.	1 3/12	20	121	83	27	-	-	-
97.	I.L.	4	20	121	83	27	-	-	-
x98.	J.McL.	3½	20	121	83	27	-	Mild	14/4/34.
99.	N.G.	2 10/12	20	121	83	27	12	Attenuated	23/4/34.
100.	A.F.	3½	20	123	81	32	-	-	-
101.	W.R.	3	20	123	81	32	-	-	-
102.	J.W.	2	No Serum	C O N T R O L			10	Classical	21/4/34.
103.	M.I.	2½	No Serum	C O N T R O L			-	-	-
104.	F.McD.	2½	No Serum	C O N T R O L			-	-	-
105.	P.D.	2 8/12	No Serum	C O N T R O L			-	-	-

x Contacts who proved to have been in Pre-eruptive stage of Measles when inoculated.



ATTENUATED MEASLES.



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CLASSICAL MEASLES.

Commentary Group 13.

Scotstoun House Convalescent Home suffered a second outbreak of measles and provided the thirteenth group. On 10/4/34, four of the children had catarrhal symptoms and Koplik's spots, and each showed a typical rash next day.

There were twelve presumably susceptible contacts: eight of these each received 20 c.c. of adult immune serum on 10/4/34, the third day after exposure, and four did not receive serum and acted as controls.

Three children, believed to have had a previous attack of measles, contracted the infection (rashes appeared on 11/4/34, 12/4/34, and 13/4/34). Owing to lack of hospital accommodation the measles cases were not removed, and for the time being, the home was transformed into a miniature measles hospital.

Two of the immunised contacts (W.S. and J.McL. Nos.94 and 98) showed typical measles rashes within four days after the administration of the serum; they had been therefore in the pre-eruptive stage of measles when the serum was given, and had probably contracted the infection from the same source as the previous cases - not from them: they are not comparable with the other contacts and have not been included in the results.

One immunised contact developed an attenuated attack, and five did not contract measles. Three of the four uninoculated controls escaped infection, despite the fact that they occupied the same dormitory as the cases for over a week: apparently they possessed natural immunity.

The one uninoculated contact or control who contracted the infection, had a severe attack complicated by catarrhal laryngitis.

GROUP 13.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	8	
Inoculated in Pre-eruptive Stage of Measles, ...	2	
Available Inoculated Contacts,	6	(No Measles, 5 (Attenuated Measles, 1
Uninoculated Presumably Susceptible Contacts (CONTROLS), ...	4	(No Measles, 3 (Classical Measles, 1

MEASLES CONTACTS GROUP 14.

Contacts from Knightswood Hospital Ward I.

Illness from which Contacts were Suffering - Diphtheria.

Particulars of the Case of Measles Who Exposed the Contacts to Infection	(Admitted to Ward,	23/2/34.
	(Catarrh Appeared,	-
	(Rash Appeared,	14/4/34.
	(Removed from Ward,	14/4/34.

Date when Contacts were Immunised, 14/4/34.
Day After Exposure when Contacts were Immunised, 4th.day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
106	M.W.	5	15	124	10	43	-	Secondary Attenuated	3/5/34
107	M.P.	2	15	124	10	43	6	Attenuated	20/4/34
* 108	E.McM.	2½	15	124	10	43	-	Very Mild	15/4/34
109	E.L.	5½	No Serum	C O N T R O L			-	-	-

*Contact who proved to have been in Pre-eruptive Stage of Measles when Inoculated.

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NAME M.W. (SERIAL No 106).

AGE 5 YEARS.

15 C.C. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

NO CATARRH.

FAINT SCANTY DISCRETE MACULAR RASH.

Bowels

Urine

ATTENUATED MEASLES.

APRIL 20 21 22 23 24 25 26 9413 68B.

TIME

A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M.

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NAME M.P. (SERIAL Nº 107).

AGE 2 YEARS.

15 C.C. ADULT IMMUNE SERUM.

No KOPLIK'S SPOTS.

NO CATARRH.

FAINT DISCRETE MACULAR RASH - SMALL CONFLUENT AREAS.

Bowels

Urine

ATTENUATED MEASLES.

COMMENTARY GROUP 14.

A diphtheria ward in Knightswood Hospital provided group fourteen. A child showed a measles rash on 14/4/34, and was removed from the ward on that day. Four presumably susceptible children were exposed to infection: each of three received 15 c.c. of adult immune serum on 14/4/34, the fourth day after exposure, and one who did not receive serum was the control.

An immunised child (E.McM.No.108) showed a measles rash on the day after the serum was given. This case must have been in the pre-eruptive stage of measles when the serum was administered, and is not included in the results, since the source of infection differed from that to which the other contacts were exposed.

One of the immunised contacts (M.P.No.107) developed an exceedingly attenuated attack. There was no catarrh, no Koplik's spots, and no pyrexia. The rash appeared on 20/4/34, on the face, trunk and lower limbs, and consisted of slightly raised macules, faint dull red in colour, and widely separated except on the thighs, where they were confluent in small patches. This exceedingly mild case appeared, however, to be infectious and was probably the source from which the other immunised contact (M.W.No.106) received the infection. The latter developed a secondary attenuated attack, the rash appearing on 3/5/34.

The uninoculated control was the only contact who did not contract measles, and apparently possessed natural immunity.

GROUP 14.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	3	
Inoculated in Pre-eruptive Stage of Measles, ...	1	
Available Inoculated Contacts,	2	(Attenuated Measles, 1
		(Secondary Attenuated Measles, 1

One Uninoculated Control Escaped Infection.

MEASLES CONTACTS GROUP 15.

Contacts from Mearnskirk Hospital Isolation Pavilion.
Illness from which Contacts were Suffering - Surgical Tuberculosis.

Particulars of the Case of Measles Who Exposed the Contacts to Infection:
- Admitted to Ward, 2/4/34.
- Catarrh Appeared, -
- Rash Appeared, 15/4/34.
- Remained in Ward During Attack.

Date when Contacts were Immunised, 15/4/34.
Day after Exposure when Contacts were Immunised, 4th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
110	D.J.	6	20	111	108	17	-	-	-
111	I.G.	1	20	121	98	27	-	Secondary Attenuated	5/5/34
112	D.S.	4	No Serum	C O N T R O L			8	Classical	22/4/34
113	J.L.	3	No Serum	C O N T R O L			-	Secondary Classical	2/5/34
114	E.S.	8	No Serum	C O N T R O L			-	-	-

COMMENTARY GROUP 15.

All children entering Mearnskirk Tuberculosis Hospital are admitted to the isolation block and remain there for three weeks, after which time, if free from infection, they are transferred to the pavilions.

In the isolation block six cases of measles had occurred as follows:-

(1) Rash appeared 15/3/34.
(2) " " 28/3/34.
(3) " " 5/4/34.
(4) " " 9/4/34.
(5) " " 14/4/34.
(6) " " 15/4/34.

The measles cases had to remain with the contacts in the isolation block, as there was no other suitable accommodation.

On 15/4/34 there were five children in the block who had not had measles. Two of these (D.J. and I.G.Nos.110 and 111) had been admitted on 12/4/34, and each received 20 c.c. of adult immune serum on 15/4/34, when they had been exposed to infection for four days. One child (J.L. No.113) had been admitted on 5/4/34, one (D.S. No.112) on 4/4/34, and one (E.S. No.114) on 22/2/34. None of the latter received serum.

The uninoculated child (D.S. No.112) who had been admitted on 4/4/34 developed a classical attack, the rash appearing on 22/4/34. The uninoculated child (J.L. No.113) admitted on 5/4/34, had been exposed to infection from four cases of measles showing rashes on 5/4/34, 9/4/34, 14/4/34, and 15/4/34, without contracting the disease. She contracted infection from the case (D.S. No.112) who showed a measles rash 22/4/34, the fifth case

with which she had been in contact, and developed a classical attack, the rash appearing on 2/5/34. This child apparently possessed a considerable degree of natural immunity which was only overcome after repeated exposures to infection.

Complete natural immunity to measles appeared to be possessed by an uninoculated child (E.S. No.114) who was admitted on 22/2/34, and was continuously exposed to infection from 15/3/34 to 2/5/34, by nine consecutive cases, and remained free from infection. Her parents were sure that she had never had a previous attack of measles.

One of the immunised contacts (admitted on 12/4/34) developed an attenuated attack after a second exposure to infection; the other remained free from measles.

GROUP 15.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	2	(No Measles,	1
		(Secondary Attenuated Measles,	1
Uninoculated Presumably Susceptible Contacts (CONTROLS), ...	3	(No Measles,	1
		(Classical Measles,	2

MEASLES CONTACTS GROUP 16.

Contacts from Oakbank Hospital Ward S2.
The Contacts were Surgical Cases.

Particulars of the case of Measles who Exposed the Contacts to Infection

Admitted to Ward	27/3/34.
Catarrh Appeared	14/4/34.
Rash Appeared	15/4/34.
Removed from Ward	15/4/34.

Date When Contacts were Immunised, 16/4/34.
Day After Exposure when Contacts were Immunised 5th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
115	C.McS.	10	20	118	94	28	-	-	-
116	G.McG.	2	20	109	112	30	-	-	-
117	J.A.	4	20	109	112	30	-	-	-
118	J.M.	3	No Serum	C O N T R O L			-	-	-

COMMENTARY GROUP 16.

In a surgical ward in Oakbank Hospital, four children who had not had measles were exposed to infection by a child who showed a measles rash on 15/4/34. Three of the children were each given 20 c.c. of adult immune serum on 16/4/34, the fifth day after exposure, and one did not receive serum and acted as a control. Neither the immunised contacts nor the uninoculated control contracted the infection, but a child believed to have had a previous attack of measles showed a typical rash on 22/4/34.

GROUP 16.

SUMMARY OF RESULTS.

3 Immunised Presumably Susceptible Contacts did not contract Measles.

One Uninoculated Control Remained free from Infection.

MEASLES CONTACTS GROUP 17.

Contacts from Stobhill Hospital Ward 3B.
The Contacts were Suffering from Skin Diseases.

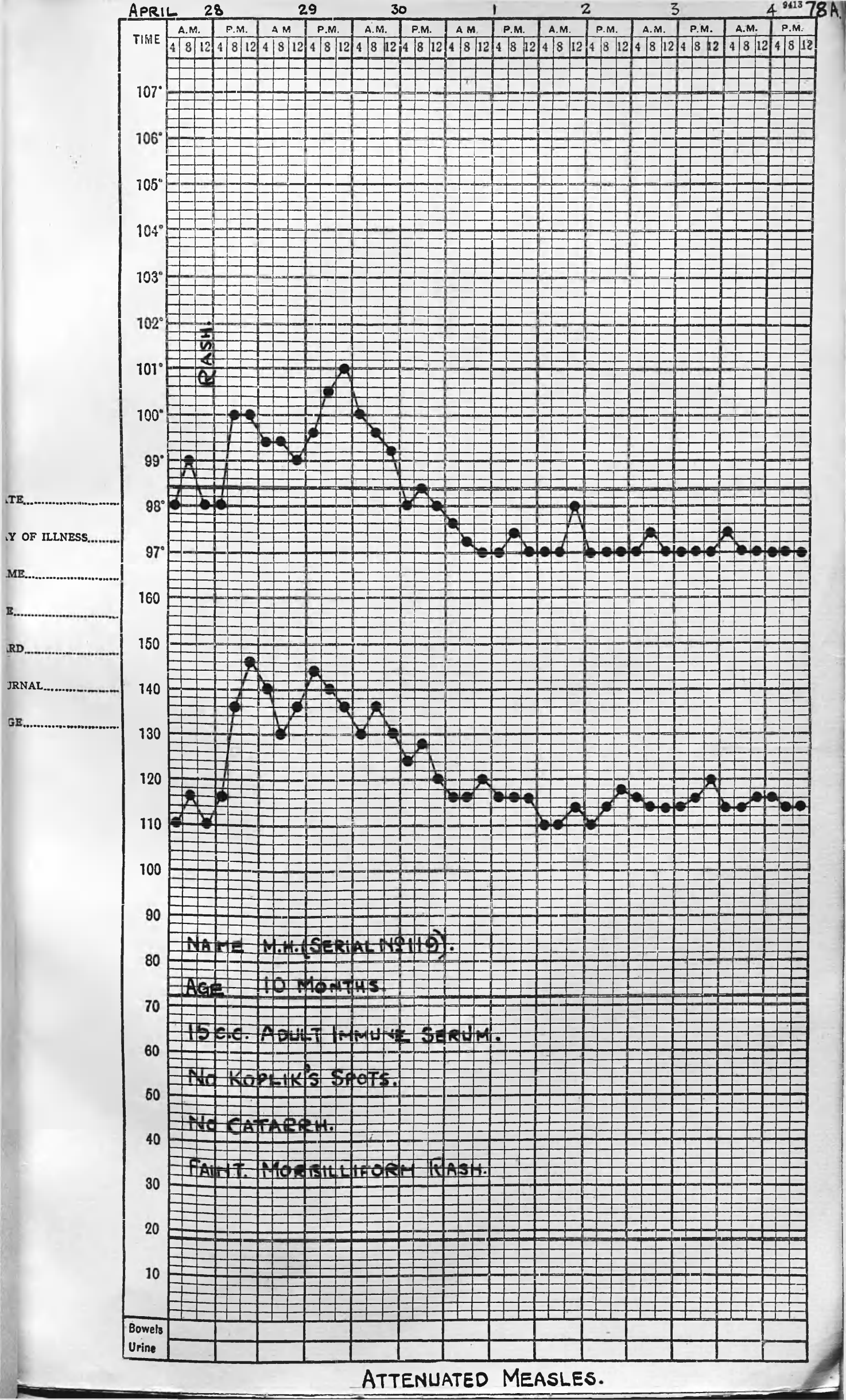
Particulars of the Case of Measles Who Exposed the Contacts to Infection

- Admitted to Ward 14/4/34.
- Catarrh Appeared 14/4/34.
- Rash Appeared 15/4/34.
- Removed from Ward 19/4/34.

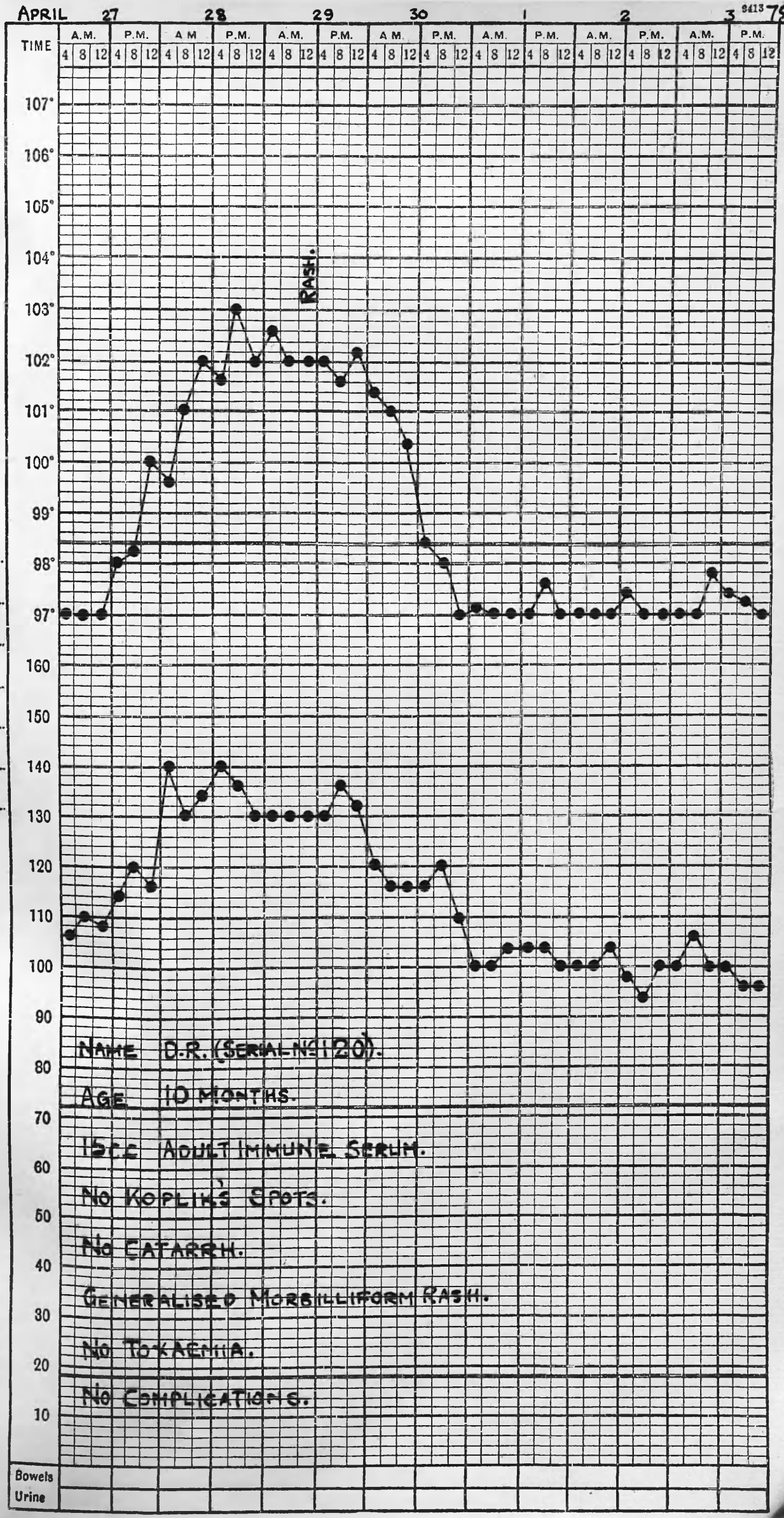
Date when Contacts were Immunised, 19/4/34.
Day after Exposure when Contacts were Immunised 6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
119	M.H.	10/12	15	122	91	35	13	Attenuated	28/4/34
120	D.R.	10/12	15	122	91	35	14	Modified	29/4/34
121	M.G.	3	15	117	99	21	14	Modified	29/4/34
122	A.U.	11/12	15	122	91	35	14	Attenuated	29/4/34
123	M.D.	3	No serum	C O N T R O L			11	Classical	26/4/34
124	E.S.	5	No serum	C O N T R O L			12	Classical	27/4/34



ATTENUATED MEASLES.



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NAME M.G. (SERIAL NO 1121).

AGE 3 YEARS.

15c.c. ADULT IMMUNE SERUM.

NO KOPLIK'S SPOTS.

NO CATARRH.

GENERALISED MORBILLIFORM RASH.

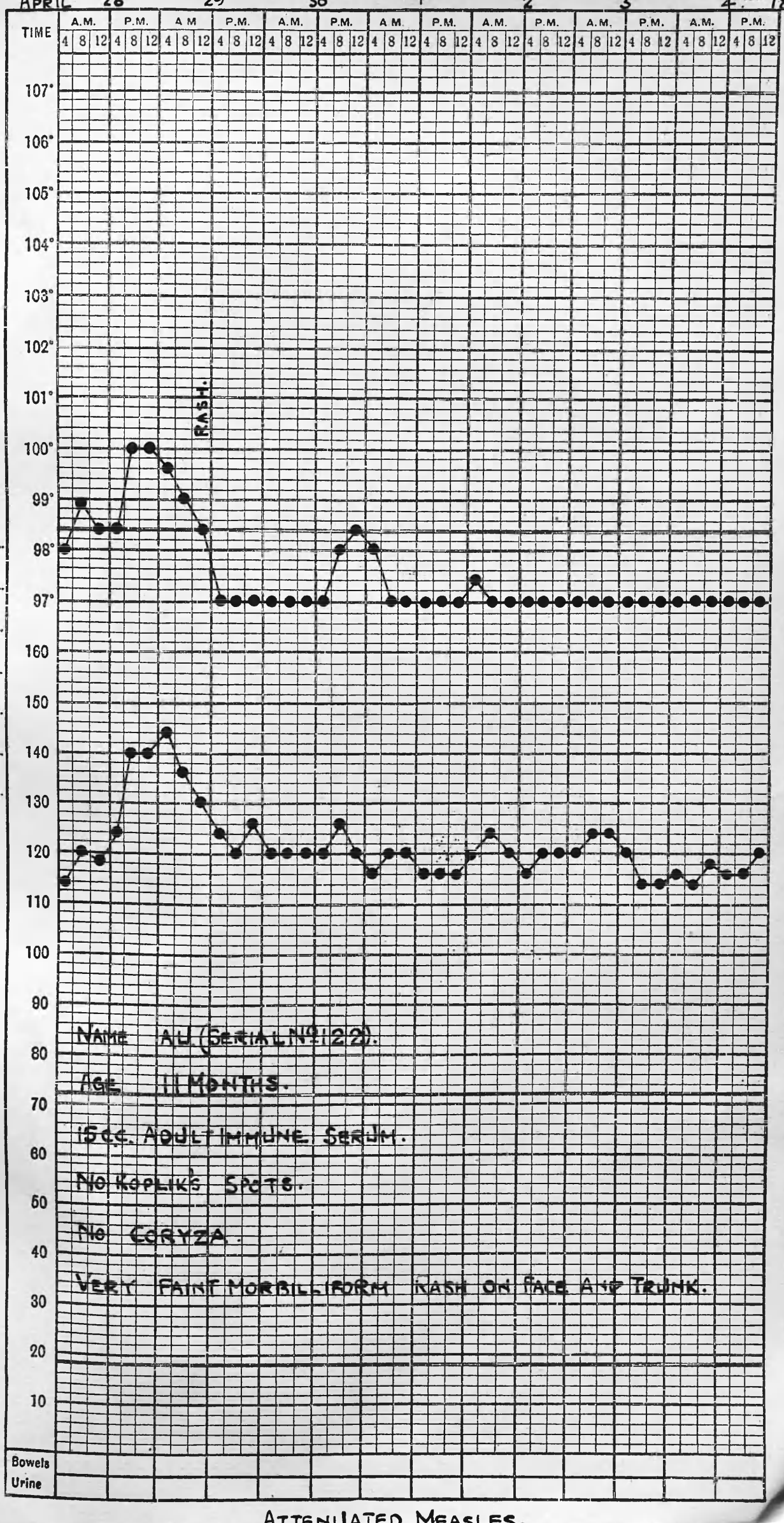
NO TOXAEMIA.

NO COMPLICATIONS.

Bowels

Urine

MODIFIED MEASLES.



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ATTENUATED MEASLES.

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RASH.

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NAME M.D (SERIAL No 123)

AGE 3 YEARS.

CONTROL - NO SERUM.

KOPLIKS SPOTS PRESENT.

PURULENT CONJUNCTIVITIS - RHINORRHOEA.

TYPICAL CONFLUENT RASH.

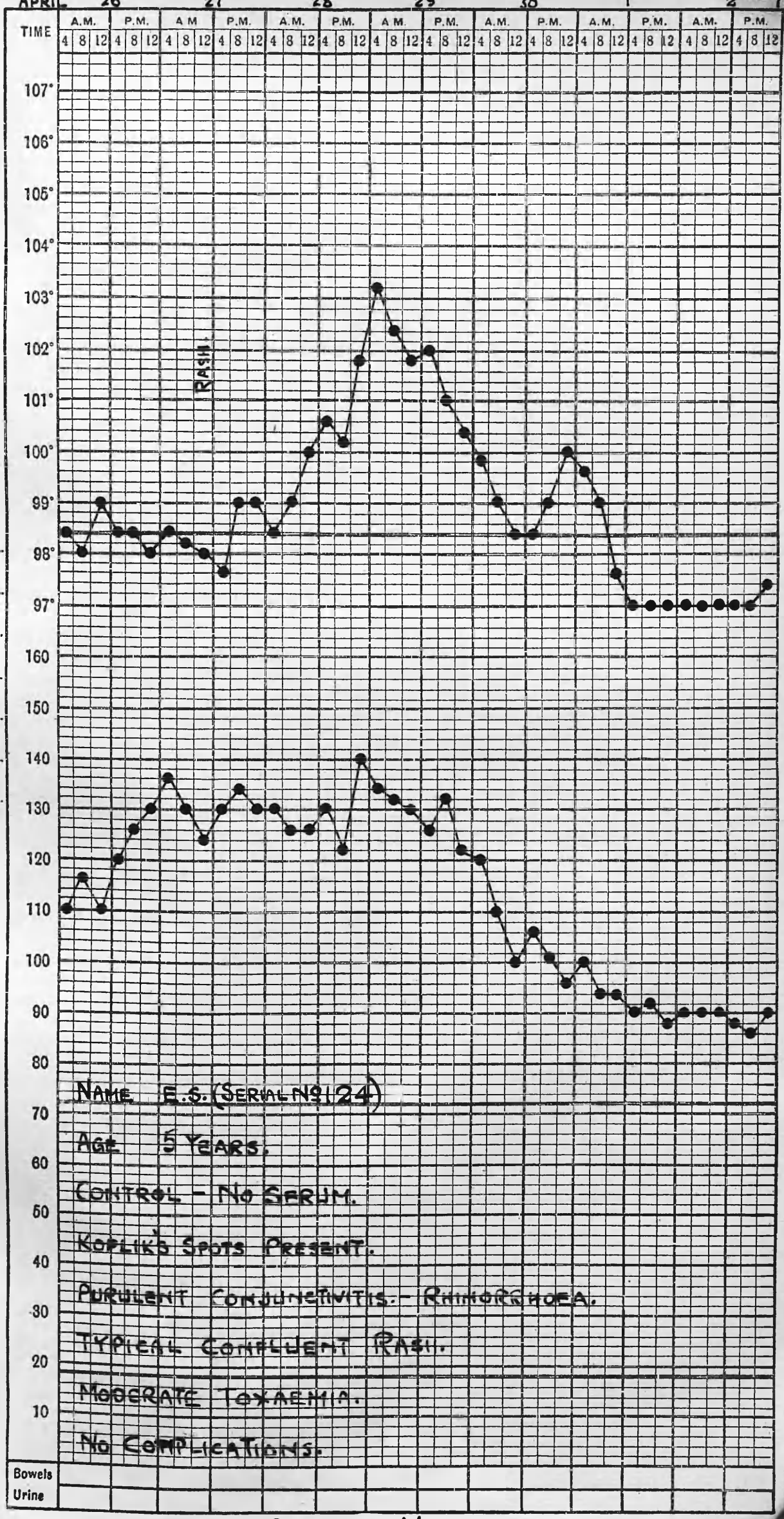
MARKED TOXAEMIA

NO COMPLICATIONS.

Bowels

Urine

CLASSICAL MEASLES.



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CLASSICAL MEASLES.

COMMENTARY GROUP 17.

A child showing catarrhal symptoms was admitted to a dermatological ward in Stobhill Hospital on 14/4/34, and on the following day developed a typical measles rash. Owing to the insufficiency of fever hospital accommodation the child was not removed from the ward till 19/4/34.

Six children who had not had measles were exposed to infection; four were each given 20 c.c. of adult immune serum on 19/4/34, the sixth day after exposure, and two did not receive serum and acted as controls.

All the susceptible contacts contracted measles. The uninoculated controls showed classical attacks. Two of the inoculated contacts had attenuated measles and two had modified attacks. The accompanying temperature charts show that the degree and duration of the pyrexia in the modified cases was not very different from that in the classical cases; the rash was typically morbilliform, but Koplik's spots were absent and the catarrhal symptoms were slight. The remarkable feature about these modified cases was the entire absence of constitutional symptoms during the illness which somewhat resembled rubella.

The clinical differences between the children suffering from modified attacks and those suffering from classical attacks were apparent to all who observed them.

GROUP 17.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	4	(Attenuated (Measles,	2
		(Modified (Measles,	2

CONTROLS - 2 Uninoculated Presumably Susceptible Contacts Contracted Classical Measles.

MEASLES CONTACTS GROUP 18.

Contacts from Ruchill Hospital Ward 28.
Illness from which Contacts were Suffering - Diphtheria.

Particulars of the Case of Measles Who Exposed the Contacts to Infection	Admitted to Ward	18/4/34.
	Catarrh Appeared	20/4/34.
	Rash Appeared	22/4/34.
	Removed from Ward	20/4/34.

Date when Contacts were Immunised 22/4/34
Day after Exposure When Contacts were Immunised 5th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
125	A.S.	5½	20	107	132	36	-	-	-
126	R.H.	1.10/12	20	107	132	36	-	-	-
127	S.B.	3	20	117	102	21	12	Attenuated	4/5/34
128	B.L.	4	20	124	18	43	-	-	-
129	S.McC.	5	20	109	118	30	-	-	-
130	R.M.	5	20	109	118	30	-	-	-
131	W.S.	6	20	107	132	36	-	-	-

COMMENTARY GROUP 18.

The children in this Group were patients in a diphtheria ward in Ruchill Hospital. A child showed catarrhal symptoms and Koplik's spots on 20/4/34 and was removed from the ward on that day; the rash appeared on 22/4/34.

Seven presumably susceptible children were exposed to the infection and each was given 20 c.c. of adult immune serum on 22/4/34, the fifth day after exposure. One child only contracted measles - an attenuated attack, the rash appearing on 4/5/34.

It was not possible to secure permission to leave any of the presumably susceptible contacts uninoculated, to act as controls.

GROUP 18.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	7	(No Measles, 6 (Attenuated Measles, 1

MEASLES CONTACTS GROUP 19.

Contacts from Stobhill Hospital Ward 37.
The Contacts Were Healthy Children.

Particulars of the Five Cases of Measles Who exposed the Contacts to Infection		Case 1.	Cases 2 & 3.	Case 4.	Case 5.
	Admitted to ward	18/3/34.	30/3/34.	2/4/35.	6/4/35.
	Catarrh Appeared	-	-	-	
	Rash Appeared	11/4/34.	20/4/34.	21/4/34.	23/4/34.
	All remained in Ward During Attack.				

Date when Contacts were Immunised 23/4/34.
Day after Exposure when Contacts were Immunised 7th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
132	G.M.	9	20	103	168	34	-	-	-
*133	S.M.	7	20	103	168	34	-	Classical	24/4/34
134	J.McG.	5	20	103	168	34	-	-	-
135	H.P.	4	20	102	169	40	-	-	-
136	W.C.	3	20	106	157	49	12	Attenuated	2/5/34
137	B.C.	1½	20	106	157	49	-	-	-
138	W.W.	1	20	106	157	49	11	Modified	1/5/34
139	J.W.	3	20	106	157	49	11	Modified	1/5/34
*140	R.J.	3	20	104	164	23	-	Classical	24/4/34
141	W.M.	10	20	104	164	23	-	-	-
142	T.C.	10	20	104	164	23	-	-	-
143	A.C.	7	20	100	180	42	-	-	-
144	M.McV.	3	20	100	180	42	-	-	-

*Contacts who Proved to have been in the Pre-eruptive Stage of Measles when Inoculated.

COMMENTARY GROUP 19.

In Stobhill Hospital there are several blocks for healthy children who for various reasons have become chargeable to the Corporation of Glasgow.

A child in one of these blocks had contracted measles, the rash appearing on 11/4/34. Four children had received infection from this case and showed rashes on 20/4/34, 21/4/34 (two cases), and 23/4/34. On 23/4/34 there were thirteen children in the block who had not had measles. Because of the insufficiency of fever hospital accommodation, the measles cases could not be removed, and had to remain in the block. Owing to this circumstance, all of the thirteen presumably susceptible contacts were each given 20 c.c. of adult immune serum on 23/4/34, the seventh day after the second exposure to infection. Two of the immunised contacts showed a rash on the following day: they also had received their infection from the first case (rash 11/4/34) and are not included in the results. Eight of the remaining eleven immunised contacts escaped infection, one showed an attenuated attack and two modified attacks.

It is notable that of seventeen uninoculated and presumably susceptible children, exposed to infection from the case showing a rash on 11/4/34, only six contracted the infection from that case, the rashes appearing on 20/4/34, 21/4/34 (two cases), 23/4/34, and 24/4/34 (two cases). The eleven contacts who escaped infection apparently possessed at least partial immunity; each was given 20 c.c. of adult immune serum on 23/4/34, the seventh day after the second exposure, and three received infection from the second generation of cases.

GROUP 19.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	13		
Inoculated in Pre-eruptive Stage of Measles, ...	2		
Available Immunised Contacts,	11	(No Measles,	8
		(Attenuated (Measles,	1
		(Modified (Measles,	2

MEASLES CONTACTS GROUP 20.

Contacts from Ruchill Hospital Ward 21.
Illness from which Contacts were Suffering - Scarlet Fever.

Particulars of the Case of Measles who Exposed the Contacts to Infection
(Admitted to Ward 7/1/34.
(Catarrh Appeared 21/4/34.
(Rash Appeared 22/4/34.
(Removed from Ward 22/4/34.

Date when Contacts were Immunised 24/4/34.
Day after Exposure when Contacts were Immunised 6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation period in Days	Type of Attack	Date When Rash Appeared
145	I.McI.	6	20	101	172	21	10	Attenuated	2/5/34
146	G.M.	2½	20	101	172	21	13	Attenuated	5/5/34
147	A.M.	4	20	99	186	46	13	Attenuated	5/5/34
148	J.D.	1½	20	99	186	46	13	Modified	5/5/34
149	J.G.	1 10/12	20	99	186	46	14	Classical	6/5/34
150	E.W.	2½	20	101	172	21	10	Attenuated	2/5/34
151	J.H.	2½	20	101	172	21	13	Attenuated	5/5/34

COMMENTARY GROUP 20.

In a scarlet fever ward in Ruchill Hospital, a child was observed to have catarrhal symptoms and Koplik's spots on 21/4/34, and was immediately removed; a typical rash appeared next day. Seven children who had not had measles were exposed to the infection, and each was given 20 c.c. of adult immune serum on 24/4/34, the sixth day after exposure.

All of the susceptible contacts contracted measles; five of the cases were attenuated, one was modified, and one only was classical.

Permission was not obtained to leave any of the presumably susceptible contacts uninoculated, to act as controls.

GROUP 20.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	7	(Attenuated Measles,	5
		(Modified Measles,	1
		(Classical Measles,	1

MEASLES CONTACTS GROUP 21.

Contacts from Stobhill Hospital Ward 7A.
Illness from which Contacts were Suffering - Ear Nose or Throat Affections.

Particulars of the Case of Measles Who exposed the Contacts to Infection	(Admitted to Ward	2/3/34.
	(Catarrh Appeared	26/4/34.
	(Rash Appeared	27/4/34.
	(Removed from Ward	26/4/34.

Date when Contacts were Immunised 28/4/34.
Day after Exposure when Contacts were Immunised 5th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
152	M.B.	1½	20	114	113	24	16	Attenuated	13/5/34
153	E.C.	1 12/12	20	113	115	34	9	Classical	6/5/34
154	E.L.	2½	20	110	123	20	-	-	-
155	J.J.	6/12	20	113	115	34	15	Attenuated	12/5/34
156	M.B.	9/12	20	113	115	34	15	Attenuated	12/5/34
157	J.McM.	1 4/12	20	110	123	20	-	-	-
158	F.R.	9	No serum	C O N T R O L			-	-	-

The Contacts in this Group were Immunised with Serum from Adults who had not had Measles.

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NAME M.B. (SERIAL Nº152)

AGE 1½ YEARS.

20 C.C. OF SERUM FROM AN ADULT WHO HAD NOT HAD MEASLES.

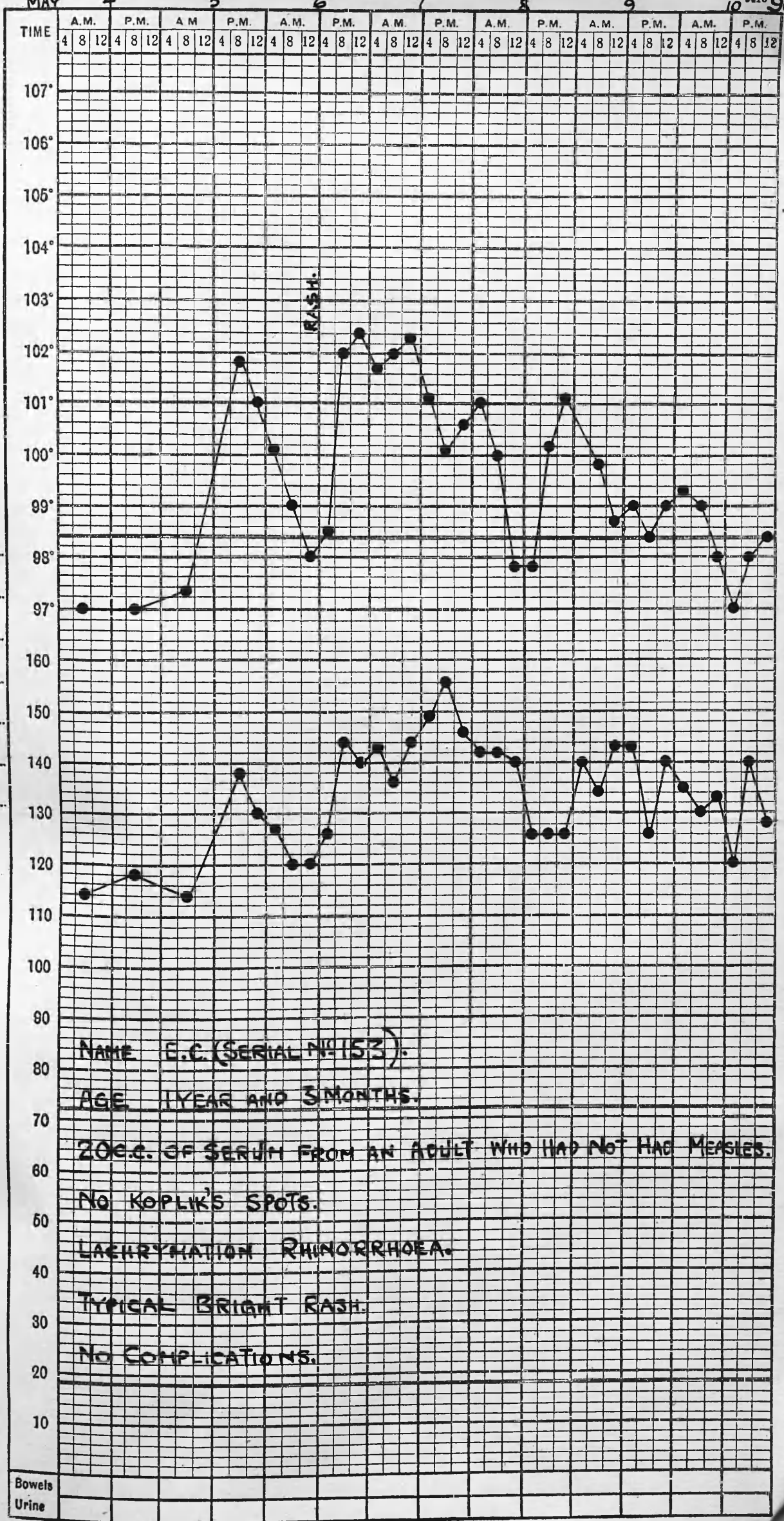
NO KOPLIK'S SPOTS.

NO CATARRH.

FAINT SPARSE DISCRETE RASH MAINLY ON TRUNK.

Bowels
Urine

ATTENUATED MEASLES.



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NAME E.C. (SERIAL NO 153).

AGE 1 YEAR AND 3 MONTHS.

20 C.C. OF SERUM FROM AN ADULT WHO HAD NOT HAD MEASLES.

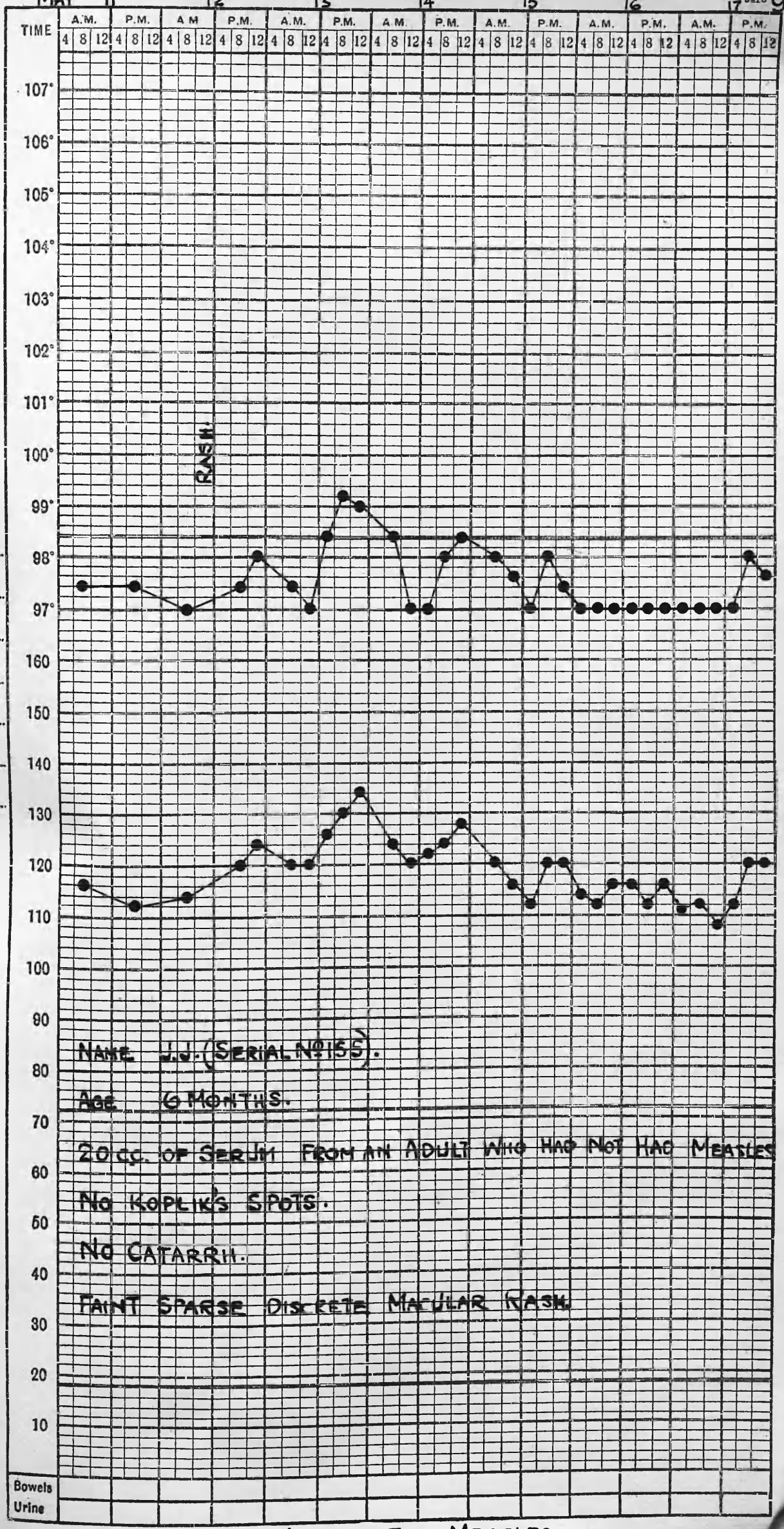
NO KOPLIK'S SPOTS.

LACHRYMATION RHINORRHOEA.

TYPICAL BRIGHT RASH.

NO COMPLICATIONS.

CLASSICAL MEASLES.



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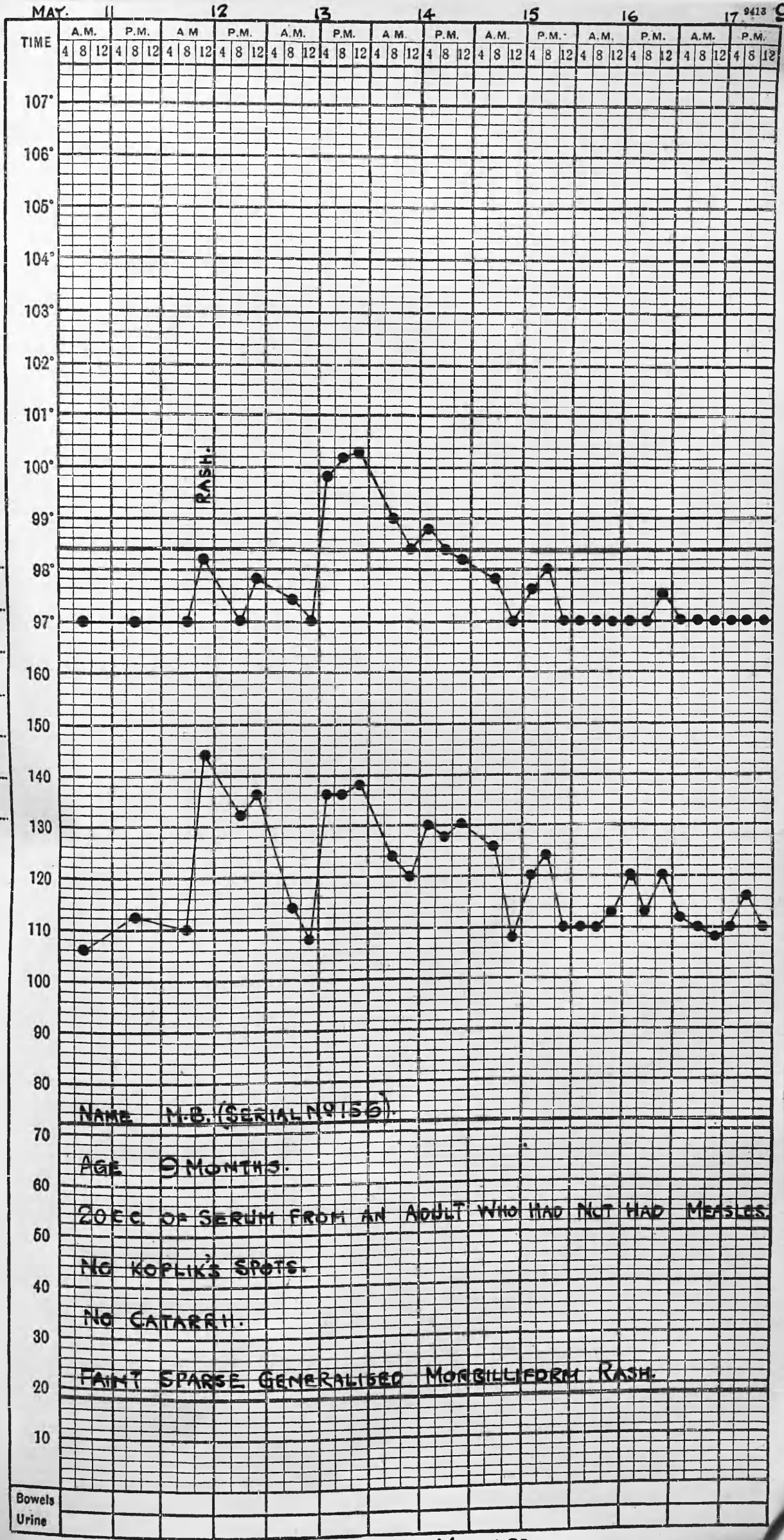
ATTENUATED MEASLES.



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ATTENUATED MEASLES.

COMMENTARY GROUP 21.

The Ear, Nose and Throat Department in Stobhill Hospital furnished this group of seven presumably susceptible contacts, who were exposed to infection by a case of measles showing a typical rash on 27/4/34. On 28/4/34, the fifth day after exposure, six of the contacts each received 20 c.c. of serum from adults who had not had measles, and one did not receive serum and acted as a control.

Two of the immunised contacts escaped infection, three showed attenuated attacks and one had a classical attack: the uninoculated control did not contract measles.

GROUP 21.

SUMMARY OF RESULTS.

Presumably Susceptible Contacts Immunised with Serum from Adults Who had not had Measles,	6	(No Measles,	2
		(Attenuated (Measles,	3
		(Classical (Measles,	1

One Uninoculated Control Escaped Infection.

MEASLES CONTACTS GROUP 22.

Contact from Stobhill Hospital Ward 7A (Dayroom).
Illness from which Contact was suffering - Otitis Media.

Particulars of the Case of Measles Who Exposed the Contact to Infection

Admitted to Ward	5/3/34.
Catarrh Appeared	25/4/34.
Rash Appeared	25/4/34.
Removed from Ward	28/4/34.

Date when Contact was Immunised 28/4/34.
Day after Exposure when Contact was Immunised 7th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACT.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
159	M.G.	1 7/12	20	110	123	20	10	Classical	5/5/34

The Contact was given Serum from an Adult who had not had Measles.

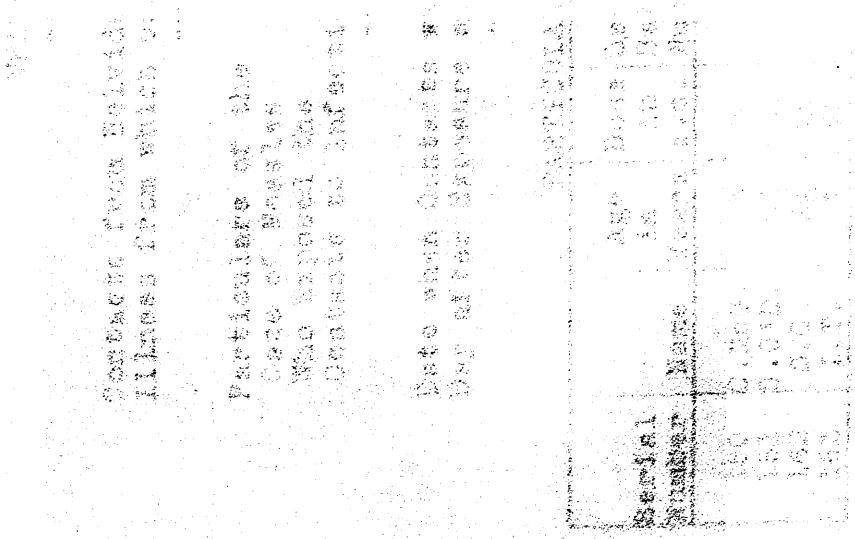
COMMENTARY GROUP 22.

The day-room of the Ear, Nose and Throat Department in Stobhill Hospital was occupied by several children one of whom showed a typical measles rash on 25/4/34. One child only, had not had measles and was given 20 c.c. of serum from an adult who had not had measles, on 28/4/34, the seventh day after exposure. She nevertheless developed a classical attack, the rash appearing on 5/5/34.

GROUP 22.

SUMMARY OF RESULTS.

One contact Immunised with Serum from an Adult who had not had Measles developed a Classical Attack.



MEASLES CONTACTS GROUP 23.

Contacts from Belvidere Hospital Ward 3 West.
Illness from which contacts were suffering - Scarlet Fever.

Particulars of the Case of Measles Who Exposed the Contacts to Infection	Admitted to Ward	20/4/34.
	Catarrh Appeared	1/5/34.
	Rash Appeared	2/5/34.
	Removed from Ward	1/5/34.

Date when Contacts were Immunised 1/5/34.
Day after Exposure when Contacts were Immunised 3rd.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
160	C.McG.	3	20	118	109	28	10	Modified	12/5/34
161	S.O'D.	2½	20	118	109	28	-	-	-
162	D.C.	2½	20	118	109	28	16	Attenuated	18/5/34
163	I.T.	7	20	119	106	42	-	-	-

COMMENTARY GROUP 23.

On 1/5/34, a child in a scarlet fever ward in Belvidere Hospital, showed catarrhal symptoms and Koplik's spots, and was at once removed; a typical rash appeared on the following day. Four children in the ward had not had measles and each was given 20 c.c. of adult immune serum on 1/5/34, the third day after exposure.

Two of the immunised contacts escaped infection, one had an attenuated attack, and one, who had returned home on 5/5/34, had a modified attack and was not ill, although the rash was bright. Ten days later two brothers of this child who had been in close contact with him, contracted very sharp attacks of measles.

The contact who developed measles at home, had not the temperature taken regularly, and therefore, a chart is not available.

GROUP 23.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	4	(No Measles,	2
		(Attenuated Measles,	1
		(Modified Measles,	1

MEASLES CONTACTS GROUP 24.

Contacts from Stobhill Hospital Ward 36.
The Contacts were Healthy Children.

Particulars of the Case of Measles Who exposed the Contacts to Infection	(Admitted to Ward	14/11/33.
	(Catarrh Appeared	-
	(Rash Appeared	29/4/34.
	(Removed from Ward	30/4/34.

Date when Contacts were Immunised 2/5/34.
Day after Exposure when Contacts were Immunised 7th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
164	M.O'N.	7	20	94	219	39	-	-	-
165*	E.McC.	3	20	94	219	39	-	Classical	4/5/34
166	A.W.	6	20	94	219	39	-	-	-
167	J.P.	1	20	119	107	42	17	Classical	16/5/34
168	J.C.	1 4/12	20	119	107	42	17	Modified	16/5/34
169	M.C.	5½	20	81	321	34	-	-	-
170	A.F.	2	20	81	321	34	15	Classical	14/5/34
171	J.G.	2	20	91	239	31	22	Classical	21/5/34

* Contact who Proved to have been in the Pre-eruptive Stage of Measles when Inoculated.

COMMENTARY GROUP 24.

In Stobhill Hospital, another block containing healthy children, suffered an outbreak of measles. A child showed a typical rash on 29/4/34, and was removed from the block on the following day. Eight children who had not had measles were exposed to infection, and each received 20 c.c. of adult immune serum on 2/5/34, the seventh day after exposure. Permission to leave any of the presumably susceptible contacts uninoculated, to act as controls, was not granted.

One child showed a rash two days after receiving the serum; he had been therefore in the pre-eruptive stage of measles when inoculated, and it is likely that he had received infection from a source other than the case who showed a rash on 29/4/34. This contact is not comparable with the others, and has therefore been excluded from the results.

Three of the immunised contacts remained free from infection, one had a modified attack and three had classical attacks.

GROUP 24.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	8		
Inoculated in Pre-eruptive Stage of Measles, ...	1		
Available Inoculated Contacts,	7	(No Measles,	3
		(Modified Measles,	1
		(Classical Measles,	3

MEASLES CONTACTS GROUP 25

Contacts from East Park Home, 1092 Maryhill Road.
The Contacts were Convalescent Medical and Surgical Cases.

Particulars of the Cases of Measles Who Exposed the Contacts to Infection	Admitted to Ward	16/4/34.
	Catarrh Appeared	29/4/34.
	Rash Appeared	1/5/34.
	Removed from Ward	1/5/34.

Date when Contacts were Immunised 3/5/34.
Day After Exposure when Contacts were Immunised 6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
172	B.C.	4	20	87	299	38	12	Classical	13/5/34
173	M.S.	2	20	88	296	39	-	-	-
174	D.M.	6	20	87	299	38	-	-	-
175	J.McM.	8	20	84	312	36	-	-	-

COMMENTARY GROUP 25.

East Park Home admits children convalescing after serious illness or operation.

One of the children in this home showed a measles rash on 1/5/34. Four children who had not had measles were exposed to infection and each was given 20 c.c. of adult immune serum on 3/5/34, the sixth day after exposure.

One child only contracted the infection, and showed a classical attack, the rash appearing on 13/5/34.

GROUP 25.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	4	(No Measles,	3
		(Classical Measles,	1

MEASLES CONTACTS GROUP 26.

Contacts from Stobhill Hospital Ward 35.
The Contacts were Healthy Children.

Particulars of the Case of Measles Who Exposed the Contacts to Infection	(Admitted to Ward	15/4/34.
	(Catarrh Appeared	3/5/34.
	(Rash Appeared	6/5/34.
	(Removed from Ward	4/5/34.

Date when Contacts were Immunised 8/5/34.
Day after Exposure when Contacts were Immunised 6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
* 176	D.S.	4	20	114	123	24	-	-	-
* 177	G.K.	2	20	114	123	24	7	Classical	13/5/34
* 178	J.McG.	3	15	114	123	24	-	-	-
* 179	W.M.	2	20	92	235	36	10	Classical	16/5/34
* 180	I.G.	6	20	92	235	36	9	Classical	15/5/34
* 181	J.G.	3	20	92	235	36	9	Classical	15/5/34
182	I.H.	4	20	64	396	41	-	-	-
183	G.R.	4	20	69	386	48	7	Classical	13/5/34
184	D.M.	3	20	69	386	48	-	-	-
185	P.H.	3	20	62	404	37	-	-	-
186	I.W.	6	No Serum	C O N T R O L			-	-	-
187	D.W.	6	No Serum	C O N T R O L			-	-	-
188	J.S.	9	No Serum	C O N T R O L			-	-	-
189	B.J.	8	No Serum	C O N T R O L			-	-	-

Contacts Marked thus * were given Serum from Adults who had not had Measles.

COMMENTARY GROUP 26.

An outbreak of measles occurred in still another of the blocks in Stobhill Hospital, occupied by healthy children. A child was observed to have catarrhal symptoms on 3/5/34, and was removed on the following day; the rash appeared on 6/5/34. Fourteen children who had not had measles were exposed to infection.

On 8/5/34, the sixth day after exposure, four of the presumably susceptible contacts were each given 20 c.c. of adult immune serum, six were given 20 c.c. of serum from adults who had not had measles, and four did not receive serum and acted as controls.

Three of the four contacts who were given adult immune serum, escaped infection, and one had a classical attack. Two only, of the six contacts who were given serum from adults who had not had measles, escaped infection, and four had classical attacks. All the uninoculated controls escaped infection.

GROUP 26.

SUMMARY OF RESULTS.

Presumably Susceptible Contacts Immunised with Adult Serum,	4	(No Measles,	3
		(Classical Measles,	1
Presumably Susceptible Contacts Immunised with Serum from Adults who had not had Measles,	6	(No Measles,	2
		(Classical Measles,	4

CONTROLS - 4 Uninoculated Presumably Susceptible Contacts did not Contract Measles.

MEASLES CONTACTS GROUP 27.

Contacts from Knightswood Hospital Ward 10.
Illness from which Contacts were Suffering - Scarlet Fever.

Particulars of the Case of Measles Who Exposed the Contacts to Infection (A Nurse had Catarrhal Symptoms but Remained on Duty in the Ward till a Typical Measles Rash Appeared on 13/5/34.

Date when Contacts were Immunised 14/5/34.
Day after Exposure when Contacts were Immunised 5th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
190	B.W.	1½	20	77	370	35	21	Classical	3/6/34
191	I.C.	4	20	76	371	17	14	Classical	27/5/34
192	I.G.	4	20	76	371	17	-	-	-
193	E.McC.	9	20	77	370	35	-	-	-
194	E.K.	5½	20	77	370	35	-	-	-
195	W.McI.	1 8/12	No Serum	C O N T R O L			21	Mild	3/6/34
196	E.G.	5	No Serum	C O N T R O L			-	-	-
197	E.B.	9	No Serum	C O N T R O L			13	Classical	26/5/34

The Contacts in this Group were Immunised with Serum from Adults who had not had Measles.

COMMENTARY GROUP 27.

One of the nurses in a scarlet fever ward in Knightswood Hospital, although suffering from catarrhal symptoms, remained on duty in the ward till she developed a typical measles rash. Eight children who had not had measles were exposed to infection. Five of these presumably susceptible contacts were each given 20 c.c. of serum from city-bred adults who had not had measles, and three did not receive serum and acted as controls.

Three of the contacts who had been given serum escaped infection, and two had classical attacks. One of the three uninoculated controls did not contract measles, one had a mild attack, and one, a classical attack.

GROUP 27.

SUMMARY OF RESULTS.

Presumably Susceptible Contacts Immunised with Serum from Adults Who had not had measles,	5	(No Measles,	3
		(Classical Measles,	2
Uninoculated Presumably Susceptible Contacts (CONTROLS), ...	3	(No Measles,	1
		(Mild Measles,	1
		(Classical Measles,	1

GROUP 27.

SUMMARY OF RESULTS.

Presumably Susceptible Contacts Immunised with Serum from Adults Who had not had measles,	5	(No Measles,	3
		(	
		(Classical (Measles,	2
Uninoculated Presumably Susceptible Contacts (CONTROLS), ...	3	(No Measles,	1
		(	
		(Mild (Measles,	1
		(	
		(Classical (Measles,	1

MEASLES CONTACTS GROUP 28.

Contacts from Bridge Street Fever Hospital, Paisley.
Illness from which Contacts were suffering - Scarlet Fever.

Particulars of the Case of Measles Who exposed the Contacts to Infection	(Admitted to Ward	17/5/34.
	(Catarrh Appeared	-
	(Rash Appeared	25/5/34.
	(Removed to Cubicle in same Ward	25/5/34.
Date when Contacts were Immunised		27/5/34.
Day after Exposure when Contacts were Immunised		6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
198	E.M.	2	20	129	6	42	16	Classical	10/6/34
* 199	A.McG.	5	20	129	6	42	-	Classical	28/5/34
200	M.C.	$1^{9}/12$	20	129	6	42	18	Attenuated	12/6/34
201	R.W.	2	20	128	16	58	-	-	-
202	A.B.	$3\frac{1}{2}$	No Serum	C O N T R O L			17	Mild	11/6/34

* Contact who proved to have been in the Pre-eruptive Stage of Measles when Inoculated.

COMMENTARY GROUP 28.

A scarlet fever ward in Bridge Street Hospital, Paisley, was cross-infected by a case of measles showing the rash on 25/5/34. On that day, the case was removed to a cubicle which had been constructed by partitioning-off a corner of the ward by boarding not reaching to the roof. The so-called (!) cubicle had no door, and the doorway communicated with the ward, so that, in effect, the case was barrier-nursed in the ward.

Five children who had not had measles were exposed to infection; four were given each 20 c.c. of adult immune serum on 27/5/34, the sixth day after exposure, and one did not receive serum and acted as a control.

One of the contacts showed a rash on the day after inoculation, and had been therefore in the pre-eruptive stage of measles when the serum was given. This case is not comparable with the other contacts, and has been excluded from the results.

One of the immunised contacts escaped infection, one had an attenuated attack and one showed classical measles.

The uninoculated control developed mild measles.

GROUP 28.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	4		
Inoculated in Pre-eruptive Stage of Measles, ...	1		
Available Immunised Contacts,	3	(No Measles,	1
		(Attenuated Measles,	1
		(Classical Measles,	1

One Uninoculated Control Developed Mild Measles.

MEASLES CONTACTS GROUP 29.

Contacts from Country Branch of Royal Hospital for Sick Children.
The Contacts were Convalescent Medical Cases.

Particulars of the Case of Measles who Exposed the Contacts to Infection	(Admitted to Ward	5/5/34.
	(Catarrh Appeared	26/5/34.
	(Rash Appeared	30/5/34.
	(Removed from Ward	30/5/34.

Date when Contacts were Immunised 31/5/34.
Day after Exposure when Contacts were Immunised 5th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
203	A.C.	2½	20	128	20	58	-	-	-
204	C.McL.	5	20	128	20	58	-	-	-
* 205	W.McA.	6½	20	127	24	20	-	-	-
* 206	R.H.	3	20	127	24	20	-	-	-
207	J.I.	5/12	No Serum	C O N T R O L			-	-	-
208	H.M.	4/12	No Serum	C O N T R O L			-	-	-

Contacts marked thus * were given Serum from Adults who had not had Measles.

COMMENTARY GROUP 29.

The Country Branch of the Royal Hospital for Sick Children at Drumchapel accommodates patients from the hospital whose convalescence is protracted.

A child here showed a measles rash on 30/5/34, and was removed on that day. Six children who had not had measles were exposed to infection. On 31/5/34, the fifth day after exposure, two of the presumably susceptible contacts were immunised each with 20 c.c. of adult immune serum, two were each given 20 c.c. of serum from city-bred adults who had not had measles, and two did not receive serum and acted as controls.

None of these presumably susceptible contacts contracted measles.

GROUP 29.

SUMMARY OF RESULTS.

2 Presumably Susceptible Contacts Immunised with Adult Serum did not Contract Measles.

2 Presumably Susceptible Contacts immunised with Serum from Adults who had not had Measles escaped Infection.

CONTROLS - 2 Uninoculated Presumably Susceptible Contacts did not Contract Measles.

MEASLES CONTACTS GROUP 30.

Contacts from Nazareth House.
These Contacts were Healthy Children.

Particulars of the Case of Measles who Exposed the Contacts to Infection	(Admitted to Home	18/3/34.
	(Catarrh Appeared	30/5/34.
	(Rash Appeared	1/6/34.
	(Removed to Hospital	1/6/34.

Date when Contacts were Immunised 3/6/34.
Day after Exposure when Contacts were Immunised 6th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
209	J.McK.	10	20	26	533	34	-	-	-
210	B.M.	10	20	26	533	34	-	-	-
211	L.F.	10	20	26	533	34	-	-	-
212	M.O'C.	9	20	28	533	27	10	Abortive	No Rash
213	E.F.	10	20	29	528	32	-	-	-
214	A.McK.	10	20	29	528	32	-	-	-
215	B.B.	8	20	29	528	32	-	-	-
216	P.P.	9	20	29	528	32	-	-	-
217	S.C.	10	20	29	528	32	-	-	-
218	K.D.	10	20	31	526	32	-	-	-
219	M.C.	10	20	31	526	32	-	-	-
220	J.Q.	8	20	31	526	32	-	-	-
221	S.B.	8	20	31	526	32	-	-	-

(Continued)

MEASLES CONTACTS GROUP 30 (Continued).

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
222	R.F.	8	20	31	526	32	-	-	-
223	J.E.	9	20	33	511	44	-	-	-
224	I.B.	10	20	33	511	44	-	-	-
225	L.H.	10	20	33	511	44	-	-	-
226	S.C.	10	20	33	511	44	-	-	-
227	T.G.	9	20	33	511	44	-	-	-
228	M.O'K.	7	20	34	510	37	10	Abortive	No Rash
229	B.M.	8	20	34	510	37	10	Abortive	No Rash
230	M.B.	7	20	34	510	37	-	-	-
231	B.E.	7	20	36	504	27	-	-	-
232	M.C.	8	20	36	504	27	-	-	-
233	S.C.	6	20	36	504	27	11	Classical	12/6/34
234	M.G.	7	20	36	504	27	-	-	-
235	S.H.	7	20	36	504	27	11	Classical	12/6/34
236	A.D.	8	20	60	443	20	-	-	-
237	B.S.	6	20	60	443	20	-	-	-
238	B.T.	8	20	60	443	20	-	-	-
239	A.D.	7	20	60	443	20	10	Abortive	No Rash
240	M.F.	9	20	59	444	20	-	-	-
241	E.R.	7	20	59	444	20	12	Attenuated	13/6/34
242	K.F.	9	20	59	444	20	-	-	-
243	K.McC.	8	20	59	444	20	-	-	-
244	S.G.	6	20	59	444	20	-	-	-
245	A.McG.	8	No Serum	C O N T R O L			-	-	-
246	M.McC.	10	No Serum	C O N T R O L			-	-	-
247	S.O'K.	10	No Serum	C O N T R O L			-	-	-
248	C.H.	8	No Serum	C O N T R O L			-	-	-
249	M.W.	10	No Serum	C O N T R O L			-	-	-

COMMENTARY GROUP 30.

Nazareth House is a residential institution for homeless girls under thirteen years of age. One of the girls had catarrhal symptoms on 30/5/34, but was not removed from the home till 1/6/34, when a typical measles rash was observed.

Forty-one contacts who slept in the same dormitory had not had measles and were exposed to infection. Thirty-six of these were each given 20 c.c. of adult immune serum on 3/6/34, the sixth day after exposure, and five only, did not receive serum and acted as controls.

On 13/6/34, twelve days after the appearance of the rash in the first case, four of the immunised contacts were observed to have watery eyes; they complained of headache and their temperatures were found to be elevated, ranging from 99.4° to 101°. None showed a rash, or Koplik's spots, or injection of the buccal mucosa, and except for eye suffusion, there were no catarrhal symptoms: the illness was over within twenty-four hours. Since these immunised susceptible contacts developed, after a normal incubation period, mild illnesses of which eye suffusion was a symptom, it is likely that they suffered from abortive forms of measles, and as such their illnesses have been regarded.

Twenty-nine of the immunised contacts remained free from infection, one had an attenuated attack, and two showed classical attacks.

None of the five uninoculated controls contracted measles.

GROUP 30.

SUMMARY OF RESULTS.

Immunised Presumably Susceptible Contacts, ...	36	(No Measles,	29
		(Abortive Measles,	4
		(Attenuated Measles,	1
		(Classical Measles,	2

CONTROLS - 5 Uninoculated Presumably Susceptible Contacts did not Contract Measles.

MEASLES CONTACTS GROUP 31.

Contacts from Royal Hospital for Sick Children Ward 6.
The Contacts were Medical Cases.

Particulars of the Case of Measles who Exposed the Contacts to Infection	(Admitted to Ward	2/6/34.
	(Catarrh Appeared	-
	(Rash Appeared	17/6/34.
	(Removed from Ward	17/6/34.

Date when Contacts were Immunised 17/6/34.
Day after Exposure when Contacts were Immunised 4th.Day.

PARTICULARS OF SUSCEPTIBLE CONTACTS.

Serial Number	Name	Age in Years	Dose in c.c.	Serum Batch Number	Age of Serum in Days	Age of Donor in Years	Incubation Period in Days	Type of Attack	Date When Rash Appeared
250	J.W.	4/12	15	128	10	58	-	-	-
251	M.D.	1	20	132	10	18	-	-	-
252	W.K.	5/12	20	132	10	18	-	-	-
253	S.McK.	5½	20	132	10	18	-	-	-

COMMENTARY GROUP 31.

A medical ward in the Royal Hospital for Sick Children, provided the last group of measles contacts.

A patient in the ward showed a measles rash on 17/6/34, and was removed on that day. Four children who had not had measles were exposed to infection, and on 17/6/34, the fourth day after exposure, each was given 20 c.c. of adult immune serum. Permission to leave any of these presumably susceptible contacts uninoculated, to act as controls, was not granted.

None of the contacts developed measles.

GROUP 31.

SUMMARY OF RESULTS.

4 Immunised Presumably Susceptible Contacts did not Contract Measles.

AGGREGATE OF THE RESULTS OBTAINED IN THE DIFFERENT GROUPS OF MEASLES CONTACTS.

SUM OF RESULTS IN THE SERIES OF MEASLES CONTACTS INOCULATED WITH ADULT IMMUNE SERUM.

Group No.	Institution where Contacts Presented	Day after Exposure	Contacts Inoculated	No Measles	Type of Measles Attack			
					Abortive	Attenu-ated	Modified	Classical
1	Kilmarnock Fever Hospital	6th.	15	12	-	1	1	1
2	Scotstoun House Home	3rd.	7	-	-	3	1	3
3	Southern General Hospital	6th.	11	10	-	1	-	-
4	Blawarthill Fever Hospital	5th.	3	-	-	-	-	3
5	Moffat St.Reception House	6th.	2	2	-	-	-	-
6	Victoria Infirmary Ward 12	6th.	2	2	-	-	-	-
7	Knightswood Hospital Ward 7	6th.	3	3	-	-	-	-
8	Shieldhall Hospital Ward 5	3rd.	4	3	-	-	-	1
9	Shieldhall Hospital Ward 4	6th.	2	1	-	-	1	-
10	Knightswood Hospital Wd.I.(M.)	4th.	2	1	-	1	-	-
11	Stobhill Hospital Ward 42B	3rd.	9	6	-	2	1	-
12	Stobhill Hosp.Wd.42B(Isolation)	5th.	2	-	-	1	-	1
13	Scotstoun House Home	3rd.	6	5	-	1	-	-
14	Knightswood Hospital Wd.I.(F)	4th.	2	-	-	2	-	-
15	Mearnskirk Hospital (Isol.)	4th.	2	1	-	1	-	-
16	Oakbank Hospital Ward 2	5th.	3	3	-	-	-	-
17	Stobhill Hospital Ward 3B	6th.	4	-	-	2	2	-
18	Ruchill Hospital Ward 28	5th.	7	6	-	1	-	-
19	Stobhill Hospital Ward 37	7th.	11	8	-	1	2	-
20	Ruchill Hospital Ward 21	6th.	7	-	-	5	1	1
23	Belvidere Hospital Wd.3.W.	3rd.	4	2	-	1	1	-
24	Stobhill Hospital Ward 36	7th.	7	3	-	-	1	3
25	East Park Home	6th.	4	3	-	-	-	1
26	Stobhill Hospital Ward 35	6th.	4	3	-	-	-	1
28	Paisley Fever Hospital	6th.	3	1	-	1	-	1
29	R.H.S.C.- Country Branch	5th.	2	2	-	-	-	-
30	Nazareth House	6th.	36	29	4	1	-	2
31	Royal Hosp.for Sick Children	4th.	4	4	-	-	-	-
	Total		168	110	4	25	11	18

SUM OF RESULTS IN THE SERIES OF MEASLES CONTACTS INOCULATED WITH SERUM FROM ADULTS WHO HAD NOT HAD MEASLES.

Group No.	Institution where Contacts Presented	Day after Exposure	Contacts Inoculated	No Measles	Type of Measles Attack			
					Abortive	Attenu-ated	Modified	Classical
21	Stobhill Hospital Ward 7A	5th.	6	2	-	3	-	1
22	Stobhill Hospital Wd.7A (Day-Room)	7th.	1	-	-	-	-	1
26	Stobhill Hospital Ward 35	6th.	6	2	-	-	-	4
27	Knightswood Hospital Wd.10	5th.	5	3	-	-	-	2
29	R.H.S.C.Country Branch	5th.	2	2	-	-	-	-
Total			20	9	-	3	-	8

SUM OF RESULTS IN THE SERIES OF MEASLES CONTACTS WHO DID NOT RECEIVE SERUM (Controls).

Group No.	Institution where Contacts Presented	No. of Controls	No Measles	Type of Measles.		
				Very Mild	Mild	Classical
1	Kilmarnock Fever Hospital	3	3	-	-	-
2	Scotstoun House Home	6	-	-	-	6
3	Southern General Hospital	5	4	1	-	-
4	Blawarthill Fever Hospital	2	1	-	-	1
5	Moffat St.Reception House	1	1	-	-	-
6	Victoria Infirmary Ward 12	2	2	-	-	-
7	Knightswood Hospital Ward 7	2	2	-	-	-
8	Shieldhall Hospital Ward 5	1	1	-	-	-
9	Shieldhall Hospital Ward 4	1	-	-	-	1
10	Knightswood Hospital Wd.I.(M.)	1	-	-	-	1
11	Stobhill Hospital Ward 42B	4	1	-	-	3
13	Scotstoun House Home	4	3	-	-	1
14	Knightswood Hospital Wd.I.(F.)	1	1	-	-	-
15	Mearnskirk Hospital (Isol.)	3	1	-	-	2
16	Oakbank Hospital Ward 2	1	1	-	-	-
17	Stobhill Hospital Ward 3B	2	-	-	-	2
21	Stobhill Hospital Ward 7A	1	1	-	-	-
26	Stobhill Hospital Ward 35	4	4	-	-	-
27	Knightswood Hospital Ward 10	3	1	-	1	1
28	Paisley Fever Hospital	1	-	-	1	-
29	R.H.S.C.Country Branch	2	2	-	-	-
30	Nazareth House	5	5	-	-	-
Total		55	34	1	2	18

TOTAL NUMBER OF CONTACTS OBSERVED.

Contacts Immunised with Adult Immune Serum,		168
Contacts Immunised with Serum from Adults who had not had Measles,	...	20
Controls (No Serum),	... ...	55
		243
Contacts Subsequently Found to Have been in Pre-eruptive Stage of Measles when Inoculated and Excluded from Results,		10
Total Contacts,		253

ANALYSIS OF DATA.

One hundred and sixty-eight presumably susceptible contacts received an injection of adult immune serum. Of these 110 (65.5 per cent.) did not contract measles, 4 had abortive attacks, 25 showed very mild or attenuated attacks, 11 had mild or modified attacks and 18, classical attacks.

Twenty presumably susceptible contacts received an injection of serum from city-bred adults who had not had measles. Of these 9 (45 per cent.) escaped infection, 3 showed very mild or attenuated attacks, and 8 had classical measles.

As controls, 55 presumably susceptible contacts did not receive serum. Thirty-four (61.8 per cent.) did not take measles. One showed very mild measles; two had mild measles and 18, classical measles.

TABLE I. - GENERAL RESULTS.

Type of Serum	Number of Contacts	No Measles	Type of Attack				Total Mild Cases
			Abortive	Very Mild	Mild	Classical	
Adult Immune Serum	168	110 (65.5%)	4	25	11	18	40 (23.8%)
Serum from Adults who had not had Measles	20	9 (45.0%)	-	3	-	8	3 (15.0%)
Controls (No Serum)	55	34 (61.8%)	-	1	2	18	3 (5.4%)

The proportion of naturally immune children may seem high, but the controls in each group were subject to the same conditions of infection as the immunised children - a most important condition, since it was clearly evident throughout the investigation, that infectivity depended largely on propinquity, being greater where the children were in close contact, as in the convalescent homes, and less where contact was not so intimate, as in the hospital wards. It is not sufficient to compare groups of contacts where all have been immunised, with different groups where all have been left uninoculated, because infectivity varies, and is dependent mainly on propinquity, but also on the severity of the attack in the infecting case, and on the duration of contact.

From the above figures (Table I.) it is apparent that adult immune serum is practically useless in the prevention of measles.

TABLE II. - PROPORTION OF MILD ATTACKS IN IMMUNISED AND NON-IMMUNISED CASES.

Type of Serum	Total Measles Cases	Type of Measles Attack								Total Mild Cases	
		Abortive		Very Mild		Mild		Classical			
		No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Adult Immune Serum	58	4	6.9	25	43.1	11	19.0	18	31.0	40	69.0
Serum from Adults who had not had Measles	11	-	-	3	27.3	-	-	8	72.7	3	27.3
Controls (No Serum)	21	-	-	1	4.8	2	9.5	18	85.7	3	14.3

The attack was mild in 69 per cent. of the measles cases who had been immunised with adult immune serum, in 27.3 per cent. of the measles cases who had been given serum from city-bred adults who had not had measles, and in 14.3 per cent. only of the measles cases who had not received serum.

The attenuative value of adult immune serum is therefore considerable, whilst that of serum from adults who have not passed through an attack of measles is small.

Effect of Interval Between Exposure to Infection and Immunisation.

The results of injection of adult immune serum on various days after exposure to infection are set forth in Table III.

TABLE III. - EFFECT OF INTERVAL BETWEEN EXPOSURE AND IMMUNISATION.

Number of Days after Exposure when Serum was Given.	Number of Contacts	No Measles	Type of Attack				Total Measles	Total Mild Cases	Percentage of Measles Cases which were Mild.
			Abortive	Attenuated	Modified	Classical			
3	30	16 (53.0%)	-	7	4	3	14	11	79.0
4	10	6 (60.0%)	-	4	-	-	4	4	100.0
5	17	11 (64.7%)	-	2	-	4	6	2	33.3
6	93	66 (71.0%)	4	11	5	7	27	20	74.0
7	18	11 (61.1%)	-	1	2	4	7	3	43.0
Total	168	110 (65.5%)	4	25	11	18	58	40	69.0

The proportion of attenuated cases was relatively high when the serum was given on or prior to the fourth day after exposure, but thereafter fell considerably.

TABLE IV. - GROUPED FINDINGS OF TABLE III.

Number of Days After Exposure When Serum Was Given.	Number of Contacts	No Measles	Total Mild Cases	Classical Cases	Total Measles	Percentage of Measles Cases which were Mild.
3-4	40	22 (55.0%)	15	3	18	83.3
5-7	128	88 (68.7%)	25	15	40	62.5
Controls	55	34 (61.8%)	3	18	21	14.3

The table shows that when the serum was given on the third and fourth days after exposure, the attack was mild in 83.3 per cent. of those contacts who developed measles, whereas when given on the fifth to seventh days after exposure, 62.5 per cent. only, of the measles cases were mild.

Effect of Time on Serum Potency.

An analysis of the results with serum stored for varying periods is given in Table V., which shows that the attenuating power of the serum remained unimpaired for some 200 days, but thereafter fell to a lower level at which the potency was maintained for over 500 days.

TABLE V. - EFFECT OF TIME ON SERUM POTENCY.

Age of Serum in Days.	Number of Contacts	No Measles	Type of Attack				Total Measles	Total Mild Cases	Percentage of Measles Cases which were Mild.
			Abortive	Attenuated	Modified	Classical			
0- 50	12	8 (66.7%)	-	3	-	1	4	3	75.0
50-100	23	12 (52.2%)	-	7	3	1	11	10	87.0
100-150	15	10 (66.7%)	-	2	2	1	5	4	80.0
150-200	33	20 (60.0%)	-	7	4	2	13	11	84.0
200-250	3	2 (66.7%)	-	-	-	1	1	-	-
250-300	4	2 (50.0%)	-	1	-	1	2	1	50.0
300-350	15	7 (46.7%)	-	3	1	4	8	4	50.0
350-400	22	16 (72.6%)	-	1	1	4	6	2	33.3
400-450	11	8 (72.7%)	1	1	-	1	3	2	66.6
450-500	-	-	-	-	-	-	-	-	-
500-550	30	25 (83.3%)	3	-	-	2	5	3	60.0
Total	168	110 (65.5%)	4	25	11	18	58	40	69.0

Interval Between Attack and Donation.

An attempt was made to ascertain whether the interval between the attack of measles and the donation of blood by the subject, had any effect on the value of the serum. The donors had invariably forgotten the age at which they had measles, and so, the ages of the donors have been used as indices of the interval between the attack and the donation of blood.

TABLE VI. - EFFECT OF AGE OF DONOR ON SERUM POTENCY.

Age of Donor in Years.	Number of Contacts	No Measles	Type of Attack				Total Measles	Total Mild Cases	Percentage of Measles Cases which were mild.
			Abortive	Attenuated	Modified	Classical			
15-20	31	19 (61.3%)	1	6	2	3	12	9	75.0
20-25	32	19 (59.4%)	-	6	2	5	13	8	61.5
25-30	26	19 (73.0%)	1	3	1	2	7	5	71.4
30-35	24	18 (75.0%)	-	3	1	2	6	4	66.6
35-40	27	19 (70.4%)	2	3	1	2	8	6	75.0
40-45	14	9 (64.3%)	-	2	1	2	5	3	60.0
45-50	14	7 (50.0%)	-	2	3	2	7	5	71.4
Total	168	110 (65.5%)	4	25	11	18	58	40	69.0

Table VI. exhibits the results with sera from donors of different ages, and shows that the attenuative value of the serum remains unimpaired in adults up to 50 years of age.

Dose of Adult Immune Serum.

The first few contacts received doses of 10 c.c. or 15 c.c. of adult immune serum, but as uniform results were not obtained, a standard dose of 20 c.c. was adopted and maintained throughout the investigation. The foregoing results suggest that where the injection is given later than the fourth day after exposure, or

where the serum has been kept for more than six months, the dose may with advantage be increased to, say, 30 c.c. in order to obtain optimum results.

Incubation Period and Infectivity of Attenuated Measles.

The incubation period was judged by observing the interval between the first appearance of the rash in the infecting case, and its first appearance in the contacts. The average incubation period was 12.6 days in attenuated cases, 13.0 days in modified cases, 13.0 days in classical cases, and 12.0 days in the non-immunised contacts or controls. The incubation period in the immunised cases, therefore, did not differ materially from that in the controls.

Attenuated cases of measles are infectious, though less so than classical cases, owing to the absence or trifling nature of the catarrhal symptoms. In several groups exposed to infection by an attenuated case, classical attacks resulted both in immunised contacts and non-immunised controls.

Natural Immunity.

Several presumably susceptible uninoculated contacts or controls, although in very close contact with measles over a comparatively long period, failed to contract the infection.

A nurse whose duties brought her into close contact with the children, remained in the ward throughout the catarrhal stage of her illness, and went off duty only when the rash appeared: four of five presumably susceptible uninoculated contacts did not contract measles. (Group Number 3.)

In one of the convalescent homes, four presumably

susceptible uninoculated children occupied the same dormitory as several children in the catarrhal stage of measles, and were otherwise in very intimate contact with them, yet one only, contracted measles (Group Number 13).

Complete natural immunity appeared to be possessed by a presumably susceptible uninoculated child, who was almost continuously exposed to infection for fifty days, by nine consecutive cases of measles, and did not contract the infection (Group Number 15).

One control was continuously exposed to infection for seventeen days by five consecutive cases of measles, and only contracted infection from the fifth case (Group Number 15).

Two presumably susceptible uninoculated contacts (controls) contracted classical attacks after a second exposure, gaining their infections from an immunised contact or control who had developed measles. Five immunised contacts contracted measles after a second exposure to infection, and in four the attack was attenuated.

A child, then, may come into close contact with measles on several occasions, and resist the infection and yet contract the disease at a subsequent contact.

It is probable that the degree of natural immunity varies in different children, and that in the individual child, the level of natural immunity varies from time to time, so that, infection resisted when immunity is high, may be contracted later, when immunity is low.

In this series, 61.8 per cent. of the presumably susceptible uninoculated contacts (controls) did not contract the infection: as it is likely that many

of these children were in contact with measles for the first time, it is not surprising that the proportion who resisted the infection is relatively high. Throughout childhood and adolescence, members of urban populations repeatedly come into contact with cases of measles and the majority contract the infection before reaching adult life. Only SIXTEEN per cent. of the adult donors stated that they had not had measles. It appears that in the children of urban populations, partial natural immunity to measles is common, and complete natural immunity is not rare.

SUMMARY.

During the measles epidemic which occurred in Glasgow in the spring of 1934, opportunity was taken to test the value of adult immune serum in the prophylaxis and attenuation of measles. By "adult immune serum", is meant the blood-serum from adults who have had an attack of measles in childhood. In order to have a store of serum on hand at the beginning of the epidemic, and also to enable the keeping properties to be proved, the collection of serum was begun at Knightswood Hospital during the winter of 1932-1933, and carried on, as donors became available, right up to and during the epidemic. Owing to the unusually late appearance of the epidemic in the spring of 1934, batches of serum of different ages up to eighteen months old were available. In all 16,000 c.c. of blood were collected from 137 donors and yielded 8,003 c.c. of serum. Twenty-two (16 per cent.) of the donors who were all city-bred, denied any history of measles, and from them 1,368 c.c. of serum were collected in order to compare its value with that of adult immune serum. The serum from each donor was collected under aseptic conditions, Wassermann tested, and stored separately in an ice-chest.

The investigation was carried out on susceptible measles contacts in children's homes and wards of municipal hospitals, and comprises thirty-one groups, involving in all, 243 contacts. The subjects of the investigation were therefore under close observation. The serum was given intramuscularly, and the usual dose was 20 c.c. In a large number of the groups, a proportion of

the susceptible contacts did not receive serum and acted as controls. The contacts were kept under close observation until the twenty-first day after exposure to infection, and during that time their temperatures were taken four-hourly.

When measles occurred in immunised contacts, the type of attack was classified as (a) abortive, (b) attenuated, (c) modified, or (d) classical. Cases admitted to these categories showed the following characters:-

(a) Abortive. - No rash: slight or moderate pyrexia occurring after the usual incubation period, and accompanied by headache and slight eye suffusion: no Koplik's spots: no injection of buccal mucosa: recovery within twenty-four hours. Only four such cases occurred in the whole series.

(b) Attenuated. - No catarrhal symptoms: no Koplik's spots: sparse ill-defined rash: little or no pyrexia: no constitutional symptoms: no complications. An attack of this kind did not appear to differ in any way from an exceedingly mild attack of measles, such as occasionally occurs in children who have not had measles serum.

(c) Modified. - Little or no catarrhal symptoms: no Koplik's spots: fairly bright and more or less typical morbilliform rash: slight or moderate pyrexia: no constitutional symptoms: no complications. The objective signs were those of a mild or moderate attack of measles, but the constitutional symptoms usually associated with such an attack were entirely lacking. From the onset the children were bright and alert; they playfully sat up or stood up in their cots, and they ate and slept well. The whole illness was not unlike rubella.

(d) Classical. - Catarrhal symptoms: Koplik's spots: typical rash: moderate or high pyrexia: characteristic toxaemia.

Cases of measles which occurred in the "control" series were classified as very mild, mild, and classical. In general, cases admitted to these categories corresponded respectively to the attenuated, modified, and classical types which occurred amongst the immunised children, thus allowing a comparison of the severity of the attack, in immunised and non-immunised contacts.

One hundred and sixty-eight susceptible contacts received an injection of adult immune serum. Of these 110 (65.5 per cent.) did not contract measles, 4 had abortive attacks, 25 showed very mild or attenuated attacks, 11 had mild or modified attacks and 18, classical attacks.

Twenty susceptible contacts received an injection of serum from city-bred adults who had not had measles. Of these 9 (45.0 per cent.) did not take measles, 3 showed very mild or attenuated measles and 8, classical measles.

As controls, 55 susceptible contacts did not receive serum. Thirty-four (61.8 per cent.) did not take measles. One showed very mild measles; two had mild measles, and 18, classical measles. The proportion of naturally immune children may seem high, but the controls in each group were subject to the same conditions of infection as the immunised children.

From the above figures it is apparent that adult immune serum is practically useless in the prevention of measles.

The attack was mild in 69.0 per cent. of the measles cases who had been immunised with adult immune

serum, in 27.3 per cent. of the measles cases who had been given serum from city-bred adults who had not had measles, and in 14.3 per cent. only, of the measles cases who had not received serum. The attenuative value of adult serum is therefore considerable, whilst that of serum from adults who have not passed through an attack of measles is small.

The proportion of attenuated cases was relatively high when the serum was given on or prior to the fourth day after exposure to infection, but thereafter fell considerably. When the serum was given on the third and fourth days after exposure, the attack was mild in 83.3 per cent. of those contacts who developed measles, whereas when given on the fifth to seventh days after exposure, 62.5 per cent. only of the measles cases were mild.

An analysis of the results with serum stored for varying periods shows that the attenuating power of the serum remained unimpaired for some 200 days, but thereafter fell to about 60 per cent. of its former value, at which level the potency was maintained for over 500 days.

An attempt was made to ascertain whether the interval between the attack of measles and the donation of blood by the subject, had any effect on the value of the serum. The donors had invariably forgotten the age at which they had measles, and so the ages of the donors were used as indices of the interval between the attack and the donation of blood. It was found that the attenuative value of the serum remained unimpaired in adults up to 50 years of age.

The first few contacts received doses of 10 c.c. or 15 c.c. of adult immune serum, but as uniform results were not obtained, a standard dose of 20 c.c. was adopted and maintained throughout the investigation. The

foregoing results suggest that where the injection is given later than the fourth day after exposure, or where the serum has been kept for more than six months, the dose may with advantage be increased to, say, 30 c.c. in order to obtain optimum results.

The average incubation period was 12.6 days in attenuated cases, 13.0 days in modified cases, 13.0 days in classical cases, and 12.0 days in the non-immunised controls. The incubation period in the immunised cases therefore, did not differ materially from that in the controls.

Attenuated cases of measles are infectious, though less so than classical cases, owing to the absence, or trifling nature of the catarrhal symptoms. In several groups exposed to infection by an attenuated case, classical attacks resulted in both immunised contacts and non-immunised controls.

Evidence has been adduced to show that in city bred children who have not had measles, susceptibility varies within very wide limits, and it is apparent that some possess complete natural immunity.

C O N C L U S I O N S.

1. Adult immune serum when administered in 20 c.c. doses to susceptible measles contacts does not prevent the onset of the disease, but has considerable power to attenuate or modify the attack. If given within the first four days after exposure to infection, the attack may be expected to be attenuated or modified in about 80 per cent. of those contacts who develop the disease; if given on the fifth to seventh day after exposure, 60 per cent. of the cases may be expected to be attenuated or modified. Normally, when serum is not given, only about 14 per cent. of the cases are mild.

2. When stored in the ice box the serum retains its full potency for six months; thereafter the potency drops to about 60 per cent. of its former value, and remains at this level for at least one and a half years.

3. The serum from adults up to 50 years of age is as potent as that of adolescents.

4. The serum from city-bred adults who have not had measles possesses but slight attenuating power.

5. Attenuated measles is infectious and the incubation period corresponds to that of ordinary measles.

6. In contacts who have been inoculated with adult immune serum, and who, notwithstanding, develop unmodified measles, complications may occur as in uninoculated cases, and the attack may even prove fatal.

7. Partial natural immunity to measles is common in city-bred children, and complete natural immunity is not rare.

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