

ON AN EPIDEMIC OF SMALLPOX OF IRRGULAR TYPE
IN TRINIDAD DURING 1902-1904

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Smallpox was so prevalent in prevaccination times that hardly anyone escaped the disease. It entered the palace of the king with the same freedom as it did the hovel of the peasant; it penetrated everywhere carrying desolation with it. Those who escaped death were left disfigured or crippled for life. Almost every face was seamed and scarred and on every side were met the blinded victims of the scourge. At times whole towns were depopulated. When the contagion fell upon virgin soil it raged with special virulence and wrought dreadful havoc. Among the black races, whole tribes were extirpated; its ravages were then fearful to contemplate and the mortality which followed in its train was appalling. Macaulay in his History of England thus alludes to this scourge in speaking of the death of Queen Mary from it in 1694: "That disease over which science has achieved a succession of glorious and beneficent victories was then the most terrible of all the ministers of death. The havoc of the plague had been more rapid, but the plague had visited our shores only once or twice within living memory. The smallpox was always present, filling the churchyard with corpses, tormenting with constant fears all those whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother

shuddered and making the eyes and cheeks of the betroth-
-ed maiden objects of herror to her lover."

Even more impressive than this classical picture of the great historian, is the evidence presented by statistics in which is crystallized the experience of entire nations. The features of this leathsome and destructive disease were then familiar even to the man in the street and medical men had ample oppertunities of becoming thoroughly acquainted with its various manifestations, but since the discovery or more correctly speaking, the introduction of vaccination by the immortal Jenner, this most dreaded of all the infectious diseases has been by degrees stamped out in all civilised countries, or at any rate its prevalence has been lessened to such an extent that there are nowadays many experienced physicians who have never seen a case. Furthermere, the practice of vaccination has rendered the diagnosis mere difficult, as the phases of the disease have been made by it far more numerous and intricate than they were before. It is not surprising therefore, since its epidemic character has been se greatly modified by vaccination and other causes, that difficulties in recognising its true nature are experienced at times.

Since the great pandemic of 1871-2 the colony of Trinidad was not visited by smallpox until April 1902

when the disease introduced itself in a very mild and irregular form and gave rise to considerable diversity of opinion in regard to its nature. Among the sixty medical practitioners in the island there were not eight who had had any experience of this disorder and even the doyen of the medical faculty here who had witnessed the terrible ravages of 1871-2 was misled by the aberrant symptomatology of the disease in this latter epidemic and failed to recognise its true nature. The selection of this subject for my thesis was mainly prompted by the interesting points connected with the origin and spread of the epidemic, the unusual and anomalous features of the disease; the instructive results obtained in regard to the relation of vaccination to it, and above all by the mortality which was so strikingly low.

The following account of the origin of the epidemic in Trinidad is taken from a pamphlet by Dr. Dickson the Assistant Medical Officer of Health and Dr. Lassalle, Assistant Surgeon, Colonial Hospital, Port-of-Spain, entitled "Varioloid-Varicella in Trinidad". This paper was read at the meeting of the British Medical Association at Swansea in 1903. "The first case of which there is a record was that of an inmate of the Lunatic Asylum, St. Ann's. The Asylum is situated in an isolated position beyond the limits of the town.

(See accompanying map). This patient had been an inmate of the Asylum for some years and developed the disease on April 16th, 1902. The case was isolated on the appearance of the rash, but other cases appeared during May, June, July and August until nineteen inmates and attendants, all adults, were affected. The source of infection could not be traced and must have been either a visitor or attendant who had a mild attack and escaped notice. The cases were returned as "Varicella" but the Medical Superintendent has since reported that they were similar to the cases of Eruptive Fever now occurring, and in one instance, that of an attendant who had the disease in August 1902, a few pigmented marks identical in appearance with the macules already described, were visible up to a month ago. It is of interest, that of the nineteen cases, ten were in vaccinated and six in unvaccinated persons, and in three the evidence of vaccination was doubtful. The most severely attacked were an inmate vaccinated in infancy and an attendant revaccinated in 1898 and showing three good marks of successful vaccination.

"On May 2nd 1902, a similar case in an adult was reported from Woodbreek, a suburb to the west of Port-of-Spain. Cases next occurred in Dundonald Street in the north-west of the town in September. Early in October, a woman who lived in a barrack yard in the south

east of the town developed the disease within a fortnight of her arrival from Yrapa in Venezuela. About the third week of October a case, that of a trader, who had recently come from Guiria in Venezuela, occurred in Duke Street, about the middle of the town. Both of these cases lived in largely tenanted barrack-yards, did not seek medical aid and were not reported at the time; other inmates of these yards were subsequently affected but this fact was discovered only in the early part of December and after they had recovered. During November eleven cases occurred in the middle and south-east of the town and though in all probability the two cases above quoted were the sources of infection yet there is ground for believing that in three of the cases, the contagion was derived from other sources. Five of the cases occurred in one yard in Duncan Street in the first week of November and of these, two who showed most distinct vaccination marks, were most severely attacked. During December, eight cases were reported from the eastern, south eastern and middle portions of the town. Of these one was a vagrant who developed the disease within a week of his arrival from Yrapa. In January 1903 a house to house inspection was instituted, other cases were discovered in various parts of the town and the disease began to assume epidemic proportions. At first the majority of

persons affected were hucksters, sailors and quay labourers, that is were of that class of the population which would earliest be exposed to contact with an imported disease".

Reports of the prevalence of a similar disease in the adjoining coastal villages of Venezuela had for some time been circulated and early in February information was received that several deaths had occurred and that the disease was now stated to be Variola. With the view of obtaining accurate information, a commission of two medical practitioners, one of whom had had extensive experience of smallpox, were sent to Venezuela to investigate and report upon the nature of the eruptive fever prevalent there. The commissioners visited Yrapa and Guiria. The following extracts are taken from their report. "The disease had existed in Yrapa for nearly a year and had not varied in character, that is, has always been a mild affection. Two deaths had occurred in the country around, one was that of a chronic alcoholic, the other died probably more from privation and neglect than anything else. We visited Messrs. Fournelli and Cottin, both Frenchmen long established in Venezuela. Their household had not been attacked and they were under the impression that Europeans were spared. Mr Fournelli stated that in Carupano where there was a large European community and where

where this disease had been very prevalent, no European had been attacked. These gentlemen informed us that no alarm was ever felt at Yrapa about the sickness, that they called it "Lechina" (Spanish for Chickenpox). As a proof of the mildness of the disease, they referred to the attack of Guiria by the revolutionary forces from Yrapa where many of the troopers though covered with the eruption carried their mausers cheerfully to battle." The commissioners came to the conclusion that the disease was exactly of the same nature as that occurring in Port-of-Spain and was not smallpox. They expressed the opinion that the disease was imported into Trinidad from Yrapa. There is a large daily passenger and trade traffic between Port-of-Spain and the villages on the adjoining Venezuelan coast and the voyage does not occupy more than a day. Under these circumstances and in view of the instances above quoted, there seems to be little doubt that the disease was introduced into Trinidad from Venezuela. I may here add the population of Yrapa is about 12,000 and is practically unvaccinated. So aberrant and misleading were the clinical features of the disease that its real nature was unrecognised except by a few. As I had charge of the Isolation Hospital for seven months and treated 564 cases of the disease I had the opportunity of studying closely its

various manifestations. I was also placed in charge of the Maternity ward where fifty one women who had had the disease during pregnancy were delivered.

Three different theories were advanced to explain the nature of the "eruptive fever". At the commencement of the epidemic and indeed for a considerable time after, many of the medical men in the colony considered the disease to be chickenpox of an aggravated form; the co-existence of syphilis and other constitutional taints as well as the presence of diathetic tendencies were put forward to explain the unusual severity of many of the cases. This theory was eventually abandoned by all.

Those who could not countenance or accept this view of the nature of the disease and yet did not feel justified in considering it to be smallpox, suggested the possibility of the existence of a hybrid between Variola and Varicella in the same way as Rubella was once considered by Schönlein and other writers to be a hybrid between Scarlatina and Morbilli. This theory, however was never seriously maintained but many were of opinion that the disease was a specific entity, and called it Varioloid Varicella owing to its supposed similarity to an eruptive fever which occurred in epidemic form many years ago in Jamaica, and was describ-

ed under that name by Dr Izett Anderson of Kingston,
 I need not comment upon the name "Varioloid Varicella"
 which is wholly unscientific and misleading, but some
 reference as to the possibility of the existence of a
 new disease in the form assumed by this epidemic may
 not be out of place here. It is well known that at
 one time Measles, Scarlatina, Rubella and the "Fourth
 disease" were included under one name and were regard-
 ed as one malady. With the progress of medical science
 they were gradually differentiated one from another,
 so that at the present day they are considered to be
 perfectly distinct and definite diseases.

It was not until the close of the 17th century that
 Scarlet fever was distinguished from Measles whilst
 the differences between these two diseases and Rubella
 were fully indicated only about the middle of the 18th
 century when that disease became known as Roseola. The
 existence of the "Fourth disease" as a specific entity
 has been claimed within very recent years.

Similarly smallpox was for a long period confounded
 with measles and even in the 16th century when the
 former disease was generally recognised, errors of
 diagnosis were not infrequent. English writers in the
 early part of the 18th century mention Varicella as a
 variety of smallpox but the end of that century saw the
 differences between them clearly established.

Can the eruptive fever which forms the subject of this paper be regarded as the "third disease" in the second group of infectious diseases which I have mentioned above, taking its place between Varicella and Variola? I think not.

The evolution of the diagnosis of the infectious fevers was no doubt in the main due to careful clinical observation, but in those instances where inherent difficulties of diagnosis existed by reason of very close resemblances, the application of Cullen's law was necessary. "One attack of an eruptive fever entails immunity from a second attack in the same individual during childhood." This fundamental law in medicine was the most reliable means of differentiating some of the very closely allied eruptive fevers and was sometimes the final test in their elucidation; even now where the Bacteriologist fails to enlighten in such cases, it is a very valuable and certain test. The opportunity for the application of this principle in the present case has not arisen but we have in vaccination a somewhat analogous and equally convincing method of differentiation which can be applied to distinguish other eruptive diseases from Variola. Vaccinia and Variola are mutually protective and if the same relation exists, as I shall endeavour to prove, between Vaccinia and the disease under review, it is reasonable

to infer the identity of the latter with Variola. As far as I am aware two epidemics of an eruptive fever which closely resembled chickenpox and smallpox have been described and regarded as neither Variola nor Varicella. One of these epidemics broke out in Jamaica in 1863 and was described in a paper read before the Epidemiological Society of London by Dr. Izett Anderson in 1866 and published in the transactions of that Society in 1867 (on Epidemic Varioloid Varicella in Jamaica: Transactions of the Epidemiological Society of London, Volume 11 page 414). The other epidemic occurred in Glasgow in 1898 and was reported in the Lancet, October 22nd, 1898 by Drs. Brownlee and Thomson. It appears to me that the disease described by Drs. Brownlee and Thomson is Varicella and that described by Dr. Anderson is more akin to Variola. Drs. Brownlee and Thomson expressed the opinion that the Glasgow epidemic was identical in nature with that which occurred in Jamaica in 1863 and regarded the disease as a specific entity hitherto unidentified. This seemed to have lent some support to the " sui generis " theory here.

Although some of the characteristics of the Trinidad epidemic were very unusual and aberrant yet the more salient features of the disorder were identical with those of smallpox, so that apart from the Vaccination test there are grounds for the belief that the

two diseases differed only in type. In connection with the theory that the disease was a new malady, the recent volcanic disturbances in the West Indies notably in Martinique and St. Vincent appealed to the vulgar mind which promptly attributed to these convulsions of nature the origin and source of the disorder. The third view on the subject and in my opinion the correct one as I have already indicated was that the prevailing eruptive fever was an irregular form of smallpox. To Dr. Masson is due the honour of having been the first to recognise the variolous nature of the disease. Early in November 1902 he was called to see in Duncan Street, Port-of-Spain, a few cases of an eruptive fever which he at once suspected to be smallpox. In this the Acting Surgeon General of the Colony and the Assistant Medical Officer of Health and others who saw these cases did not concur; they held the opinion that the disease was chickenpox. In accordance with this official declaration no steps whatever were taken to prevent the spread of the disease or to circumscribe its area of infection until much later on when it became so widespread as to be almost beyond control. On the other hand it must be admitted that it would have been difficult to prevent its dissemination in view of the extreme mildness of a large proportion of the cases. In any case the fail-

ure on the part of the Health Department to recognise the true nature of the disease led to its wide diffusion in the town and its invasion of the country districts. This was a blessing in disguise, for the disease not only retained its mild character throughout the epidemic but it spread far and wide in the country, so that a large proportion of the population have become immune from smallpox at a very small sacrifice of lives, through protection afforded either by an attack of the disease or the operation of vaccination which the people largely availed themselves of. Fortunately the clamour of the antivaccinationists has not yet reached this colony nor does a "conscience clause" exist in our vaccination ordinance. Dr. Masson was not satisfied with the decision arrived at by the Health Authorities. Early in December 1902 he visited Barbados another West Indian island which was in the throes of a smallpox epidemic of a more or less mild form, with the object of studying its clinical features and for the purpose of comparing them with those of the cases which he had seen in Port-of-Spain. His observations in Barbados only confirmed his views on the matter. At first the medical men in Trinidad felt great difficulty in accepting his diagnosis owing to the unusual and variant features of the disease, but subsequently when they became more intimately acquainted with the epidem-

ic, many recognised the correctness of his view. In the meantime the disease which had spread very slowly so slowly in fact, that it did not attract any particular attention, began to assume epidemic proportions in the town at the beginning of the year 1903 and to cause much alarm and anxiety to the authorities, as it was getting beyond control. Early in 1903 certain measures were adopted to repress its growth. As many cases as possible were sent to the Isolation Hospital, while for want of accommodation the vast majority of the patients were treated at their homes. In February 1903 two medical men were especially appointed for this purpose. Contacts were vaccinated and revaccination was encouraged generally. The disease continued to spread and owing to its mild character many of those affected by it were seen in the street, in its various stages and in some instances were able to pursue their daily labours. In order to protect the public health against the so-called "Varioloid Varicella" certain regulations were made by His Excellency the Governor in Executive Council but these were never strictly enforced and the disease followed untrammelled its own course and spread throughout the whole island.

From April 16th. 1902, when the first case was discovered to December 31st. 1902 there were only 60 cases reported. The extremely slow and insidious

spread of the epidemic was one of the circumstances which led the profession to persist in the error of diagnosis. The negro race is known to be especially susceptible to the contagion of smallpox and when their conditions of life in crowded barrack yards and their ignorance of ordinary sanitation are considered, the slow advance of the disease is very remarkable. It was only in January that the disease began to assume epidemic form reaching its maximum height in May and then gradually declining until its entire disappearance in the town in November 1903, and in the country in January 1904. It must be borne in mind that although the native population is a fairly well vaccinated one owing to the rigidly enforced vaccination ordinance, there is a large influx of unvaccinated immigrants from neighbouring islands and Venezuela where apparently vaccination is not in great favour. For ten years ending in 1900 the average proportion of vaccination to births in Trinidad was 83.11%. In the year 1898 the corresponding proportion was 96.48%. Such a result is not probably equalled in any other part of the British dominions. Among the 564 cases which came under my observation in the isolation wards, only 118 were Trinidadians; the rest being aliens and of these 254 hailed from Barbados. (See Table 1). The protection afforded to the Colony against an epidemic of

smallpox will not be complete until provision is made for the successful vaccination of the large number of unvaccinated persons coming from the other colonies and the adjacent continent. Every immigrant should be required to exhibit proof of successful vaccination before being allowed to land in this country as is done in some states of America.

The slow spread of the epidemic was due to the slight infectivity of the disease. In many cases, the contagion or virus seemed to require intimate contact for its transmission from one person to another and even then it was remarkable how frequently instances were found in which such contacts escaped infection. The Assistant Medical Officer of Health in a pamphlet already referred to, mentions that in several instances in barrack yards persons in close association with these affected by the disease did not contract it and subsequently reacted to vaccination. Such a case came under my own observation. A large number of patients were admitted to the general wards of the Colonial Hospital in the incubation or invasion period and were removed to the Isolation Hospital only a day or sometimes two days after the appearance of the rash and yet no fresh infection took place in these wards. Two cases which developed the disease in the House of Refuge were transferred to the Isolation Hospital in the

vesicular stage and none of the other inmates contracted the disease. Four cases sent to the Male and Female Prisons in the incubation period, were removed to the smallpox wards only after the rash had appeared and yet there was no spread of the disease in these institutions, although there was no disinfection of any of these buildings. It was frequently observed that children born of mothers in the invasion period or early eruption stage of the disease escaped infection when they were removed from the mother within two or three days after birth, but when left until pustulation or desquamation had commenced they invariably contracted the disease. The isolation wards were only ninety nine feet from two of the nearest general wards of the Colonial Hospital and only one case in each of these wards developed the disease; one was thirty days and the other sixty five days in Hospital before the initial symptoms of smallpox showed themselves. It may be remarked that there were at this period more than a hundred smallpox patients in all stages of the disease under treatment in the isolation wards. From these observations it may be inferred that the infectivity of the disease was slight, that the most active period of infection was during pustulation and desquamation, and also that aerial convection which is held by some recent observers to play an important part in the

dissemination of smallpox was apparently no factor in the diffusion of this epidemic.

The mode of spread of the disease to the country districts was also very interesting. It was only in January that the disease occurred in two districts, — Tacarigua and Blanchisseuse — which are widely separated from each other. The cases were derived from Port-of-Spain and occurred on the 8th January in the one and on the 24th of January in the other. The next cases in these districts occurred on the 12th and 5th February respectively and no further cases appeared until April 3rd and May 1st. The first case which occurred in Blanchisseuse was that of a man who arrived on January 21st from Port-of-Spain where he had associated with persons suffering from the disease. Three days after his arrival he developed the initial symptoms of the disease.

In March several other districts became infected; the diffusion of the contagion to the country districts in March is readily accounted for by the fact that there is always a large influx of country visitors to the town to witness the annual "Carnival" which is held at this period of the year.

The first case which was admitted to the Isolation Hospital was that of a woman who was received into one of the general wards of the Colonial Hospital with an infant thirty five days old on November 22nd 1902. On

December 4th she developed the prodromal symptoms of smallpox and was then transferred to an isolated room with her infant. I afterwards discovered that this patient had come from a house where there were several cases of "eruptive fever". Her child developed the disease on December 21st 1902, that is, seventeen days after the mother had shown symptoms of smallpox. On January 4th 1903 it was found necessary on account of the number of cases seeking admission to Hospital, to provide further accommodation. Accordingly a ward containing sixteen beds was opened on that day but at the end of February it had become so overcrowded that another with twenty two beds was provided on February 28th. On March 1st, forty two patients were under treatment. Owing to the rapid spread of the epidemic during this month both wards soon became overcrowded. On March 19th there were no less than sixty six cases in Hospital so that only the urgent cases were admitted. On March 27th the number had risen to eighty six. A third ward with seventy five beds was then opened but in a very short time this increased accommodation was barely adequate, for on April 2nd there were no less than one hundred and three cases under treatment. In May a gradual decrease in the number of cases seeking admission began to take place and this continued until October. The last patient was discharged on the 19th of

that month.

This eruptive fever, as already mentioned, was at its onset officially declared to be chickenpox but this diagnosis was revised and altered in the month of March 1903 by the same authorities and the disease became known as "Varioloid Varicella", a name which it bore to the end of the epidemic.

These diagnoses were accepted without demur by almost all the medical men in the island.

Early in 1903, disquieting rumours and conflicting views on the subject of the "Trinidad Eruptive Fever" determined the Government of Barbados to send Dr. Bridger, the medical officer in charge of their Small-pox Hospital, as a special commissioner to investigate and report upon it.

He arrived in Port-of-Spain on February 2nd and furnished the Government of Trinidad before his departure on March 8th, with a report in which he declared the disease to be smallpox of a very mild type. Two days after the receipt of this communication, a meeting of the Medical Board of the island was convened at the special request of His Excellency the Governor for an expression of opinion upon it. Thirty four members attended the meeting; the report was read and after a full discussion on the subject the following resolution was passed with only three dissentients.

"That no such disease as mild smallpox exists in epidemic form, and that the eruptive fever now prevailing in Trinidad is not smallpox," Such then was the almost unanimous view of the medical profession in Trinidad in regard to the epidemic at that period. The difference of opinion between the Barbados Commissioner and the Trinidad medical practitioners gave rise to a bitter controversy; the columns of the press of both islands became the channel of much abuse and recrimination. Severe comments were made in some of the British Medical journals which reflected little credit on the diagnostic acumen of the West Indian Medical practitioners and much ridicule was levelled at the profession.

In justification or rather in extenuation of ^{the} doubt and hesitancy which existed in the minds of the profession here in regard to the nature of the epidemic, it may be stated that anomalous and atypical forms of eruptive fevers specially in reference to smallpox have, at all times, presented similar difficulties of diagnosis, even to experienced observers, causing in many instances much diversity of opinion. Further on, I shall refer to two epidemics of a peculiar form of smallpox popularly known as "swinepox" and "pearlpox" respectively which occurred in Jenner's time. We find in the proceedings of the Epidemiological Society of London

a paper entitled "Varioloid Varicella" in Jamaica which was read by Dr Izett Anderson before that Society in 1867. He describes under that name an eruptive fever which occurred in epidemic form in Jamaica in 1863. He states that in some cases the eruption was apparently that of simple Varicella whilst in others the "inexperienced" would have pronounced it to be that of "Variola". The disease attacked young and old, the vaccinated as well as the unvaccinated and even one or two persons who had had smallpox in 1852, that is, eleven years previously. There was no constitutional disturbance in the majority of the cases and no necessity to confine the patients to bed. Some malaise and feverishness but no continued fever of any intensity preceded the rash, the fever existed for two days and papules appeared on the third day usually first on the face in the severer cases and within twenty four to forty eight hours became vesicles with sometimes a depression in their centre. The vesicles were then transformed into pustules. The full development of the eruption was attained on the fifth or sixth day of the disease and desquamation followed. Macules and pitting resulted sometimes. The Pharynx was occasionally affected and in one or two instances the conjunctivae. Secondary fever or anything approaching to it was almost always absent. In the mild cases the vesicles aborted. The epidemic lasted

four or five months and was apparently unattended by any mortality. The disease originated in a Penitentiary and no source of infection from outside could be traced, a fortnight after the appearance of the first case a Boy's Reformatory three miles away from the Penitentiary with which there was daily communication became infected and forty of the inmates contracted the disease. About a fortnight after the first case appeared in the Boy's Reformatory the disease broke out in the Girls Reformatory which was half a mile apart and thirty of the inmates were attacked. The disease apparently did not spread to any extent among the general public although there was communication between the infected institutions and the outside world. It would appear that the disease was not invariably regarded as Varioloid Varicella for in a memorandum Dr Bowerbank of Kingston writes in 1863 "we are at present suffering from a severe influenza and also from a most peculiar epidemic of Varicella, I suppose. To me it looks much more like "Varioloid" or modified smallpox. Most of the vesicles suppurate and in some instances are distinctly umbilicated and are sometimes confluent. I never saw Varicella like this before." In connection with this epidemic in Jamaica it is interesting to note that a fatal form of smallpox which was introduced from Colon

followed in 1864.

It would be interesting to know whether those who were attacked by the previous epidemic were affected by this fatal form of the disease.

The eruptive fever described by Dr. Anderson certainly bears very close resemblance to that which broke out here but it appears to have been milder in type.

Again more recently in the Lancet of October 22nd 1898, Drs. Thomson and Brownlee record their observations on an infectious disorder in Lascars, having close relations with smallpox and chickenpox. This infectious disorder appeared to resemble both of these diseases in certain respects and yet to possess symptoms alien to both. After careful consideration the diagnoses of smallpox and chickenpox were excluded and the disease was regarded by these observers as a specific entity.

I do not share with these observers the opinion that the Glasgow epidemic was identical in nature with that which was reported by Dr Anderson. The differences between it and the Trinidad Eruptive fever are even more marked.

In a pamphlet reprinted from the journal of the American Medical Association, August 3rd, 1901, Dr. Heman Spalding, Chief Medical Inspector, Department of Health, Chicago, discusses the diagnosis of a mild

and irregular form of smallpox which broke out in the United States in 1899. The following extract from this paper indicates the difference of opinion which existed in various parts of the United States in regard to the nature of that outbreak. "From March 9th 1899 to June 1901, three hundred and ten cases of smallpox have been found in Chicago, sixty four of these in various stages of the disease were imported into the city from nineteen of the surrounding states and the cases came as far East as New York and as far West as California. In the meantime I visited three of the neighbouring states where the diagnosis of this disease variously called "Impetigo Contagiosa" "Giant Chickenpox" "Cuban Itch" or some other indefinite name, was in dispute. With this opportunity of observing cases from such wide-spread and various sources, I think, it is fair to assume that the disease we call smallpox in Chicago, is the same disease which has been the subject of controversy in all parts of the United States".

In the British Medical Journal of May 11th, 1901, Dr. Montizambert, Director General of Public Health Department, Ottawa, speaks of a mild type of smallpox which was undoubtedly of the same nature as that referred to by Dr. Spalding and probably similar to that which broke out in Trinidad. In this article which is entitled "Notes on a mild type of Smallpox, (Variola

Ambulans)", the author writes "The Dominion of Canada is now being threatened with and in some cases, invaded by smallpox from her neighbour, the United States. It began on this continent several years ago in the United States, the southern states especially. It has gradually spread northwards. Its origin is difficult to establish either as to time or place with any historical accuracy. It has been attributed by many to soldiers returning from Cuba or from the Phillipines. But it is certain that it was prevalent in the United States before the beginning of the war between that country and Spain. The difficulty in tracing back its history is due in great part to the unusual mildness of the type. Many cases were diagnosed as chickenpox many as German measles. In many of the lumber camps, it went by the name of "Cedar Itch"

In the Lancet of July 4th, 1903, page 65, a reference is made to an "outbreak of chickenpox in Cambridge" which appeared to have caused some doubt and uncertainty in the minds of the Health Authorities. Owing to the severity of the cases, smallpox was at first considered as a possible diagnosis but the main features of the disease seemed to be incompatible with those of smallpox and the alternative diagnosis of chickenpox was made, but as the epidemic increased in severity expert advice was sought and Dr. Wanklyn, the

referee to the Metropolitan Asylum Board, who was invited to examine the cases, reported the disease to be undoubtedly modified smallpox. From these few examples it will be seen that sometimes irregular forms of smallpox present great difficulty of recognition and create doubt even in the minds of the experienced. The strictures, therefore, which were passed by those who were not confronted by this atypical variety of smallpox were unmerited and unjustified. The nature of the Trinidad epidemic was apparently similar to that described by Drs. Spalding and Montizambert. The disease probably originated in the southern states of North America and travelled northwards to Canada and southwards to South America whence it was imported to this island as already pointed out.

The main difficulties which presented themselves in the diagnosis of the disease in Trinidad will best be appreciated when the features and peculiarities of the epidemic have been considered.

THE DISEASE.

Definition:- A communicable febrile disease characterised by definite periods of incubation, invasion and eruption; the last passing through successive stages of papule, vesicle, pustule and crust.

Influences of (1) age, (2) sex, (3) race, (4) season.

(1). Age: (see appendix, Table 11)

The youngest attacked was two weeks old whilst the oldest was eighty nine years of age. Adults were far more frequently attacked than children, 56.20 % of my cases occurred in adults between the ages of twenty and thirty four years whilst only 12.23 % occurred amongst children under fourteen years of age . This is exactly what one would expect in an epidemic of smallpox occurring in a vaccinated community such as exists in Trinidad, where a vaccination ordinance which is strictly enforced requires the successful vaccination of all infants before the age of three months. Again, amongst adults, more were affected during the quinquennial twenty- twenty-four, than during any other and amongst twenty one children under five years of age, twelve were unvaccinated infants whose ages ranged from two weeks to four and a half months. (See Tables III and IV). These figures clearly indicate the rôle which vaccination played in connection with the disease. Even the foetus was sometimes attacked and the earliest period at which this occurred was four and a half months of intrauterine life. Four such cases came under my observation. Fifty one pregnant women were admitted to the Maternity Ward after recovery from the disease. Eleven aborted and nine were delivered prematurely. In the aborted cases, eight of the foetuses showed distinct evidence of an attack of the

disease; and of the prematurely born, four showed external manifestations of it, including a case of twins. All those who were attacked were born in the eruptive stage of the disease except one which presented the characteristic macules on the body and a deep scar on the left cheek. The history of the twin case referred to above is interesting. The mother developed the initial symptoms of smallpox on March 23rd. and the rash appeared on the face on March 26th. Three days before the onset of the invasion period she was vaccinated and both vaccinia and variola ran their course concurrently; the vaccine vesicles were typical and the attack of smallpox was moderately severe. On April 17th. when she was in the desquamating stage of the disease she was delivered prematurely at the seventh month of twins. Both foetuses showed the eruption of smallpox - white macerated vesicles - sparsely scattered on the scalp, face, and trunk and limbs including the palms and soles. ^{Photo. 1.} There was one large placental mass which was partially implanted in the lower uterine segment. Each foetus was enclosed in a separate bag of membranes. The first foetus was stillborn and the second died a few minutes after birth. In this case the foetuses were apparently infected simultaneously or almost simultaneously with the mother. In the other cases there was no correspondence as regards

date of disease in mother and child, although allowances were made for the peculiar conditions which affect the evolutions of the rash in the foetus. The disease was much more advanced in the mother than in the foetus. It would appear therefore that either the incubation period of the foetus is longer than that in the adult or that the foetus becomes infected after the disease has reached the eruptive stage in the mother. The liability of the foetus to the disease seemed to decrease directly with its age.

The remaining thirty one pregnant cases were delivered at the term and of these one gave birth to a child who showed evidences of having passed through a complete attack of the disease. In this case the mother contracted the disease in May 1903 and was delivered in the following July of a healthy female child with nine macules sparsely scattered on the left cheek, right lower eyelid, right arm, both forearms and the buttocks. (Photo 2). A similar case came under my observation outside of the hospital. In this case the mother developed the initial symptoms of the disease on July 29th, 1903, and was admitted to the Isolation Hospital on August 6th. She was discharged well on September 5th, and on the 21st, of the same month gave birth to a full term infant with twenty seven macules scattered on the face, trunk and extremities and one

mark with a depressed centre on the right cheek. The macules on the extremities were smaller than those on the face and trunk. In no instance was the eruption copious in the foetal cases, though the majority of the mothers were severely attacked. It was also noticed that the face was not more affected than any other part of the body; this observation supports the theory that light influences the distribution of the rash in the adult. In the cases where the foetus showed evidences of an attack of the disease in utero, we must assume the passage of the germs into the foetal circulation. This would seem to require a breach of continuity in the walls of the maternal vessels in the placenta, if this organ acts normally as a barrier to microbes. The disease in the mother may undoubtedly produce a pathological change in this organ.

Toxins and Antitoxins on the other hand probably pass along with the nutrient matters by osmosis. Recent investigations on the subject would seem to show that the placenta has a selective power and is something more than a mechanical or a biological filter. In that case the existence of a placental lesion may not be necessary to explain the passage of the micro-organism of smallpox and the transmission of its toxins may take place in a more complicated way than by

osmosis.

The proportion of cases of foetal infections which came under my observation in this epidemic appears to be unusually high but the fact that in smallpox of ordinary severity the mortality amongst pregnant women is high, and abortions or premature labours occur more frequently, and before the external signs of the disease in the foetus declare themselves, explains this difference.

(2). SEX. (see Table 11)

Amongst my cases more males were affected than females in the proportion of three hundred and fifty two to two hundred and twelve, and the number of attacks was greater absolutely among males than females at all ages except in the quinquenniad, ten-fourteen, the numbers being fifteen and nineteen respectively.

(3). RACE. (see Table V)

The blacks were almost exclusively attacked; very few among the white section of the community suffered from the disease. This fact is in conformity with the observation that the negro race has a peculiar susceptibility to smallpox, but in this epidemic the case mortality was, contrary to all experience, exceedingly low among this class. A very significant fact was the immunity enjoyed by the East Indian population. This is to be attributed not to racial influence but

rather to the protection afforded by efficient vaccination and revaccination; the "coolies" as they are called here are particularly well vaccinated. Their vaccination marks are numerous and large. There was only one East Indian amongst the five hundred and sixty four cases that came under my care. The estimated population of Trinidad is 280,000, and that of the East Indian section of the community is 90,000. One of the most populous suburbs of Port-of-Spain is peopled mainly by East Indians not one of whom contracted the disease although many cases occurred among the blacks living in their midst. It is certainly not the sanitary conditions under which these people live that can account for this remarkable immunity, for their habits are primitive in all matters concerning public hygiene. This consideration, however, may be of little moment for it is a fairly well established fact that while general cleanliness and purity of water and food are useful against all diseases, the prevalence and spread of smallpox is not affected by hygienic conditions as some of the other infectious diseases are, though naturally overcrowding favours its propagation.

(4). SEASON.

There are two distinct seasons in Trinidad, the wet and dry. Approximately the dry season extends from

January to May and the wet from May to December; there is usually a spell of dry weather in September or October which lasts two or three weeks and is commonly known as the "Indian Summer".

The disease made its appearance in April 1902 and showed no tendency to spread during the rainy season: it was only in January, that is, the commencement of the dry season that it began to assume epidemic form and continued to increase until it reached its maximum height in May when the onset of the rains checked it.

It then gradually declined until it finally disappeared in the town in November 1903 and in the country districts in January 1904. The seasonal prevalence of smallpox in the tropics had long ago been observed. As far back as the middle of the eighteenth century, Holwell, in speaking of the ravages of smallpox in Bengal thus refers to the periodicity of the disease and the influence of the seasons on it.

"Every seventh year with scarcely any exception, the smallpox occurred in these provinces during the months of March, April and May and sometimes until the annual returning rains about the middle of June put a stop to its fury". (Table VIII.)

INCUBATION:-

The determination of the duration of this period was surrounded with some difficulty on account of the un-

reliability of the patients who for the most part were ignorant and also on account of other unavoidable sources of error; it may however be stated with a fair amount of accuracy that this period lasted ten to fourteen days as is borne out by the following cases which afforded a decided opportunity for judging of the precise time of incubation.

CASE I:—E.S. nursed a case of the disease in the isolation ward for two days, viz:—December 24th and 25th, 1902; ten days after, fever and general pains lasting three days developed. On January 7th, 1903 a rash appeared on the face. Probable incubation period ten to twelve days.

CASE II:—M.P. came to Port-of-Spain from Arima, a borough sixteen miles from Port-of-Spain on February 23rd, 1903, and stayed in a home in which there were two cases of the disease. She returned to the country on February 26th and developed fever and general pains on March 8th, a rash appeared on March 10th, 1903. Probable incubation period ten to thirteen days.

CASE III:—N.W. admitted with a suspicious rash to the eruptive fever ward on February 3rd, was discharged on February 7th on disappearance of this rash. He developed the disease on February 17th. Probable incubation period ten to fourteen days.

CASE IV:—T.W. arrived from a neighbouring island

which was free of the disease, on February 21st, and stayed in Port-of-Spain with a Venezuelan who was in the pustular stage of the disease until February 23rd, when he went to a country district which was not yet infected, and ten days after he developed the initial symptoms of smallpox; the rash appeared on March 8th, Probable incubation period ten to twelve days.

CASE V. :- B. M. an unvaccinated infant three months old spent a day or part of a day on February 19th. in a house where there were several cases of the disease and ten days after, the child developed the disease. Incubation period ten days.

CASE VI. :- E. B. nursed the smallpox cases in the Isolation Ward on April 2nd, 3rd, and 4th, 1903 and developed fever and general pains on April 14th. A rash appeared on April 18th.

Incubation period ten to twelve days.

CASE VII. :- Infant of A. S. born on April 23rd, 1903 developed the disease on May 6th; the rash appeared on May 8th. The mother of this infant was in the vesiculo-pustular stage of the disease when she was delivered. The infant was removed to another ward on the day of its birth. Incubation period thirteen days.

CASE VIII. :- Infant of B. S. born on April 23rd, when the mother was six days ill with the pox. On the day of delivery the mother was admitted to the Isolation

Ward and the child was left at home. On May 7th, it developed the disease. Incubation period fourteen days.

The history of the following cases does not afford the same definite data as the above for determining the precise incubation period, but they are of sufficient interest and value to be recorded here.

CASE I. :- Male infant of E. S. born on March 10th, when the mother was in the invasion period of the disease, became feverish and restless on March 26th. and the rash appeared on March 29th. Probable incubation period not longer than sixteen days.

CASE II. :- J. B. left Port-of-Spain on board R.M.S. "Trent" on March 16th, 1903, returned on March 27th, and developed fever and general pains on March 28th, the rash appeared on March 30th. During the voyage the ship had no communication with any infected port. Incubation period not shorter than twelve days.

CASE III. :- E. R. born on March 13th, 1903, developed the disease on March 23rd, and three days after, the rash appeared on the face. The father of this child was in the pustular stage of the disease when it was born and occupied the same room.

Incubation period not longer than ten days.

CASE IV. :- J. M. was admitted to the Isolation Ward on February 7th, 1903, with a rash which proved to be measles; he was discharged on February 16th, and devel-

oped the initial sumptoms of smallpox on February 22nd.
 the characteristic rash appeared on February 25th.
 Incubation period six to fifteen days.

Case V.:— Child of C. M. born on February 9th, 1903
 developed the disease on February 26th; when it was
 born the mother was in the invasion period of the
 disease. Incubation not longer than seventeen days.

CASE VI.:— Child of E. T. developed the disease on
 December 21st, 1903 whilst it was in an isolated room
 with the mother in whom the rash had appeared on Decem-
 ber 7th, after fever for three days.

Incubation period not longer than seventeen days.

CASE VII. Child of M. L. born on April 4th, 1903 when
 the mother was in the invasion period of the disease;
 developed the symptoms of smallpox on April 27th.

The child was in the Isolation Ward with its mother
 and other cases in all stages of the disease from the
 day of its birth until it developed the disease.

Incubation period not longer than twelve days.

In cases V & VI the incubation period of seventeen
 days is probably beyond the mark, as these children
 were born of mothers in the invasion stage of the
 disease and at this stage the disease did not seem to
 be very infectious as I shall point out later on.

INVASION.

This period was hardly ever ushered in by rigors.

Headache, backache, fever and occasional vomiting or nausea appeared without any warning. Constipation was almost invariably the rule in adults, and giddiness was often complained of. This stage lasted from one to seven days but in the majority of the cases it was of three days duration.

1. Headache. This was not a constant symptom and was not confined to any particular part of the head; it was usually general and its intensity varied very much.

2. Backache. This symptom was rarely absent. Sometimes it was very slight but in most of the cases it was severe and in a few instances it was described as being very violent. In pregnant women it was frequently mistaken for labour pains so that many of the cases were admitted to the maternity ward where the nature of their complaint became at once apparent.

3. Fever. The fever developed usually without any preliminary chill, at least its presence was almost invariably denied; in children it was often ushered in by convulsions. The usual conditions associated with pyrexia were present, viz:- general malaise, anorexia, thirst, furred tongue, quick pulse and disturbed sleep.

The temperature rose rapidly and within twelve to twenty four hours of the commencement of initial symptoms it was at its maximum height, reaching from

102° to 105° F. even in the abortive cases; (See Temperature charts 1 - 9). The fever persisted with slight morning remissions as a rule during this period. Previous vaccination did not seem to influence the temperature at this stage. (See Temperature charts 1 - 4 .). On the appearance of the rash it fell suddenly to normal or subnormal in the mild or abortive cases. (See Temperature charts 1 - 6); in the severe discrete and confluent forms defervescence was gradual but in the latter the temperature seldom dropped to normal. (See Temperature charts 7 -18).

4. Vomiting. This was not a constant symptom but it was observed in a large number of cases and was of short duration; in some instances it was however very distressing and persistent, causing much exhaustion. In four of my cases it ceased only when the eruptive stage was already far advanced.

5. Nausea. This occurred in a fair proportion of the cases.

6. Constipation was almost invariably the rule in adults whilst in children the opposite condition often obtained.

7. Vertigo. This was frequently complained of; most patients in this stage reeled from side to side whenever they attempted to assume the erect posture.

8. Violent pulsation of the carotids was often observed

at this period.

There was no relation between the intensity of the initial symptoms and the severity of the disease nor was there any relation between the duration of this period and the abundance of the rash. Indeed, a severe invasion period was sometimes followed by a very sparse and insignificant eruption. Similarly, a long invasion period sometimes ended in a very mild attack. In infants, the initial symptoms were as a rule so mild that the disease was often recognised only in the eruptive stage.

INITIAL RASHES:- No preliminary rashes occurred as far as I could ascertain in any of the cases that came under my care in the isolation ward. In one case a rubroleid erythematous rash appeared on the front of the thorax of a boy during the desiccation period of the disease; it was at first very faint, then deepened in hue and gradually faded away leaving no marks behind.

ERUPTIVE PERIOD:- On the appearance of the rash all the initial symptoms of the disease subsided more or less according to the abundance of the eruption. The sense of entire relief was experienced on the first day of the eruption in the abortive and most of the mild cases but in the severe discrete this took place somewhat later, whilst in the confluent variety owing to the painful phenomena of the eruption on the

mucous membranes and of suppuration, it hardly occurred at all. The same remarks held good as regards the temperature. In the abortive and mild cases the fever subsided at once to normal or subnormal on the appearance of the rash; (see Temperature charts 1-6); in the severe discrete form this was generally accomplished only after twenty four to seventy two hours so that there was a short intermission before the onset of the secondary fever; (see Temperature charts 7-13); in the confluent cases although defervescence took place it did not co-incide with the beginning of the eruption; it was slow and the temperature rarely fell to normal consequently there was only a remission which was of short duration owing to the early commencement of the secondary fever. (See Temperature charts 15-18). In some of the severe discrete cases there was no intermission but only a remission of temperature, (see Temperature chart 14), whilst in some confluent cases there was an intermission between the primary and the secondary fever. The one form merged into the other.

Generally on the fourth morning of the disease small papules appear^{ed} on the forehead and face, then on the back of the hands and about the wrists; the eruption gradually extended to the arm, trunk and lower extremities.

The rash on the face was often shotty and usually a day in advance of that on the trunk and two or three days in advance of that on the thighs, whilst the legs and feet became affected at a still later period. During the first two or three days especially in the severe discrete and confluent cases fresh papules kept appearing, even on those parts which were more or less thickly covered. This probably accounts for the slow and gradual fall of temperature. These secondary papules as a rule remained small and shrivelled up rapidly, especially in the vaccinated.

In the great majority of instances the rash first appeared on the face; the next most common site being the dorsum of the hands, a fact which I observed in 9.2% of my cases. Of eleven cases in which the rash first appeared on sites other than the face or hands, the back, forearms, thighs and buttocks each furnished two instances and the scrotum, penis and feet, one each.

The papules gradually enlarged and became hard and resistant to pressure and in about twenty four to thirty six hours they were transformed into vesicles, this change was observed to take place sometimes even earlier than this. The vesicles were multilocular and their contents were expressed only with great difficulty. Those on the trunk and limbs were sometimes umbilicated in the severer cases. (Photo 3, 5 and 91).

The vesicles increased in size until about the sixth day of the disease when they became surrounded by an inflammatory areola which appeared red or black according as the colour of the patient's skin was white or black. The contents of the vesicles began to become turbid and the central depression to disappear at about this time. Vesicles of unequal sizes were not unfrequently seen side by side on the same parts. On the seventh to eighth day of the disease the vesicles on the face were fully converted into pustules and this transformation gradually extended to those on the trunk and limbs. In abortive cases whether occurring in vaccinated or unvaccinated persons, the papules shrivelled up before reaching the vesicular stage and in the instances where the papules had become vesicles, desiccation took place soon after, before pustulation had occurred. The disease ran a similar course in a few of the mild discrete cases.

The rash was generally very abundant on the face, back of hands and forearms, dorsum of feet, buttocks and thighs. Frequently the back was thickly peppered. (Photos ^{9b} 5, and 19b) The front of the thorax and abdomen even in the severe cases were often remarkably free from eruption, (Photos 6, 7, 8, 10-12); the palms of the hands and the soles of the feet were invariably affected even in the mild cases. (Photos 1, 4, 9, 10, 14,

4,9,15, 19.) In a large proportion, the scalp, ears, scrotum, penis and vulva were invaded especially in the confluent and severe discrete varieties. The mucous membrane of the lips, palate, fauces, uvula, pharynx, conjunctivae, nostrils and meatus urinarius were not unfrequently implicated in the severe cases and occasionally in the mild discrete ones. Special symptoms depended on the mucous membrane affected. Thus sore-throat was often complained of. The vesicles on the mucous membrane were smaller and they matured earlier than those on the cutaneous surface; they were white in appearance; in one case where they were confluent on the palate a dirty membrane was formed simulating that of diphtheria. Again, these vesicles did not maturate and scab as on the outer skin from being constantly kept moist by the secretion of these surfaces; for the same reason the eruption on the foetus at birth presented a similar appearance. The presence of the eruption on irritated surfaces was well illustrated in the case of an old man who had worn a truss for many years. The eruption followed closely the part that had been chafed by the truss and formed a girdle round the waist. Where ringworm was coexistent with the "pox" the vesicles formed a distinct chain along the margin of the patches. (Photo 56). In the case of ulcers, the same ring-like arrangement was observed and in all

these situations the vesicles were larger and more advanced in development than those on other parts of the body. There was a distinct shotty "feel" of the papules especially on the forehead in many cases. The resisting power of the vesicles and pustules showed that they were invested with more than the mere cuticle of the skin; moreover, pitting, which resulted in a fair proportion of the cases indicated the depth of the lesion. The bullous or pemphigoid character of the eruption on the limbs more especially on the forearms and legs, was remarkable and was observed in the confluent cases and in a few of the severe discrete variety. (Photo 6.) This closely resembled the blebs of scalds or superficial burns. The contents of these bullae were dark, watery and very offensive and the temperature was septic in character. These cases may be called "Variola pemphigoides" from the character of the eruption. I may here remark that the odor emitted from the cases generally was very slight except in those referred to above. The fully developed pustules were more or less of the same size in all the cases but there was always a variation according to the part affected in each case. The pustules on the face were invariably smaller than those on the trunk and those on the trunk smaller than those on the limbs. The largest pustules were situated on the back of the

hands and the dorsum of the feet; these were generally about five millimetres in diameter when fully matured. (Photos 5-10, 13.) In a few instances the pustules were remarkably large everywhere. In the confluent form the rash on the face was small and fine whilst large bullae were invariably present on the limbs.

MATURATION:- This process could hardly be said to occur in all the cases, even in what seemed to be severe attacks of the disease; it began in the vesicles which had appeared first, that is, on the face, on or about the 6th day of the disease and gradually extended to those on the trunk and limbs in the order of their appearance. The areola which had begun to form around the vesicles on about the sixth day became more extensive and inflamed on the trunk and limbs; umbilication when present began to disappear and the pustules became hemispherical and unilocular, especially on the limbs on about the tenth to twelfth day. (Photo 5-10.)

On pricking them their walls collapsed and the fluid which escaped was in some cases even at this late stage clear but on pressure upon them this clear fluid was followed by seropurulent exudation and some solid debris. The face was generally puffy at the commencement of the maturation period especially about the eyelids and lips in the severe cases; (Photos 6-9, 10, 11.)

The facial oedema increased as the lesions matured, only subsiding when scabbing commenced.

On about the twelfth to the fourteenth day the feet and legs sometimes became oedematous and less frequently the hands and forearms. (Photo //). These swellings always caused considerable pain and discomfort and so caused insomnia. Secondary fever was absent in the abortive attacks and also sometimes in the mild discrete cases and when present in these its intensity and duration varied very much. (see Temperature charts 19--36). As a rule there was little constitutional disturbance at this period of the disease. In the severe discrete and confluent varieties however, the secondary fever was generally severe, but its severity was not commensurate with the abundance of the lesions. In a few instances, however, the secondary fever was very severe and prolonged. (see Temperature charts 7-18, 37--43). It began with the process of maturation and its duration and severity depended more or less upon the abundance of the pustules; it lasted five or six days, but was not as high as that of the primary fever. The morning remissions were well marked. At this period of the disease in the severe cases all the painful and distressing symptoms of the prodromal stage returned and to them were added pain all over the body due to the tumefaction of the skin

especially on the face, hands and feet and discomfort in the throat and other mucous membranes where the vesicles appeared. Even in these cases there was, generally speaking, little depression and the constitutional symptoms were mild in comparison with the abundance of the rash. In most of the cases the patients were able to walk about and appeared cheerful. The only inconvenience experienced by them was the pain caused by pressure on the pocks in the sole of the feet whilst walking. In a few cases however there was great prostration usually associated with fever of a septic nature. (see Temperature charts 44-51) Secondary fever in smallpox is generally attributed to the absorption of pus into the system from the foci of suppuration in the skin during the maturation of the pocks. If this were the sole cause of the fever, it would have been more severe and fatal, considering the extensive area of cutaneous surface involved in many of the cases that came under my care. In some instances there was hardly any healthy skin left and yet the temperature did not rise beyond 102 degrees Fahr. It is also noteworthy that "cutaneous asphyxia" did not ensue in these severe cases.

Another theory regarding the cause of maturation fever assigns the pyrexia to the absorption into the blood, of the decomposed discharge from the pustules;

if this were so, one would expect the fever to be more or less within control but in spite of great cleanliness and the frequent use of antiseptic baths the temperature was not checked; moreover, secondary fever begins before the rupture of the pustules and terminates before they are dry. There seems therefore to be some other agency at work to produce the rise of temperature at this period. It may be that a specific variolous poison is evolved in the pustules and becomes absorbed into the general circulation causing this so-called maturation fever. In this way could be better explained the comparative mildness of the fever in this epidemic even in the severe cases, on the presumption that the poison was less virulent than that which is produced in the pustules of smallpox of the ordinary type.

DESICCATION:-This process began early on the face, usually on about the eight or ninth day of the disease; the pustules burst and the exudation from them caked and formed moist yellow crusts. As scabbing commenced the oedema of the face began to subside. In only two cases did the pustules on the face dry up without first bursting. When the crusts dried up and the scabs fell off on about the eleventh or twelfth day, the solid bases of the pocks remained as warty elevations on the face. (Photo 14). Little by little

these small pink excrescences, which were probably due to the persistent tumefaction of the papillary layer of the skin, disappeared by absorption and in about two weeks were replaced by macules on a level with the skin, varying in hue but usually pink in the centre and dark at the periphery. In many cases further absorption took place until actual pitting occurred. (Photos 15, - 18 , 19). This peculiar condition, so-called wartpox, was characteristic of this epidemic and was almost invariably present even in the mild cases. It was confined to the face. In only three instances did I observe similar excrescences on the exteursor surface of the forearms and once on the legs. Pitting occurred in one or two cases after the shedding of the scabs, notably in a recurrent case without the process of absorption referred to above taking place.

About twenty four or thirty six hours after the commencement of the desiccation of the pustules on the face, the same process occurred on the trunk and arms and then on the forearms and thighs and later on on the legs. Those on the dorsum of the hands and feet were very resistant owing to the thickened epidermis on these parts. After the rupture of the pustules on the trunk and limbs and the escape of their contents small crater-like depressions were left at the bottom

of these poeks. (Potos 7, 8, 11). Occasionally, the pustules on the trunk and limbs dried up without rupturing and formed brownish circular crusts which on falling off left a pink pale base which gradually became lighter in colour and eventually faded away. The pustules on the palms and soles never ruptured spontaneously. Their contents became inspissated and were absorbed; the superimposed epidermis was shed later on.

As the pustules began to burst, the areola around them faded away. The face was the first part to clear up. The same order of succession was maintained in the desiccation of the eruption as that in which it originally appeared. Desiccation was rapid on the face, trunk and upper part of the limbs, but very slow on the forearms, hands, legs and feet even in the mild cases. After the scabs had fallen off the trunk and limbs, circular macules were left on a level with the skin, having a dark, pigmented periphery encircling a light coloured or pinkish centre. (Photo 15-17) These marks persisted for a considerable time and then gradually disappeared after several months. During desiccation itching was often a distressing symptom. The duration of this stage varied very much as it was dependent more or less on the severity of the attack, but in many of the mild cases the process was long and tedious on the hands and feet.

CONVALESCENCE :- Was short and rapid in the mild cases whilst in the severe discrete and confluent forms, especially when complications arose, it was sometimes much prolonged. In the majority of the cases, convalescence was uninterrupted. Hardly any emaciation resulted except in a few instances. The patients usually developed a voracious appetite as soon as scabbing commenced on the face.

The average duration of the disease in the five hundred and sixty four cases I had charge of, was 28.43 days but this is however below the mark for unfortunately at the beginning of the epidemic many cases were discharged before they could be considered "cured" owing to the want of accommodation. The shortest case lasted seven days and this occurred in three instances where vaccination performed during the incubation period of the disease caused its abortion. The longest case remained eighty three days in hospital, but its detention for such a long period was due to complications and sequelae.

TREATMENT :- This resolved itself mainly into scrupulous cleanliness and judicious diet.

In the initial stage of the disease calomel followed by a saline purge or castor oil was administered; a diaphoretic mixture was then given until the rash appeared.

During the eruptive stage, carbolic acid or Fowler's Solution was tried in several cases at first, but as no real benefit seemed to accrue from the use of these drugs, they were discontinued. Arsenic which has been lauded in the treatment of smallpox by some writers proved positively harmful in some of my cases, as it caused much intestinal irritation which was difficult to allay. Internal medication was abandoned during the eruptive and desiccation stages except in special cases where the use of digitalis, ether, strychnine and other drugs was indicated. Cinchona proved very beneficial in the desquamation stage especially where malaria was a complication. Mild preparations of iron gave good results in the anaemic cases. Opiates relieved pain and irritation and induced sleep when most of the other hypnotics failed.

EXTERNAL APPLICATIONS :- Tepid antiseptic baths especially Condy's fluid properly diluted, were used from the first in almost every case much to the comfort and relief of the patients. These baths were continued until desquamation was quite complete. Boric or Zinc ointment and Carbolised vaseline or coconut oil were largely employed, but the application of Guaiacol in olive or coconut oil (one in eighty) gave the best results; it relieved itching promptly and appeared to hasten the desiccation of the pustules. This drug had

been recommended by Dr. J.J.Ridge in the British Medical Journal of May 30th, 1903.

In complications the remedies used were simply those for the disorders occurring in uncomplicated states. The wards were well ventilated and although there was at times some overcrowding the death rate did not seem to be affected thereby, as it invariably is in the case of smallpox of a virulent type.

DIET :- During the invasion and early eruptive stage of the disease there was, as in all febrile disorders, anorexia and only liquid nourishment could be taken. As soon as the eruption had fully appeared the appetite was restored and a liberal diet was allowed. At the onset of the secondary fever the appetite was again impaired necessitating a return to low diet but as scabbing commenced on the face the patient clamoured for food. In the abortive and mild cases where there was no secondary fever, the appetite was impaired only during the invasion period. Stimulants were given in the few instances where its use was indicated; alcohol proved very beneficial in the old and debilitated.

COMPLICATIONS :- Occurred in all stages of the disease and were in some instances of a grave character.

A. In the invasion or early eruptive stage:

1. Respiratory system:-

(a). Dyspnoea occurred in five cases; in one of them

it was accompanied with much pain in the chest; this condition was very distressing while it lasted but in every case except one where there was haemorrhage into the lungs, it subsided on the appearance of the rash. In the other cases I was unable to detect any pulmonary or cardiac lesion to account for it.

(b). Haemoptysis took place in the haemorrhagic case referred to above, which was the only one of this type that occurred during the epidemic.

2. Nervous system:--

(a). Delirium was observed in five cases, in two of which the disease ran a mild course, whilst in the other three cases the attack was severe and in two of these motor aphasia was also present. Delirium was more marked at night than during the day; it disappeared altogether as the eruptive stage was reached; in one case however it lasted ten days.

(b). Convulsions occurred in three female adults, two of whom had undoubtedly a hysterical tendency whilst the third was an epileptic. In children it usually ushered in the initial symptoms of the disease and was often attributed at first to worms or dentition. This condition was of short duration and was never an alarming symptom at this stage.

(c). Aphasia which sometimes occurs in acute disease and is generally considered to be due to the toxins

engendered by the specific bacilli operating upon the cells of the cerebral cortex concerned in the production of articulate speech, occurred in two cases, in both of which there was also delirium during the invasion and early eruptive stage. Both patients after the cessation of delirium were able to understand spoken, written and mimic speech and to translate their thoughts in writing but the power of articulation was lost, showing that the aphasia was purely motor. Although some improvement took place during convalescence, the defect of speech was still marked even after their discharge from hospital, one, forty eight, and the other, forty three days after admission.

3. Alimentary system:-

(a) Diarrhoea developed in only four cases and was not a serious accompaniment at this early stage except in the case of an infant who was already in a debilitated state.

(b). Melaena and haematemesis occurred in the haemorrhagic case to which I have already referred.

4. Urinary system:-

(a) Albuminuria was present in 18.08% of my cases in the stage of invasion and varied in amount and duration; it vanished in the majority of the cases as soon as the rash appeared and the temperature had fallen; sometimes it persisted for a considerable

period, disappearing in some instances only at the end of six weeks from the commencement of the disease. In twenty four cases albuminuria occurred in persons suffering from chronic Bright's disease, a very common malady in this colony, probably due to malarial infection; in these, the albuminuria, of course, persisted after all the symptoms of variola had disappeared, altogether.

(b). Haematuria occurred in the haemorrhagic case.

5. Reproductive system:-

(a). The catamenia frequently appeared in this stage of the disease; in many instances it came on prematurely but sometimes its appearance at this stage was a mere coincidence. The period was often longer and the flow more copious and bloody than normally.

B. In the pustular and desiccation stages:-

1. Respiratory system:-

Apart from a few mild cases of Bronchitis and one of Catarrhal Pneumonia, this system was remarkably free from complications.

2. Nervous system:-

(a). Low muttering delirium occurred sometimes in the old and debilitated and usually signalled a fatal termination of the attack.

(b). Paralysis of the bladder was met in one case at the end of the desiccating stage.

(c). Peripheral neuritis was occasionally observed in this stage but this condition was more in the nature of a sequela than that of a complication.

3. Alimentary system:-

(a). Diarrhoea occurred in twenty two cases at this late stage, two adults succumbed to it; in children it was a frequent complication but no deaths resulted from it.

(b). Salivation was observed in only one case; it began in the eruptive stage and persisted during the maturation of the pocks; there was not much enlargement or tenderness of the salivary glands nor was there any eruption in the mouth. I may mention that no medicine containing mercury in any form had been administered to this patient.

(c). Vomiting which occurred in only one case at this period was very persistent and difficult to check.

4. Urinary system:- Pyuria occurred in one case.

5. Integumentary system:-

(a). Boils or small abscesses were by far the most frequent of all the complications; they occurred in forty six per cent of the cases and developed during desquamation usually in the axilla, on the back, thighs and buttocks and kept on appearing for a considerable time in some cases. They varied in size from that of a pea to a walnut, and caused little constitutional

disturbance. In one case forty two small abscesses formed on the back of the patient.

(b). Carbuncles occurred in two cases and produced severe general symptoms and also much exhaustion.

(c). Gangrene of the toes followed in a very anaemic and pregnant woman.

(d). Skin eruptions appeared in many instances at this stage especially ecthyma, acne, pustulosa, rupia and pustular scabies.

6. Reproductive system:-

(a). Orchitis occurred in thirteen cases and was accompanied by effusion into the sac of the tunica vaginalis in six instances: the fluid was always turbid. Both testicles were affected in one case and in another an abscess formed.

(b) Ovaritis was diagnosed in two instances.

7. Circulatory system:-

No complication could be assigned to this system except a case of phlebitis of the brachial vein.

8. Locomotory system:-

Synovitis of the knee and ankle joints occurred in a few cases but the effusion was never purulent and it was rapidly absorbed.

9. Lymphatic system:-

Enlargement of the inguinal glands and more rarely those in the neighbourhood of the elbow was observed

sometimes; the pain was usually of short duration but the swelling persistent for a long time.

10. Organs of Sense.

1. Eye:-

(a). Conjunctivitis was a rather frequent complication especially in the maturation stage.

(b). Keratitis was also present in some of the severer cases and was sometimes very rapid in its work of destruction.

(c). Panophthalmitis of the eye occurred in three patients; in one of them both eyes were destroyed.

11. Ear:-

(a). Otorrhoea was observed in two cases but yielded quickly to treatment.

(b). A mastoid abscess developed in one case.

OTHER COMPLICATIONS:-

Malarial fever which so often accompanies other disorders in the tropics was observed in a few of the cases. (see Temperature chart 52).

Typhoid fever was a complication in one case.

Sequelae:-

1. Respiratory system:-

(a). Acute Pulmonary tuberculosis developed in two cases soon after desquamation was complete and ran a very rapid course. This disease is common here and sometimes ends fatally in a remarkably short time.

2. Nervous system :-

(a). Peripheral Neuritis was not an uncommon sequela of the disease; it affected usually the ^{lower} extremities.

(b). Myelitis occurred in one case which is still in hospital.

(c). Insanity. A young woman who had just recovered from the disease developed acute mania..

3. Urinary system :-

(a). Chronic Nephritis appears to have developed in a woman during convalescence; she had smallpox when she was five or six months pregnant. Her urine was then free from albumen. It was again examined shortly before labour and found to be loaded with albumen; this persisted for three months after which time I lost sight of her. The persistent presence of albumen in the urine in this case points to some cause other than pregnancy; at any rate the albuminuria of pregnancy is as a rule temporary; it usually disappears after labour.

4. Integumentary system :-

(a). Pitting showed itself in a considerable number of the severe and in a few of the mild cases; it was confined to the face and affected especially the forehead, cheeks and nose. (Photos 15-19).

(b). Pigmentation. After the scabs had dropped off, macules were left with a pale pink centre and a dark pigmented periphery. These marks gradually faded away

and several months after recovery disappeared entirely.

(Photos 12, 21). 15. 16. 17. 19.c.)

(e). Alopecia. In two severe cases the hair dropped out completely leaving the scalp bare during convalescence; but two or three months after recovery it grew again. This condition was observed also in an infant; in this case it was only partial, the anterior portion only of the scalp being affected.

(d). Shedding of the nails. In several of the severe cases the toe nails were shed without any apparent sign of inflammation; this process was probably trophic in nature. The finger nails were less frequently affected and at a later period than the toe nails. Regeneration of these epidermic appendages followed in two or three months.

(e). Exfoliation of the skin of the hands and feet was observed in four very severe cases. The skin of these parts was cast off entire like a glove or a slipper.

Effect of the disease on pregnancy.

A. Cases admitted to the Isolation Ward :-

Thirty eight pregnant women were admitted to the Isolation Ward in the invasion or early eruption stage of the disease; twelve gave birth to, apparently full-term healthy children at this stage. In these cases the onset of labour may possibly have been precipitated

a few days by the initial fever or it may have been a mere coincidence in the regular course of pregnancy. Of the remaining twenty six women who had not completed the full term of gestation, two gave birth to premature infants and one aborted. The further history of twenty of the remaining twenty three, who were discharged well of the disease, was traced. Sixteen carried the foetus to term, three confined prematurely and one aborted. The age of the foetuses in the cases of interrupted gestation ranged from six to eight months and the date of delivery with reference to the disease in the mother was four to twelve weeks after the commencement of prodromal symptoms.

B. Cases admitted to the Maternity Ward :

Fifty one women who had had the disease during pregnancy and had recovered from it were admitted to the maternity under my care. Thirty one had reached the full period of gestation and were delivered of healthy children; one of the children showed evidence of having passed through the disease in utero; it exhibited the characteristic macules. (Photo 2). Of the remaining twenty women, eleven aborted and nine gave birth prematurely. It would appear that the disorder in the initial and early eruptive stage had little or no immediate effect upon pregnancy; it was usually four to twelve weeks after the mother had developed the prodromal symptoms

of the disease that gestation was interrupted in its course. This was due either to the death of the foetus caused by an attack of the disease in utero or to fatty degeneration of the placenta - a condition frequently observed in these cases. In the majority of instances, pregnancy ran a normal and an uninterrupted course. I may here remark that Potassium Chlorate was administered to a pregnant case as soon as desquamation began and was continued until delivery when a healthy child was born. The effect of the disease on the foetus has already been described.

Varieties :-

	.Vaccinated				Total	Unvac. ^d Total	Grand total
	one mark	two marks	three marks	four marks			
Abortive	6	6	3	5	20	21	41
Mild Discrete	21	30	4	3	58	258	316
Severe Discrete	14	6	1	2	23	165	188
Confluent	2	0	0	0	2	16	18
Haemor- rhagic	0	0	0	0	0	1	1
	43	42	8	10	103	461	564

The above table shows the large proportion of mild and abortive cases which occurred both in the vaccinated and unvaccinated. The proportion of mild to severe cases among those who were treated in their homes was even greater than is shown by this table for as a rule the worst cases were removed to Hospital.

These mild cases presented well marked irregularities not only in the initial symptoms but also in the evolution of the eruption.

The main irregularities in the symptoms were:

1. The occasional absence of headache or backache and in three instances of fever.
2. The almost entire absence of constitutional symptoms in many instances; these patients being able to pursue their daily labours without discomfort or inconvenience.
3. The complete absence of secondary fever or when present its extremely short duration as a rule lasting only a few hours.

Irregularities in the evolution of the eruption showed themselves in the abortive development of the rash; the papules often shrivelled up before being transformed into vesicles and even when the papules became vesicles these frequently desiccated without previous pustulation. These cases may be called "Variola Varicelloides".

On account of these peculiarities occurring in such a large proportion of the cases in the vaccinated as well as the unvaccinated, the epidemic may be considered the mildest which has yet been recorded. The anxiety and alarm usually apprehended in the more familiar form of the disease was conspicuously absent in the community during this epidemic.

Comparison of vaccinated and unvaccinated cases in respect to liability of attack (see Table page 65)

Vaccination had a decided influence upon the disease. Of the five hundred and sixty four cases that came under my care, one hundred and three occurred in vaccinated and four hundred and sixty one in unvaccinated persons. The patients' word as to the success of previous vaccination was not accepted without verification by careful examination of the scars. Among the vaccinated, the proportion attacked was in an inverse ratio to the number of vaccinia marks present. Thus forty three cases occurred amongst those who showed one cicatrix whilst there were only eight cases among those with three scars. The percentage of mild or abortive cases was greater in the vaccinated than in the unvaccinated and no confluent or haemorrhagic case was observed in the former class. All the deaths—thirteen in number—occurred in unvaccinated subjects. (see Table VI) . . . These facts indicate clearly the rôle played by vaccination in relation to the disease.

Observations on the incidence of the disease among the nursing staff afford a striking confirmation of the previously stated facts regarding its relation to vaccination. Thirty six nurses, eight wards-maids and three wards-men were employed in the Isolation Hospital in the course of the epidemic. (see Table VII)

Of the thirty six nurses, only three contracted the disease, and these three had never been vaccinated; Of the remaining thirty three, seven who were successfully vaccinated a week to four years previous to their joining the staff escaped the contagion; Of the remaining twenty six, fifteen were successfully revaccinated one week to four years previous to their attendance on the smallpox patients and did not "take" the disease. Of the remaining eleven five were revaccinated without success and were not attacked by the disease. Three of the remaining six were revaccinated after they had been ten, fifty two, seventy seven days, respectively, in the Isolation wards, but only one of these reacted to the operation. One nurse had been vaccinated three times without success, another was vaccinated at the age of twelve years successfully and suffered from an attack of smallpox the same week; in June 1903 she was revaccinated with negative result: another who had never been vaccinated contracted the disease before she joined the staff.

As regards the eight wards-maids, the only one who was never vaccinated took the disease; of the seven others, two were vaccinated, four revaccinated successfully shortly before their services were engaged and one was vaccinated in childhood and showed a very large cicatrix on the arm.

Of the three male attendants who showed doubtful vaccination marks, one was successfully revaccinated a few days after he was already in the ward; five days after this he developed the disease in an abortive form, vaccinia and variola running their course concurrently. Another was vaccinated three times with success and did not contract the disease whilst the third had already contracted the disease before he was taken on.

Reference has already been made to the immunity enjoyed by the East Indian population. The evidence, therefore, of the influence of vaccination upon the disease is strong and is in conformity with the experience of all observers.

Five cases of the disease deserve separate notice on account of the special features which each presented.

CASE 1. Haemorrhagic case:-

B.L. a well nourished and muscular negro, aet. 30 unvaccinated, began to complain of general malaise on June 8th. 1903, but was able to perform his usual work on that day; on the morning of the 9th he felt worse and took to bed; he then had fever and severe pain in the back; these symptoms with the addition of headache from the 10th continued unabated until the 12th when he noticed what he described as prickly heat (lichen tropicus) on the hands and feet. On the appearance of this rash the general symptoms subsided. On the 11th

his eyes had become very bloodshot; on the 13th he began to pass blood in his urine and to expectorate blood-stained sputum and on the evening of that day his motions were observed to be black and tarry.

He was admitted to the Isolation Hospital on the 14th at 4 p.m. in a very critical condition; his face was puffy and covered with an erythematous blush, but no distinct eruption could be detected. There was a purpuric rash on the trunk and limbs, which was rather abundant on the back of the hands and forearms and the dorsum of the feet and also on the back. The conjunctivae were injected and the lips swollen and bleeding.

On the palate was a pseudo-diphtheritic membrane. The tongue was coated with a thick dark fur. The sputum was bloodstained and dyspnoea urgent. The patient's mind was perfectly clear. His pulse was small and quick and his temperature at 5 p.m. 102 F. and at 8 p.m. 100.2 F.

He had no sleep during the night and experienced very great difficulty in swallowing even liquid nourishment owing to pain and soreness in the throat. The vesicles on the limbs were observed on the morning of the 15th to contain dark coloured blood. The temperature at 7 a.m. was 100.2 F. He expired at 9.45 a.m. and shortly before death vomited a large quantity of bright red blood.

Post Mortem notes of this case.

Post-mortem notes:

Well nourished, tall, muscular negro. Petechial rash on face, trunk and limbs. Petechiae contained blood of a dark colour. The blood generally was dark and fluid.

Lungs:- Both bases were congested, numerous hæmorrhages into the lung tissue: the right lung was bound down by old pleuritic adhesions.

Heart:- Slightly hypertrophied, valves healthy.

No hæmorrhages into its substance or into pericardial sac.

Liver congested. Hæmorrhages into its substance.

Weight 5 pounds, 9 ounces.

Spleen:- Very congested, not enlarged, capsule thickened, substance firm.

Kidneys:- Large; substance pale; in a state of fatty degeneration: hæmorrhages into the pelvis and calices.

Right kidney weighed nine ounces, left kidney ten and a half ounces.

Bladder:- Contained bloody urine but the mucous membrane was pale and normal in appearance.

Stomach:- Contained some blood-stained fluid; hæmorrhages into its mucous membrane.

Larynx:- Intensely congested; of a purplish hue: well marked vesicles on base of tongue containing blood.

CASE 11. Peculiar form of confluent smallpox:-

G. L. aged forty two years; unvaccinated; was admitted to the Isolation Ward on March 30th, 1903 with the history of having had fever, headache and backache followed by an eruption which appeared first on the face and hands and then spread over the body generally. The date of the first appearance of symptoms could not be ascertained with precision but judging from the eruption, the patient when first seen by me was probably in the sixth or seventh day of the disease.

Condition on admission:- A rather weak but fairly nourished woman with a very copious, vesicular eruption on the face, trunk and extremities. The face was covered with large flat vesicles having a dark central depression but ill-defined edges: there was no subcutaneous oedema, not even of the eyelids. The skin presented the appearance of coarse parchment. The vesicles on the trunk were more or less of the same character as those on the face but were larger and in parts bleb-like; those on the legs and dorsum of the feet and back of hands were still larger and more bullous. There were a few vesicles on the pharynx and palate. The tongue was coated with a yellow fur. The pulse was rapid and weak: temperature 99. 4° F. The urine contained a trace of albumen and bile. The feet and legs were swollen: the mind was eluded, and

the the patient was somewhat restless.

Progress of case:- Prostration increased and the mind became more confused; large bullae formed on the trunk and extremities; some of the vesicles on these parts resembled very much vaccine vesicles. Their contents were serous and bright yellow in colour; the skin generally became jaundiced. Extensive areas of epidermis exfoliated leaving raw surfaces on the chest and limbs such as occur in superficial burns. The skin on the buttocks sloughed away "en masse" and the patient succumbed on April 4th, 1903. (See Temperature chart 53)

P. M. Notes:-

Body fairly nourished and covered with a vesiculo-pustular eruption, large and flat, containing bright yellow seropurulent fluid. Large bullae everywhere, formed by the coalescence of adjoining pustules. The contents of these were for the most part serous and bright yellow in colour. The superficial layer of the skin was coming away from almost the entire surface of the body and in some situations especially the buttocks there were gangrenous ulcers. The feet were swollen.

Liver:- Large: very soft and fatty.

Spleen:- Slightly enlarged and soft.

Gall bladder:- Distended with thick, yellow bile.

Heart:- Flabby.

Kidneys:- Congested and fatty.

This was the only case of this kind which came under my observation.

CASE 111. Case of smallpox with secondary eruptions. V. W. Aged twenty three years, vaccinated in infancy; presented two good vaccinia scars on the arm, admitted on April 14th. to the Isolation Hospital with the history of having had fever on April 13th, followed by a rash on the face, neck and back on the morning of the 14th.

Condition on admission:- Fairly nourished young woman with a discrete papular rash on the face, neck, back and limbs. Tongue furred; temperature normal; urine free of albumen.

Progress of case:- During the following nine days fresh papules continued to appear; some of which developed into vesicles then shrivelled up whilst others dried up at once. Boils formed in the axilla. On May 14th, a month after admission, a peculiar scaly rash was observed all over the body but this disappeared very rapidly. The original papules on the face, neck, trunk and limbs were replaced by small wart-like excrescences. These varied in size from a pin's head to a small pea. Desquamation which followed the first crop of eruption continued and on June 4th, a fresh papular rash appeared on the face and was interspersed between the above described warty elevations; This

rash was very evanescent; within forty eight hours it had entirely disappeared leaving no trace behind. The wart-like excrescences were gradually absorbed; on June 12th, those on the face were no longer visible; those on the trunk and limbs persisted until June 20th, the skin then presented a smooth and normal appearance everywhere. This may possibly be a case similar to those to which Osler refers when he says "a remarkable secondary eruption (recurrent smallpox) occasionally occurs after desquamation". (Osler's Principles of Medicine, 3rd Edition, page 65). (see Temp. chart 54.)

CASE IV. A case of "Variola sine eruptione".

4. Y. Aged twenty seven years, vaccinated in infancy and showing five large cicatrices on the arm, was admitted to the Isolation Ward on July 23rd. but was removed from that ward next day as she was not suffering from smallpox. She refused revaccination and on August 1st. developed fever, headache and backache, which lasted three days but no rash appeared. On Aug. 3rd. she was delivered of a full term child; after the birth of the child she was revaccinated but did not "take"; the child was also vaccinated at the same time but the operation was unsuccessful although it was performed on three successive occasions. This may be a case similar to that recorded by Curshman and referred to in "Fagge's Principles and Practice of Medicine," thus

*Curshman tells of a woman who was seized with shivering, fever, headache and pain in the back, so that as Variola was epidemic at the time, she seemed without doubt to be passing through the initial stage but on the fourth day defervescence occurred, no rash could be detected and by the tenth day she felt practically well; however she gave birth to an infant which was covered with the eruption of smallpox. "(Fagge's Principles and Practice of Medicine 2nd. edit. Vol. I. p. 320).

In the case of A. Y. the initial symptoms of smallpox occurred nine to ten days after exposure to infection in a ward more or less crowded with smallpox patients in all stages of the disease. She exhibited the symptoms of the invasion period of smallpox and gave birth to an infant which although showing no external manifestations of the disease proved insusceptible to vaccinia; the mother was also refractory to revaccination.

CASE V. A case of recurrent smallpox:-

E. W. Aged eleven years, unvaccinated; was admitted to the Isolation Hospital on August 6th. with the history of having had fever on August 2nd. followed on the 3rd. by an eruption on the hands then on face, trunk and limbs. She stated that she had had an attack of the "prevailing eruptive fever" in April 1903, that is four months previous to this.

Condition on admission:- A well nourished girl with numerous macules on the face, trunk and extremities similar to those observed in the cases which had recovered from the prevailing disease. There was also a fresh sparse eruption on the face, back, chest, abdomen and upper limbs including the palm of the hands; the lower extremities were only slightly affected. The eruption was already drying up and on removal of the scabs which were thick and about four millimetres in diameter, an ulcerated base was exposed to view; on the back a ring of desiccating pustules had formed along the margin of a patch of ringworm. The eruption in this case aborted, only the papules around the edges of the ringworm patch reached the pustular stage. The brown, circular crusts which had formed on the face left "pits" when they dropped off. Convalescence was short and the patient was practically well on August 26th. Before leaving hospital she was vaccinated without success. (see Temperature chart 55.).

Post mortem Notes of ten cases:-

Naked eye appearances:-

1. L. K. Aged fifty years, unvaccinated, died on twelfth day of the disease.

Heart:- Muscular wall softened.

Lungs:- Healthy.

Liver:- Healthy.

Spleen:- Slightly enlarged; soft, substance studded with small infarcts.

Kidneys:- Swollen; capsule stripped off easily. Cortex enlarged and hyperaemic.

2. J. A. Aged sixteen years; unvaccinated; died on ninth day of the disease.

Heart:- Normal.

Lungs:- Congested.

Liver:- Large; soft; congested.

Spleen:- Slightly enlarged; congested but firm.

Kidneys:- Large and hyperaemic.

Intestines:- Peyers patches swollen and mucous membrane of small intestines injected.

This case was complicated with Typhoid fever.

3. T. P. Aged thirty years; unvaccinated: died on eighteenth day of the disease.

Heart:- Flabby.

Lungs:- Congested at bases.

Liver:- Slightly enlarged and fatty.

Spleen:- Large but substance firm.

Kidneys:- Large, capsule slightly adherent. Cortex slightly enlarged and congested.

4. E. A. Aged forty years, unvaccinated; died on twenty third day of the disease.

Heart:- Flabby.

Lungs:- Healthy.

Liver:- Large, pale, fatty.

Spleen:- Large, congested, soft.

Kidneys:- Slightly enlarged and congested.

5. K. E. Aged seventy five years, unvaccinated, died on eighteenth day of the disease.

Heart:- Flabby.

Lungs:- Congested at bases.

Liver:- Soft, "spongy" and of a peculiar brick red colour.

Spleen:- Large, very soft, almost diffluent,

Kidneys:- Small, tough, capsule adherent, surface very granular, cortex very small.

6. P. C. Aged fifty years, unvaccinated, died on the eleventh day of the disease.

Heart:- Normal.

Lungs:- Normal.

Liver:- Enormously enlarged but firm.

Spleen:- Enlarged, very soft, substance very dark.

Kidneys:- Small, tough, granular, capsule adherent.

7. J. G. Aged thirty three years, unvaccinated, died on eighteenth day of the disease.

Heart:- Flabby.

Lungs:- Congested.

Liver:- Congested.

Spleen:- Enlarged, soft, substance dark.

Kidneys:- Congested.

8. J. L. Aged thirty five years; unvaccinated, died on seventh day of the disease.

Heart:- Mitral valves thickened (condition of long-standing).

Lungs:- Congested and bound down by old adhesions

Liver:- Large, congested and fatty.

Spleen:- Large:and soft.

Kidneys:- Healthy

9. B. L. Already described. (page 69)

10. G. L. Already described (page 72)

ATTACKS ON THE RECENTLY VACCINATED:-

In their standard work on the theory and practice of hygiene, Drs, Netter and Horrich remark that "much valuable evidence has been collected of late years in regard to the duration of the protection which vaccination gives against smallpox. This evidence indicates that although the susceptibility to the operation of vaccination returns comparatively soon after primary vaccination, the susceptibility to smallpox returns but slowly, so slowly in fact, that the power of infantile vaccination against attack by smallpox may be said to remain at least to one half of its original extent at twenty years of age!" It is interesting therefore, to note that among the first {four thousand and nine} cases which were reported, the Assistant Medical Officer of Health had observed the

disease in twenty eight recently vaccinated and revaccinated persons; four cases had occurred within one year of vaccination; eight within three years and four within four years and eleven from four to eight years. I also observed the disease in a young married woman, aged eighteen years who had been vaccinated four weeks previously and who showed three good recent vaccinia scars; in this instance the initial symptoms were severe but the rash was sparse although every part of the body including the mucous membrane of the pharynx and tongue was affected; the disease ran a rapid course; most of the vesicles shrivelled up whilst a few became pustular. The next most recently vaccinated case which contracted the disease amongst those that were treated by me was a man who had been vaccinated four years before and who presented four good vaccinia cicatrizes on his arm.

All experience goes to show that the duration of the protection afforded by vaccination is limited and is directly proportionate to the number and size of the vesicles produced but it is very remarkable that this protection was so fleeting and transient as the above cases indicate. I do not think this unusual occurrence can be explained away by assuming that the vaccine lymph was not efficacious or that the diagnosis of smallpox was faulty, for the vaccinia marks were

unmistakable and the course of the disease typical of varioloid; at any rate in the case that came under my observation. Might the local manifestations of vaccinia have been produced in these instances without the absorption into the system of the immunising substance which is supposed to be evolved in the growing vesicles? The fact that the disease was modified, at least in my case, is a proof that a certain degree of immunity was conferred. Does the duration of immunity depend upon the nature of the lymph, the individual or both? It is true that at certain seasons of the year, during the hot months, vaccine lymph suffers deterioration but then such lymph would be inert and would produce no reaction. For the last seven or eight years glycerinated calf lymph has been used in this colony; previous to this, vaccination was practised from arm to arm. The lymph which we now employ here is obtained from the Jenner Institute for Calf Lymph and is kept in refrigerators until required for use. A fresh supply is received every fortnight but the results are not always satisfactory. It would appear that the duration of the immunity afforded by vaccination depends to some extent on the potency of the lymph employed. Voight of Hamburg in 1881 succeeded in inoculating a calf with human smallpox lymph and after twenty removes in calves, used the lymph in 1882 as a vaccine on children.

In 1893 when the time came round for revaccination of the same children, the failures were more numerous than with children vaccinated in 1882 with ordinary lymph, showing greater potency of the Hamburg lymph. (Edwards). The strain of lymph therefore determines the duration of immunity. In my experience human lymph gives a greater reaction than calf lymph; the former often succeeds where the latter has failed. The vesicles are larger and the resulting scar better marked and more persistent in those vaccinated with human lymph than in those vaccinated with calf lymph; it would appear therefore, that the former is more potent than the latter. This may partly account for the occurrence of the disease in some of the recently vaccinated in whom glycerinated calf lymph was used. Idiosyncrasy or exceptional individual susceptibility to the contagion of the disease was probably also a factor in determining this condition.

SECOND ATTACKS:- The possibility of second attacks was recognised as far back as the tenth century by Rhazes, "The Arabian Galen", and his experience has been confirmed by many observers up to the present day.

Dr. Edwards in his admirable and instructive book on "smallpox and vaccination", asks the question "Can the same person have smallpox twice within an interval of some years between the attacks" and answers it

in the affirmative. He adds, however, that such cases-fully established-are very rare and that the frequency of such second attacks in former times is suspicious, because measles and various kinds of false smallpox were mistaken for variola. The following extract is taken from his book.

"Dr. Kubler, a high modern authority on the subject (of second attacks) says that the once survival of smallpox afforded perhaps no perfect protection but a strong resistance against a fresh attack."

"The German vaccination commission of 1884 debated well this point. Dr Koch said that second attacks were certainly rare; in the great epidemic of 1871-2 in 12,000 cases in South Germany, no second attacks occurred. Dr. Reisner pointed out that in old times, all second attacks appear to have occurred in children, never in adults; this pointed to error in diagnosis. Dr. Grossheim, who represented the army, had only met with one peculiar case out of 22,641 in military hospitals; a man had a light form of variola three months after the first attack. Von Kerchensteiner (for Bavaria) had never heard of an early second attack, but he believed in the occurrence of second attacks and he himself had seen a third attack. Prof Hebra of Vienna had treated the patient in the first two attacks; he died in the third. Dr. Kruger had seen one certain second

attack in 500 cases of smallpox observed by himself.

Dr Thierfelder had never heard or seen a second attack. Dr. Von Koch had met with two in Stuttgart, both fatal, in each case the second attack was many years after the first, "a long interval of time".

Dr. Siegel stated that Wunderlich found twenty two second attacks in 1727 cases in Leipzig in 1781, six were fatal and one of these six patients had had smallpox already in the same epidemic.

Dr. Froidberg cited by Letz, reported an extraordinary case from near Breslau, during the severe epidemic of 1871-2. A child had smallpox and the attack left several cicatrices; the child was vaccinated successfully some months afterwards and then contracted smallpox a second time one month after the vaccine crusts had fallen and the second attack was fatal."

Trousseau in his book on clinical medicine tells of a medical student who was three times attacked by smallpox and mentions the fact that Diemerbraeck had seen several persons attacked three times within the short space of three months; he also alludes to the death of Louis XV of France from confluent smallpox fifty years after the first attack which occurred when that monarch was fourteen years of age.

Dr. Savill (Warrington epidemic, 1892-3) reports a woman, aged thirty years, vaccinated in infancy,

successfully revaccinated in 1873, that is at the age of ten years, contracted smallpox about probably the same time and yet twenty years afterwards had a severe attack of confluent smallpox (April 1893) which resulted in her face being badly pitted.

In the Lancet, August 1st, 1903, Dr. Pierce records a case of recurrent Varioloid rash following vaccination; he states that a boy aged fifteen years whose primary vaccination took place at ten years of age and was said to have been normal, was revaccinated on December 5th, 1901 successfully; on December 24th, that is, nineteen days after revaccination, smallpox showed itself, being ushered in by febrile excitement with increase of temperature, etc. The eruption developed fully and followed the normal course; the general symptoms were mild. On March 6th, 1902 he developed three or four vesicles of large size about the upper lips and also of nose, which were taken for Herpes; the main part of the eruption appeared on the 7th. A diagnosis of modified smallpox was made. In this, three experienced medical men concurred. He further says that from the data available it was probable that the two attacks, whatever their nature, were identical. Even allowing that the attacks were dissimilar in character, one being e.g. Varioloid and one a manifestation of vaccineinia, the explanation of the attacks in view of the

almost equal immunity against recurrence mutually exhibited by the two infections would be none the less difficult.

In Clifford Allbutt's system of Medicine (volume 11, page 578) reference is made to this subject by Dr.

J.D. Acland in his exhaustive article on vaccinia.

"Great variations" he says "may be met with in susceptibility to vaccinia as well as to smallpox, or any of the acute exanthems. It is commonly recognised that one attack of smallpox renders the individual more or less immune against contracting the disease again, and similarly that one successful vaccination protects, at any rate for a time, against the probability of a second successful inoculation. But it would seem that in some persons, one attack is no safeguard against a second. This is well illustrated by a case that came under the notice of Dr C. Allbutt, in which a woman had smallpox three times, and was also three times successfully vaccinated. Such a case seems to set at defiance all laws deduced from ordinary observation, and may be regarded as the exception which proves the rule."

It is generally recognised therefore, that second attacks are very unusual and their occurrence within a short period of a first attack is remarkably rare.

It is interesting to note therefore, that from April

1902 to May 1903, when 4029 cases of the disease had been reported the Assistant Medical Officer of Health was able to record twelve cases of second attacks occurring, one to seven months after complete recovery from the first attack and running a course identical with that of the primary infection. Two such cases came under my observation. One was treated by me in the second attack in the Isolation Hospital and the other was seen by me in company with her medical attendant at her own house. Both cases presented unmistakable evidence of a recent (primary) attack; they showed characteristic macules which were scattered over the face, trunk and limbs including the palm of the hands and the sole of the feet. Furthermore the account given by the patients themselves was in accord with the facts observed by myself. In both instances the second attack ran a mild course; the prodromal symptoms were slight and the eruption desiccated rapidly. In one case marked pitting of the face resulted after the second attack. This comparative frequency of reinfection in this epidemic was another of the many peculiarities of the "Trinidad Epidemic". I have already pointed out some facts to show that the duration of immunity from Vaccinia depends in some degree upon the potency of the vaccine lymph used. It is reasonable, I think, to infer that severe types of small-

pox afford greater protection against recurrences than mild forms of the disease. Individual susceptibility is undoubtedly an important factor in the determination of this condition.

It is not likely that faulty diagnoses were made. The identity of the attacks in the same epidemic could hardly have been mistaken, especially as great care was exercised in the examination of these cases so as to exclude any possibility of error, knowing the rarity of such a condition under normal circumstances.

I may here mention, however, that five cases were sent to the Isolation Hospital which proved not to be cases of smallpox. Two were cases of ordinary acne, one of malarial fever accompanied with sudamina and two of syphilitic rashes. (Pustular syphilidærm). The last two are of some interest and demand special notice.

N.S. Aged twenty one years, vaccinated successfully in January 1903, and showing four large vaccinia scars on the flexor surface of the left forearm, was admitted to the Isolation Hospital on April 9th, 1903, with the history of having had fever and sore throat for three days beginning on April 5th, and the appearance of a rash on the face on the second day of illness.

Condition on admission:- A fairly well nourished man with a measly rash on the face, trunk and limbs; eyes injected, throat congested, small ulcer with dirty

greyish base and angry margin situated on left side of uvula. Tongue furred. Temperature normal.

Progress of case:- The rash which was at first papular became vesicular here and there on the chest and pustular on the thighs. The size of the lesions did not increase even when the vesicular or pustular stage was reached. The ulcer in the throat rapidly grew larger and involved almost the whole of the uvula. For a long time the measly appearance of the rash was retained and then it became scaly everywhere except on the chest and thighs. Under large doses of Pot. Iodide and Mercury, the rash disappeared and the ulcer healed. The patient also developed keratitis but this yielded to persistent antisyphilitic treatment. General aches and pains were often complained of but there was no itching in the course of the disease. Fever in this case began on April 12th and continued with *irregular* remissions until April 24th. I was able to trace the past history of this patient and found out that he had been admitted on February 28th to the syphilitic ward of the General Hospital "with a single indurated ulcer on the under surface of the glans penis"; a well marked cicatrix was left to tell the tale. This case when first sent to the Isolation Hospital was pointed out by those who held the view that the "prevailing eruptive fever" was not smallpox, as a proof of the correct-

ness of their opinion. This man was unsuccessfully vaccinated by me during his stay in hospital. (see Temperature chart 56).

A. F. Aged twenty one years, vaccinated at the age of seven years; showed three good stigmata on the arm; was admitted on July 3rd to the Isolation Hospital with the history of having had fever and slight headache on the preceding two days and the appearance of a rash on the hands and feet on July 2nd.

Condition on admission :- Well nourished man with papular rash on the back, chest and limbs. Face quite free of eruption. Some of the papules were drying up and others were capped with a tiny drop of pus. He had a chancre on the glans penis.

Progress of case :- The papules never increased in size nor did they vesiculate; several acquired pustular summits; most of them became scaly and were very persistent. The patient suffered from fever until August 4th; he developed iritis of the right eye on July 21st which yielded to antisyphilitic drugs. The rash disappeared entirely at the end of August. This case was successfully vaccinated by me on July 21st. (see Temperature chart 57).

The history, the presence or remains of chancre, the existence of pyrexia throughout, the character of the eruption which did not develop into the large full

pustules which are characteristic of Variola, the want of uniformity in the size of the lesions and their polymorphic character, the slow course of the eruption, the presence of general pains and the absence of itching, all marked out these two cases from the "prevailing eruptive fever!"

RESULTS OF VACCINATION performed during desquamation or soon after recovery from the disease.

Owing to the uncertainty which existed in the mind of the profession in regard to the nature of the epidemic, every conceivable means was adopted to arrive at a correct diagnosis and I thought some light might be thrown on the subject by applying the vaccination test to a certain number of cases. Accordingly I undertook a series of experiments with this object in view. The results which I obtained confirmed the opinion which I had already entertained of the variolous nature of the disease. I performed two hundred and four primary vaccinations among adults and children who were in the desquamation stage of the disease, or who had practically recovered from it. Of these thirteen did not return for inspection, Of the one hundred and ninety one cases that were inspected, one hundred and thirty three failed to react; fifty four reacted slightly to the operation and four seemed to be fairly successful. The "slight reaction" referred to above

consisted in the delayed appearance at the site of inoculation of small red excrecences without any areola,, resembling tiny, mulberry growths which dried up without further development. There was no vesiculation.

In those in whom the reaction appeared "fairly successful" the vesicles were late in appearing and were ill-developed; there was an absence in these cases of the inflammatory zone around the vesicles and also a lack of general symptoms. On pricking these abortive vesicles a little viscid serum followed by blood exuded from them; on drying up a thin scab was formed which on falling off left a small red excrecence, which gradually became absorbed until no trace of it was left behind. These vesicles therefore differed from the normal vaccinia vesicles in size, contents, evolution & involution. Among the one hundred and ninety one cases, four were vaccinated twice and three cases thrice with negative results. I also revaccinated during convalescence from the disease twenty five cases which exhibited distinct evidence of previous vaccination. Sixteen of these gave no reaction whatever; four reacted slightly, abortive vesicles of the same character as already described being produced and one gave a normal reaction. The others were not available for further observation. The case which gave a typical reaction was that of a child, Romana Herrera, aged thirteen years in whom

the local manifestations were normal and attended with some constitutional disturbance. The child contracted the disease on June 15th and was vaccinated successfully on the 27th of the same month when she was practically well owing to the mildness of the attack. This child had been vaccinated in infancy and showed three good vaccination marks on the arm. Besides these two hundred and twenty nine cases, one patient was vaccinated in the invasion period and another in the early vesicular stage of the disease, and both gave a very slight reaction which was much delayed. Four cases were vaccinated in the papular stage two of which gave negative results, one reacted slightly and the last exhibited an abortive vesicle. Thus two hundred and thirty five vaccinations were performed at various periods of the disease; the large majority of them being done during desquamation with practically only one successful reaction. The vaccinations were performed in twenty nine different series and in fourteen of these "controls" were used which consisted of forty eight adults eleven of whom had never been vaccinated before. All the primary vaccinations were successful amongst the "controls" both as regards local and general manifestations whilst there were twelve failures amongst the revaccinated. These experiments demonstrated clearly the variolous nature of the

disease and the possibility of vaccinia running a normal course even after a recent attack of smallpox. It may be argued that the case of Romana Herrera was not of variolous nature but I have not the shadow of a doubt in my own mind that this child passed through a mild attack of the disease.

I have not been able to obtain much information on the subject of vaccination after smallpox. Indeed it would seem from an article in the British Medical Journal, January 31st, 1903, page 265, that observations on this subject are scanty and vague. The following extract is taken from that paper.

"The influence of a previous attack of smallpox on the success or failure of a subsequent vaccination is a question which has engaged the attention of several authorities. Beginning at the fountain-head. Jenner himself, in his third publication - A continuation of Facts and Observations relative to the Variola-Vaccinae or Cowpox, writes as follows :- Although the susceptibility of the virus of Cowpox is for the most part lost in those who have had the Smallpox, yet in some constitutions it is only partially destroyed and in others it does not appear to be in the least diminished. By far the greater number on whom trials were made, resisted it entirely, yet I found some on whose arms the pustule from inoculation was formed completely

but without producing the common efflorescent blush around it, or any constitutional illness whilst others have had the disease in the most perfect manner. From the figures in a Table in Dr. Seaton's Handbook on Vaccination, it appears that something like one third of the adults who had suffered from smallpox were susceptible to the local results of vaccination in a perfect manner. In this Table it is interesting to note that among the soldiers in the British Army, not recruits, the proportion of perfect success was four hundred and fifty one per thousand, while among recruits the corresponding proportion was only three hundred and forty five. The difference suggests the element of time. The likelihood is that the interval between attack of smallpox and subsequent vaccination was shorter on the average in the recruits than in the soldiers, the former being younger men. These statistics do not state the actual interval between the attack of smallpox and successful subsequent vaccination". The writer of the article referred to above, states that whatever may be said about exceptional susceptibility of individuals, this general conclusion is quite safely deducible from various recorded facts viz: that local reaction of the skin either to inoculated vaccinia or inoculated variola does not in any way prove that the individual is susceptible to attack

by smallpox in the ordinary way. The system may be protected though the skin can still be used for the cultivation of the virus; this principle applies both to smallpox inoculation and to vaccination. In the epidemic under review, the large proportion of recurrences goes to prove that even after an attack of smallpox the individual may yet be left in some rare instances, susceptible to reinfection and in the case of Romana Herrera it also shows that after an attack of smallpox, the individual may, though rarely, be left susceptible to vaccinia.

In the Lancet of October 22nd, 1898, Drs. Brownlee and Thomson in an article already referred to, write as follows on the relation of vaccination and antecedent smallpox to an infectious disease which closely resembled chickenpox and smallpox. "A certain amount of weight was given in the decision to the fact that three of the patients had already passed through an attack of severe smallpox; two of them comparatively recently. The smallpox in at least two of the cases, was unmodified. Four of the patients were revaccinated successfully during the crusting stage while the others had been revaccinated with success from two to four weeks before the first appearance of symptoms. It may be supposed that comparatively little value should be attached to this point but successful vaccination of

smallpox convalescents as well as the occurrence of smallpox so soon after successful revaccination is entirely contrary to the experience of smallpox in Glasgow. An examination into the question among the cases treated in Hospital during the last five years shows that fifty two smallpox patients were vaccinated at various periods during the stage of eruption and convalescence, some twice or even thrice, but in no single instance was any reaction manifested except in some cases a slight redness of the skin such as might occur in the neighbourhood of any superficial wound".

Reference has already been made to the case reported by Dr. Pierce in the British Medical Journal and also to the remarks of Dr. Acland in Clifford Allbutt's System of Medicine on the subject.

The conclusion deducible from my own observations is that in rare instances vaccinia or variola may occur in a person recently attacked by smallpox and run a normal course. This subject is surrounded with difficulties seeing that we have to deal with factors so variable as the human body and the variolous disease and also with vaccination performed so very differently as regards degree of efficiency.

Several cases were vaccinated in the incubation period of the disease when they appeared to be in perfect health; the results were very interesting and

showed the influence of vaccination in modifying the course of the disease when performed within a certain period after exposure to the contagion. I have a record of nine cases. Three who were vaccinated in the morning developed the initial symptoms of smallpox in the evening of the same day and both vaccinia and variola ran their course concurrently without the one or the other being modified. (Photo 4). One case was vaccinated two days before the onset of prodromal symptoms and both diseases ran a normal course. In four cases the invasion symptoms of smallpox appeared at an interval of four to eight days after vaccination and in all these vaccinia ran a typical course but the variolous attack was modified. In one instance there was an interval of eleven days between the vaccination and the onset of initial symptoms of smallpox and yet the latter disease was modified.

A case which at first sight appeared to be one of generalised vaccinia came under my care in the course of my observations; J. J. aged five months was seen by me on October 10th; he had two small ulcers on the left arm evidently following vaccination which the mother stated had been performed at least three weeks before in St. Vincent. The child arrived in Trinidad on October 4th and on the next day he developed fever which was followed on Oct. 6th by a rash which was first ob-

served around the two ulcers on the arm. When the child came under my care there were several small ulcers around the two referred to above and a few papules of varied sizes on the forearms, right arm, chest and abdomen. The papules became transformed into vesicles which on rupturing discharged a clear, serous fluid and subsequently ulcers were formed and these continued to exude serous fluid for some time and then became covered with yellow crusts. I inoculated a healthy infant with lymph obtained from the vesicles on the thigh of this child on October 13th; the result at the site of insertion was an abortive vesicle which rapidly dried up leaving no trace behind. No general symptoms were present during its evolution and no areola around the vesicle. On November 11th I revaccinated the same infant with glycerinated calf lymph and two typical vaccine vesicles developed, accompanied by the usual constitutional reaction. This showed beyond doubt that the eruption in the first child was not a genuine "Vaccinide".

VACCINATION of children born of variolous mothers:

(a). Children born of mothers in the invasion or very early eruptive stage:

Two children born of mothers in the invasion stage of the disease were vaccinated soon after birth and both "took" well; I observed that children born of mothers

in this stage of the disease when exposed to the contagion contracted the disease. I saw six such cases (b). Children born of mothers in the late stage of the disease, during desquamation or convalescence:-

Thirty six children born of mothers at this stage of the disease were vaccinated within a few days of their birth, two of these showed external manifestations of having passed through an attack in utero.

Of the thirty six cases, twenty five failed to react to the operation, that is, 69.45%, and eleven "took", that is, 30.55%. Two of the eleven successful cases did not exhibit quite typical vaccine vesicles. Of the twenty five unsuccessful cases, eleven were revaccinated, four unsuccessfully. I vaccinated five of the remaining seven for the third time and obtained a successful reaction in two cases. I again vaccinated one of the three unsuccessful cases for the fourth time with success.

All the children were vaccinated in groups of four or five and in every series I used controls. There were in all 72 controls; five adults and sixty seven infants of the same age as the above cases. Sixty controls were successfully vaccinated, that is, 83.34%, and twelve were unsuccessful, that is 16.66%. I revaccinated nine of the twelve unsuccessful cases and obtained a typical reaction in five. I again vaccinated the four refrac-

tory cases and two of them reacted to the operation normally.

I observed that children born of variolous mothers at this late stage of the disease were not attacked though exposed to the contagion. It would seem therefore, that children born of variolous mothers at this stage enjoyed a certain degree of immunity but the further history of the cases showed that this immunity was only temporary; vaccination performed at a later period proved successful in all these cases.

I was also able to observe the effect of revaccination during pregnancy on the foetus in two instances. Two infants born of mothers who had been successfully revaccinated in the later part of their pregnancy were used among my "controls" and both were refractory to vaccination. They were vaccinated a few days after birth. Three months after, they reacted in a normal manner to revaccination. Two women who had the disease when one month and two months pregnant respectively gave birth to full term healthy children who reacted normally to vaccination.

The above observations show that besides the protection afforded by contracting the disease in utero, the foetus may acquire a certain degree of immunity from the mother without itself passing through a regular attack of the disease. This must take place ei-

either by simple transmission of the already developed immunity substances from the mother to the foetus by way of the placenta or as a result of a reaction in the foetus to the immunising agent passing through the same channel from the mother. By the former method, fluids which are already endowed with properties upon which immunity depends are introduced into the foetus, whereas by the latter method these properties must first be elaborated in the foetus before immunity is conferred. The short duration of the immunity conferred in my cases would seem to indicate that the first method was the one which was operative; the children remaining protected only as long as the immunity substances which were transferred from the parent to them were retained.

Dr. Masson and I inoculated two monkeys with matter from two patients under my care in the Isolation Ward in July 1903. Both monkeys were vaccinated with the same lymph, one by Dr. Masson and the other by me. My case gave only a slight reaction whilst Dr. Masson obtained a very successful result which he recorded in the British Medical Journal of September 26th. 1903. (page 779) (Photo 20).

Bacteriological Examinations:-

Cultures on Agar-agar made by Dr. Dickson, Assistant Medical Officer of Health and Dr. Lassalle, from ves-

icles 6th. to 8th. day, shewed typical growths of the streptococcus pyogenes.

Microscopic examinations of the contents of the elements shewed:-

1st. to 5th. day: Lymphocytes and polymorpho-nuclear neutrophiles in increasing numbers.

6th. to 7th. day:- Cloudy swelling and commencing disintegration of the cells.

7th. to 9th. day: More complete disintegration.

After this the contents were purulent.

VARIATIONS IN VIRULENCE OF EPIDEMICS AND MORTALITY RATE:-

Smallpox like other epidemic diseases varies in its intensity in different outbreaks. Sydenham states that "Smallpox has its peculiar kinds which take one form during one series of years and another during another". Mild outbreaks have been observed in all ages even in prevaccination times and have occasionally we are told been mistaken for chickenpox.

The intensity of smallpox epidemics is manifested as stated by Dr. A. Newsholme by:

- (1). The extreme diffusiveness of the disease.
- (2). Its attacking in unusual proportion persons who are regarded as protected against the disease whether by previous smallpox or by vaccination.
- (3). The occurrence with quite remarkable frequency of

cases of a malignant and haemorrhagic type and a consequent high ratio of deaths to attacks. (see British Medical Journal, July 5th, 1902, page 25).

In the great pandemic of 1871 - 2. this colony suffered severely; like all pandemic extensions of the disease it was characterised by its great virulence. During that epidemic 12,531 persons were attacked and 2,449 deaths occurred. This high death rate, (19.5%) bore out the experience that in the negro and coloured races, smallpox is a severe affection and attended with a high mortality.

In this epidemic the mildness of type was shown in the slight diffusiveness of the contagion, the insignificant symptoms exhibited by a large proportion of the cases and in the extremely low mortality. On the other hand, a large number of vaccinated persons were attacked even more severely in some instances than the unprotected. This certainly appeared to be a very anomalous occurrence but the term "vaccinated" cannot be considered equivalent to "protected" and this apparent anomaly may perhaps be explained in the majority of instances by the fact that in these persons the original protection afforded by vaccination had worn itself out. There were some cases, however, where vaccination was of comparatively recent date and yet the protective power was inoperative, at any

the protective power was inoperative, at any rate against attack by the disease. This epidemic maintained a degree of mildness which has never before been witnessed in this island since the introduction of the disease by the Spaniards in the early part of the sixteenth century. Indeed the case mortality is the lowest that has ever been recorded in any country. That only twenty eight deaths should occur during an epidemic which attacked 5154 persons consisting chiefly of negroes is a result which is without parallel in the recorded history of the disease. And the fact that the disorder among infants and children was rarely fatal is also very remarkable. (Tables III & IV). Among the five hundred and sixty four cases that came under my care, thirteen deaths occurred; when it is borne in mind that the worst cases were treated in the Isolation Hospital, such a result is almost inconceivable. No small wonder that much doubt and hesitancy was felt in the diagnosis of ^{such} an anomalous form of smallpox especially when cases literally covered all over with pocks escaped death. It would appear that a fatal termination in Smallpox is not determined solely by the outward manifestations of the disease, but chiefly by the virulence of the poison which attacks the system. As the virus in this epidemic was mild, few deaths occurred notwithstanding the abund-

ance of the eruption in many cases.

Dr. Montizambert in an article already referred to says in regard to the mildness of the epidemic which visited Canada in 1900. " It has been suggested that the mildness of type is due to some meteorological condition. Against this theory is the fact that during the period since its commencement, we have had at least one intercurrent outbreak of a very virulent form of the disease, introduced from the Orient. It was quickly limited and stamped out. But in the score or so of cases that occurred the mortality ran up to over 50 %."

Anomalous forms of smallpox were not unknown in prevaccination times though they were not invariably regarded as of a variolous nature. At one time an almost unanimous belief was held by the medical profession that an attack of smallpox was an absolute and lifelong protection against another attack so that when a person who presented the traces of a previous attack became again affected the disease was called " hornpox," " waterpox," &c.

Mild epidemics of smallpox have also been described under various names. I shall refer to two classical outbreaks which occurred in Jenner's time.

At the latter end of 1789 an eruptive fever which was known to the common people as " swinepox" broke

out in various parts of Gloucestershire and appeared to have greatly puzzled the medical men there. Jenner cut the Gordian knot by inoculating his own child then about ten months old with matter taken from its nurse who was affected with this mysterious malady; this inoculation was successful and the test of variolation which was afterwards applied on several occasions showed that the child had been protected against smallpox. From this experiment it may be safely concluded that that eruptive fever was variolous in its nature.

In the year 1807, Dr. Adams of the London Smallpox Hospital took matter from an outbreak of what owing to the white appearance and small size of the vesicles, was called " Pearlpox " for inoculation purposes. The result which he obtained with this lymph was identical with that from the usual type of smallpox, showing that the disease was undoubtedly variola.

The mildness of type is due either to attenuation in the virulence of the exciting cause, to a heightened resistance of the individual affected or to a combination of these factors. We know that all organisms are susceptible of variation especially with changed conditions of environment. Attenuated forms of bacteria are produced under injurious influences whereas exalted virulence may be secured under favourable conditions.

Most of the variations with which we are familiar are

temporary and soon disappear after a return to the normal conditions but some become permanent and heritable even after such a return and thus give origin to new varieties. If these variations in attenuation or exaltation of virulence can be produced by artificial means there is no reason to suppose that spontaneous variations do not occur, especially as we know that influences capable of affecting virulence in the laboratory are operative in nature. Indeed we meet with varying degrees of virulence under natural conditions in the case of some pathogenic bacteria, e.g. bacilli diphtheriae and pyogenic cocci. In this way may be explained perhaps the varying characters of epidemics.

These variations are not confined only to micro-organisms; the zoologist and botanist by removing animals and plants to different climates and different soils, have shown that the natural forms and species are capable of alteration.

From the experiments of Guillou, Thiele of Kasan, Trousseau and Delpech, and others, it would seem that there is a possibility of attenuating the virus of smallpox without the intervention of the cow.

Jenner always looked upon Variola and Vaccinia as modifications of the same distemper and Somering expresses very well the identity of these two diseases

thus: "Variola et Vaccinia sunt morbi, non suâ naturâ sed gradû, diversi". The most recent scientific investigations of the subject strengthen the theory enunciated by Jenner and supported by Somering. Most of those who have worked in this field claim to have obtained positive results as regards the production of typical vaccinia after one or two removes as the result of variolation of the calf. It may be presumed therefore, that Variola and Vaccinia sprang from a common stock; the former departed from the original type and by successive reproduction in man under conditions favourable to its propagation and activity, acquired its well-known virulence. It may be that the organism of smallpox in this epidemic had degenerated or reverted to its ancestral type owing to unfavourable influences.

Predisposition is also another factor which must be considered: but it plays a less important rôle especially in reference to smallpox; though there is a marked racial susceptibility to the disease, predisposition as applied to individuals of the same race is of minor consequence. When ordinary smallpox attacks a mixed population of whites and negroes the latter are more frequently attacked proportionately and the attacks are more severe in this class, for the degree of susceptibility influences not only the

capacity to acquire the disease, but also the severity of the disease. Predisposition in mild varieties of smallpox may however be a more important factor in the consideration of this subject than it is in the usual type of the disease.

Probably to the combination of these two factors is due the mildness of type in the present epidemic

Essentially this eruptive fever and smallpox are alike; they differ rather in degree than in kind.

The absence or almost entire absence of constitutional symptoms in comparison with the abundance of the eruption; the absence of secondary fever in a large proportion of the cases; the fact that a great number of unvaccinated persons had mild or abortive attacks whilst some of the vaccinated suffered severely; the frequency of recurrences within a short period of the first attack or after recent vaccination; the bullous character of the eruption in some severe cases; the appearances of the rash in successive crops in many instances; the apparently slight infectivity of the disorder and its slow spread among a black population largely leavened with unvaccinated immigrants; the occasional vaccinal reaction during convalescence or after recovery from the disease and the extremely low case mortality especially among infants and children, are facts which are difficult to explain in associa-

tion with smallpox, but in the face of ~~the~~ other and more important and salient features which I have described, these anomalies must be regarded as of little weight in the diagnosis of the disease.

When one considers the history, the age incidence, the initial symptoms, the distribution, order of appearance, character and course of the eruption in the majority of the cases, the frequency and nature of the complications and sequelae, the occurrence of a typical haemorrhagic case during the epidemic, the infection of the foetus, the influence of vaccination and other facts mentioned in this paper, I think, I am warranted in coming to the conclusion and in recording the fact that the Trinidad epidemic of 1902 - 1904 was a mild and irregular form of smallpox.

Colonial Hospital,
Port of Spain, Trinidad

April 7 1904.

I hereby declare that the foregoing
thesis is entirely of my own composition
and that where not original I have
acknowledged the sources from which I
obtained the facts stated therein.

M.B. C.M. (1892.)