

transplant freely. As I observed before, I hope to transplant into the bend of the left elbow of the child referred to a large piece of skin, and so give nearly natural pliancy to the part. I endeavoured to do so on the right, but failed, because I tried to transplant on to the new raw surface; and though the piece of skin appeared at first to be likely to unite, immediately suppuration commenced it came away. The fear of failure in grafting large pieces of skin is, that some points may not adhere, in consequence of pus being formed from the granulations below, and burrowing under and separating in part or whole the transplanted skin. I do not mean that grafting will ever be a substitute for plastic operations; it cannot, since the skin in the former does not retain all its natural character, as in the latter, but it will prove most valuable where plastic operations cannot advantageously be adopted.

Another field of usefulness is open to skin-grafting in cases of severe lacerated wounds needing partial amputation, or involving considerable sloughing; where the prospect of being able to transplant when granulation is fairly established, will enable us to save more of valuable parts than we should otherwise have ventured to leave uncovered by any skin, trusting alone to granulation. Such a case was recently admitted into the Bristol Infirmary. A man had his fingers and hand severely crushed and lacerated by cog-wheels, the skin in rags, the muscle mashed, and the metacarpal bones comminuted. The thumb was uninjured, and I amputated through the middle of the palm, pinching off the bones near the carpo-metacarpal joints. There was no skin to form a covering, and some sloughing of the soft parts has followed; but granulation has commenced, and, when it is fairly established, by transplanting on to the palm, and the surface covering the ends of the bones, I shall be able to materially hasten recovery and give a firmer, harder, more yielding surface for use. In retraction of stumps leaving bones covered with granulations only, transplantation of skin will be of great service, and will doubtless save some secondary amputations. Finally, following the example of Mr. Durham, of Guy's Hospital, by modification of skin-grafting, we shall be enabled to remove, with boldness, tumours involving the loss of much integument.

Another great benefit to be derived from transplantation is that of arresting the breaking down of large cicatrices. This has just been illustrated in the case of J. Dando, already mentioned. On November 30th, an ulcer formed in a large healed surface of thin cicatrix midway between the sound skin and the grafts. On December 2nd, I planted two portions of skin of the size of a pea upon this oblong surface. One, the lower, lived, and, on December 6th, was becoming red; and had stimulated fine blue cicatrization from the margin to cover half its surrounding ulcer; while the upper had died and ulcerated the surface on which it was planted, and was increased to fully a third larger. On this, and also on another ulcer which had formed, I planted a piece of skin of the size of a fourpenny-piece.

With regard to the source from which integument should be taken, most prefer the inner side of the upper arm; but one important feature of the operation is that it gives freedom of removal from any part or any person, and our endeavour should be to gain integument of the same consistence as that belonging to the part on which we plant it, while we are careful not to produce tension in the part from which we remove skin. But we are not confined to our patient even; an amputation giving healthy skin affords an abundant supply. Mr. Leonard and I both made use lately of this source from a leg amputated by Mr. Tibbits. Mr. Leonard's grafts took, but mine failed, owing to the unhealthy character of the ulcer—a syphilo-strumous ulcer covered with aplastic lymph. I was anxious to try skin from such a source, and scraped the lymph from several granulations; though the soil was unsuitable, some grafts adhered for a time, and gave assurance that they would have succeeded in a healthy ulcer. I have since employed healthy skin from an amputated limb in three cases.

Patients in a hospital are under the control of their surgeons to a degree unknown beyond its walls, and the interest elicited in their cases when such a novel plan of treatment is adopted encourages them to put up with pain and wounds where others would require firm promise of success; therefore there will be many gentlemen who will read of successes, and, owing to distance from hospitals, will be unable to witness results, which they are anxious to behold and to urge upon unwilling patients. Moreover, we have yet to prove the stability of these cicatrices; therefore I am sure that, should the surgical staff of the Plymouth Hospital systematically carry out a series of skin-transplantations for the next seven months, so as to be able to show every stage, from graftings two days old to cicatrices of large size, which have stood hard work for six months, they will, on the occasion of the annual meeting of the Association in August 1871, alike rivet the attention of numerous visitors in their wards, and help to establish the reputation of an operation which, though simple, must prove to be one of the most valuable discoveries of the nineteenth century.

ON THE TRANSMISSION OF THE INFECTION OF FEVERS BY MEANS OF FLUIDS.*

By MICHAEL W. TAYLOR, M.D., Penrith.

It was for too long in the world's history the opinion that the atmosphere was exclusively the medium concerned in the transmission of epidemic diseases, and that the air surrounding the sick was the only nidus in which the infectious element might nestle and fructify, and diffuse itself from place to place, and from man to man. When the Hindoo, on an outbreak of cholera in his native village, looked with suspicion on his water-supply, and would fain attribute the origin of the disease to a poisoning of his tanks or water-courses through the agency of evil spirits or malevolence, in one respect, in regard to the etiology of the pestilence, he was in advance of medical knowledge in Europe up to a certain epoch. His experience, it is true, had been greater than ours; and, though not extending over more than two generations, it had been mighty and continuous; whereas ours had been exceptional and interrupted. But a rude generalisation from the phenomena observed in successive outbreaks had impressed him with the suspicion that the drinking of impure water was somehow one of the sources of the pestilence.

During the enlightened medical experience of these later years, the problem of the modes of communication of cholera has been wrought almost to a demonstration. The results of most of the special investigations which have been officially conducted by governments, as well as the evidence afforded by private medical inquiry, have consolidated the basis of those principles first enunciated with so much patience and truthfulness by that gifted pioneer in sanitary science, the late Dr. Snow—viz., that the elements of contagion reside chiefly in the fluid discharges of cholera, and that the great medium by which the disease is propagated is the drinking-water contaminated by these excretions. These propositions may be held to have been proven by the soundest of all processes of reasoning, the analytical; and each successive outbreak since 1849 has afforded additional data to substantiate them.

If it be accepted, then, that water is capable of holding and maintaining in activity the specific contagious principles cast out by the bowel-discharges of cholera, and that it moreover may be the means of conveying that disease, by being swallowed, to the healthy, analogy would forbid us to disbelieve that water may be the medium by which are transmitted the contagious *exuvie* of other diseases which possess the similar typical property of generating a contagious principle in the intestinal surface, or on other surfaces of the body. When we are told, therefore, that in enteric fever the specific virus of that disease is eliminated in the intestinal discharges, a similitude in this respect, with certain limitations, is approximated between that disease and cholera; and the value of the inference, that the means by which both the poisons may be transmitted shall be similar, depends on the degree of importance which we are inclined to attach to analogical reasoning on such questions. But, as might be expected in a so well studied disease as enteric fever, facts and observations have so accumulated as to have allowed the induction of general propositions, applicable to practice, of its modes of propagation and transmission. Thus it has been determined that the causation of this fever is essentially to be sought for in the emanations from house-drainage, in sewage, and in certain forms of putrefying animal matter, which produce the disease, according to one view, from being merely the recipient of the infectious excreta of some previous fever-patient; or, according to another view, from the spontaneous generation of the poison by peculiar fermentation in the decomposing matter itself. I will not pause to discuss this question; but I feel constrained to admit the possibility of the spontaneity of generation of fever, from, besides other reasons, the recognition of some undoubted instances in isolated houses in the country, originating under circumstances which seemed to preclude previous contagion from the sick.

In regard to the contagium of infectious diseases, there are two channels through which it may diffuse itself to those exposed to its action. These are, first, transmission by inhalation; and second, transmission by swallowing. By these two ways—in the one case air, and in the other ingesta—are the vehicles by means of which the morbid principle is carried into the body. Transmission by the air is doubtless infinitely the most frequent mode by which these so-called poison-germs are propagated. The atmosphere which supports our being, and which pervades in us and around us on every side, is unmeasurably the most abundant natural medium or recipient of volatile emanations, which property of volatility and diffusibility we presume to be an endowment

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of these miasms. Besides, the amount of absorbent surface in the human body necessarily in continuous contact with air, from the nasal fossæ to the minutest ramifications of the respiratory apparatus, is to an infinite degree greater than that which is ordinarily exposed to contact with liquids. It is not wonderful, therefore, that we are prone to attribute the preponderance of cases of infection to inhalation and absorption of the miasm in the lungs, though it is even doubtful whether, in many of such presumed examples, the virus be not mingled with the saliva, and swallowed, and in its passage infect through the mucous surfaces of the mouth and throat, either by absorption, or possibly by simple contact therewith.

But the second mode of transmission—that is, by swallowing—is so common as to remove the circumstance from the category of exceptional occurrences, and to establish it as a certain law in the history of the morbid germs. Amongst the most convincing observations on this mode of transmission of typhoid, I may mention those of Dr. W. Budd, those of Drs. Buchanan and Seaton, in the Ninth Report of the Medical Officer of the Privy Council (1866), on the outbreaks at North Tawton and at Tottenham; and those of Lebert of Zurich; also the facts elicited in the history of the fever at Guildford in 1867; at Terling, in Essex, in the same year; and at Ackworth, and at Tadcaster, as reported by Dr. Clifford Allbutt before this Association last year.

But, if the drinking-water of a locality be recognised as the means by which a fever-element is carried into the system, why may not other fluids act in a similar manner as vehicles for the same poison? Given the introduction of the contagium, in the same state of activity, into milk or beer, or any of the ordinary beverages standing in the sick-room of the fever or cholera patient, and let these fluids be swallowed by the healthy, why may not the same result follow from the drinking of these as from the drinking of infected water? The propagation of both of the above mentioned diseases to the attendants and those in intercourse with the sick, and even to those in distant places, by means of articles of food and drink so contaminated, is possibly more frequent than is generally admitted. This may occur either from the soiling of the hands, or from the direct admixture of the *exuvia* or discharges with liquids or vessels used by the patient—by the drying up of those discharges, and the dissemination of their poisonous elements, either in the form of dust, or by the particles of dust already existing in the apartment, acting as *carriers* of the infected germs, which, when absorbed by liquids, by adhering to clothes, or by currents of air, might be carried to distant quarters. In the case of a water impure from sewage-leakage, supplied by public services, or by public or even private wells, a multitude of people use the same water; and, when disease results, we are ready to admit the sequence of cause and effect, because the proofs from individual cases become various and abundant, and often even crucial. But, in the case of beverages or food exposed in a fever-chamber, on account of the paucity of persons who are likely to partake of them, it is almost impossible to arrive at any safe inferences.

To proceed further: as in cholera and typhoid, it is in the excreta from the alimentary canal that the contagious element resides; so we are led to judge that, in typhus and the exanthemata, it is from the exhalations from the respiratory tract, from the skin or its epithelial efflorescence, or from faucial exudations, that the poison comes. Do the poisons of these diseases ever infect the healthy, by being swallowed, or by coming into contact with the mouth and throat? Does not the poison of diphtheria? I have seen a man of fifty take the disease apparently from having had some saliva spurted over his face and mouth on examining a child's throat. Trousseau tells us of colleagues who died from malignant diphtheria contracted in this way. May not the dry epidemic dust from the desquamative plates of scarlatina, by being drawn into the mouth and mingling with the saliva, infect by contact, or, by becoming attached to solid or liquid ingesta, spread the disease by these means? It has fallen within my own experience to observe some facts bearing on these points; and, having led up the argument so far, let me now adduce these cases.

The first set of observations relates to an epidemic of continued fever, and the second to scarlatina; and, in both, milk from a public dairy appeared to be the medium by which the diseases were transmitted to different households. All the facts and arguments concerning the first of these epidemics were published in the *Edinburgh Medical Journal*, May 1858, in a paper entitled "On the Communication of the Infection of Fever by Ingesta." I shall, therefore, dwell but slightly on this instance.

A number of cases of fever occurred in the town of Penrith in the autumn of 1857, in rapid succession, in several houses in different localities of the town. For a considerable period previous to this time, the town had been very clear of fever. I was at some pains to trace the origin of these first cases; and a curious history it proved to be. The

first case was clearly an imported one. It was that of a young woman who in September was brought from Liverpool to her father's cottage, which contained two rooms only, small, ill-lighted, and ill-ventilated. She was then in the early stage of fever; she passed through the fever; and subsequently the fever spread to other members of the same family living in the same house. The house was that of a poor milkman, who kept three cows, and retailed the milk to about fourteen different families in the town. The milk was brought direct from the byre into the kitchen where the sick children lay; the mother, who was the nurse, milked the cows; and the milk was, by the bye, taken out in tin measures and pitchers for distribution to the customers. During the months of October and November, cases of fever appeared amongst children and young persons in seven different households in the town, which were supplied with milk from these premises; and these formed almost the aggregate and entirety of the cases of fever which existed in the town at that epoch. The investigation of the circumstances attending each particular seizure—the absence in all of direct exposure to, or contact with, the sick, and in most the absence of communication with the milk-carrier; the very transient nature of such intercourse in the exceptional cases in which it did occur—led me to the inference that the milk itself had absorbed the fever-exhalations, or become contaminated directly with fever-virus, and induced the disease in those who drank it. This happened thirteen years ago. By a singularly fortuitous chance, in the course of my practice in the same town, three years ago my attention was forcibly called to a parallel coincidence. This refers to a series of cases which I am about to relate, which led me strongly to suspect

The Propagation of Scarlatina by means of the Milk-supply.

The town of Penrith, containing a population of eight thousand, had been very free from scarlatina throughout the year 1866; and, during the first quarter of 1867, no deaths were recorded from this cause. On the 27th of April, the first death was reported in a child of a small provision-dealer. It was in a quarter thickly and exclusively tenanted by the lower orders, and situated at one extremity of the town, that this child sickened and died. The disease spread amongst several families located in the adjacent yards, who had intercourse with this shop, and six deaths took place within a stone's throw of it, between the 27th May and 7th June. Amongst those to whom the disease was conveyed, was a child of J. C., aged four months; it was ill between two and three weeks, and it died during the period of desquamation, from the secondary affection of anasarca and ascites, on June 12th. The child was buried on June 14th. It was the only child in that house, and the disease spread no further there. It was a small cottage. J. C. at that time kept four cows, and carried on a small business as a milkman; the cows being milked sometimes by himself, and sometimes by the wife, who attended to the sick child. The milk was brought direct from the byre to the dairy, or back kitchen of the cottage, where it went through the usual process of filtering; it was afterwards taken out by a servant girl and by an errand-boy (who did not sleep on the premises), to certain customers in the town, numbering about fourteen households. In the meantime, up to the date of June 10th, be it remembered that scarlatina was epidemic solely in this distinct locality of the town, in which the dairy was situated. All the deaths, which, including this last, were eight in number, had occurred, with one exception, within a pistol shot of this place.

House No. I.—On Monday, June 10th, Mary T., aged 7 years, living in A Street, was visited and found to have an injected throat and a strawberry tongue. Next day, the scarlatina rash appeared, the eruption being very copious and vividly red, with much heat and turgescence of skin, a rapid pulse, and delirium. She passed through the disease favourably, and was up on the eighth day. There were two other children in this house; one of them, a twin sister, showed the first symptom of scarlatina on the 21st of same month, and passed through a mild attack. This house was supplied with milk from C.'s dairy, and the milk was delivered daily at the door by a young girl, who served as the milk carrier of the establishment at that time. It was received and taken into the house by a servant. These children had undoubtedly some occasional and temporary intercourse with the person who brought the milk, as they sometimes came to the door and drank cupfuls of the milk immediately on its arrival in the house. This was the first case in this street, which was situated quite at a distance from J. C.'s house.

House No. II.—L Street was a wide open roadway, abutting on which some half dozen detached villas had been built. One of these, having about it all the attributes of salubrity, which altitude, isolation, or aspect could give, and the sanitary arrangements of which were as perfect as art or money could accomplish, was cruelly smitten with the epidemic. There was a family of six fair young children, one of whom escaped through having had scarlatina before, but five took it. In the

first case in this house, the date of invasion was on the same day as in house No. 1, viz., June 10th; it was in a child three years old. The case was attended with a bad form of sore throat, but recovered. Subsequently three more of the children, at the ages of 8 years, 2 years, and 11 months, died on the 8th and 9th July, from that serious diphtheritic complication and diffusive glandular engorgement which often sets in about the tenth day, and forms one of the most fatal sequelæ of the disease. This house was supplied daily with C.'s milk, which was consumed by the children, none of whom were known to have had communication with the milk-carrier.

House No. III.—Exactly on the same day, June 10th, a case was visited in a different part of the town. It was in B Square, an airy open space on a slope on the opposite side of the valley. It was in a good class dwelling house, inhabited by a married gentleman without family, but with one young female servant. In this young person, the rash appeared on the 9th of June; she was taken to her own home on the 10th, passed through a mild attack, and recovered. This house was supplied with C.'s milk, which was taken in at the door by the servant girl, who fell ill; she was the only inmate who consumed milk.

House No. IV.—A large, new, detached mansion in the same suburban square had milk delivered daily from C.'s dairy. The lady and her family of five children removed to a sea-side residence forty miles off, about the 20th of June. A few days thereafter, her eldest daughter, aged 17, commenced with scarlatina. At that watering village, at that time, or for some time before, no case of scarlatina had been known to exist. The young lady passed through the disease, which, within ten days, attacked another daughter, and subsequently others of the family. The young lady who first became affected was a great consumer of milk. She never saw, nor had any communication with, the milk-carrier, as the milk was invariably received at the threshold by one or other of the domestic female servants, who themselves escaped the disease.

House No. V.—On the morning of Saturday, June 22nd, I visited a house in the same square. The family consisted of father and mother and three young children, aged respectively 7, 5, and 2 years, as well as two young female servants. The milk was brought from C.'s dairy, and it was invariably taken at the back gate of the house by one or other of these servants. The eldest child had been indisposed the evening before, and restless all night, and on this morning the rash was out on the neck, chest, and throat, and it subsequently extended through its usual course. Isolation was maintained, and carbolic acid fumigation indefatigably pursued for two weeks (which process I advise as surpassing all other methods of disinfection in scarlatina), and the rest of the family and servants escaped. This child used milk regularly at her meals, and could not possibly have had any intercourse or even seen the person who brought the milk, being in bed or upstairs at the time of the milk-carrier's call at the house.

House No. VI.—At an inn in the centre of the town, quite in a different quarter from any of the preceding houses, I saw another case on Saturday, June 22nd. It was a young person aged 18, the niece of the landlady, whom I found covered entirely, even to the feet, with the scarlatinous rash; and it was stated that it was seen on the chest and face on the preceding morning, so that it was probably the second day of the disease. It passed through the usual course. It is proper to note that this young person occasionally took the daily supply of milk from the hands of the milk-carrier, and, moreover, that she was not in the regular habit of using milk, but that she drank a mugful on the evening of Wednesday, June 19th. This household was supplied from C.'s dairy. There were no children in the house, and the disease spread no further.

Thus ends the recital of the primary series of cases which were known to me to have followed the trail of the milk-carrier. It will be noted that all in this group of the six first infected were children or adolescent persons; and if I were to trace the progress of the milk-carrier from door to door, amongst the remainder of his customers (as I am bound to do in fairness to any antagonism to my hypothesis), I find, curiously, that in almost every case amongst the rest of the households so supplied, special circumstances afforded reasonable explanations why their inmates should have obtained immunity. Thus, *a b c* houses, with families of young children, soon after the 12th, when it became apparent that infection was conveyed from the milk-vendor's premises, ceased to take the milk. Again, the houses *d e f g* were tenanted by middle-aged and elderly persons without families or young people—a group, therefore, who were presumed not to be susceptible of the contagion. There was only one house, *h*, containing children, which continued the intercourse with the dairy to the end, that escaped the hurtful influence. Moreover, during these thirteen days, from the 10th to the 23rd, the interval during which these six cases occurred,

the disease was not prevailing yet amid the population generally; it was just being started on its epidemic career, which subsequently assumed an alarming and fatal progress, as the following returns will show.

The annual deaths in Penrith from all causes were, in the years 1866, 257 deaths; in 1867, 320; in 1868, 224; in 1869, 205. The great increase in 1867 was exclusively due to scarlatina in the last three quarters of the year, as is seen in the following table.

1867.	Deaths from Scarlatina.				Deaths from all causes.
	Under 12 yrs.	Above 12 yrs.	Total.	Per Quarter.	
January ...	0	—	—	First Quarter, none.	First Quarter, 71
February	0	—	—		
March ...	0	—	—		
April	1	—	1	Second Quarter, 18	Second Quarter, 78
May	4	—	4		
June	13	—	13		
July	12	—	12	Third Quarter, 28	Third Quarter, 86
August ...	8	—	8		
September	8	—	8		
October ...	13	2	15	Fourth Quarter, 28	Fourth Quarter, 86
November	9	—	9		
December	3	1	4		
	71	3	74	74	320

The total of deaths from scarlatina in the year 1867 was 74. The mortality ceased with the last quarter of 1867, for I find no deaths from scarlatina proper in the first quarter of 1868.

It must be conceded, that these cases which I have related must have originated from some description of intercourse with the infected dairy. Was it by means of the milk-carriers? I hardly think so. These persons had not themselves the fever; they were not in attendance on the sick child; their presence at the entrance of the different houses was very transient; in most of the cases they were never near to or even saw those who fell ill. I believe, rather, that the milk itself was the medium of the hurtful virus. All the sick were proved to have drunk the milk. Consider how readily contamination of the milk might have happened. A person has nursed a child through scarlatina for three weeks; she milks the cows; she leans over the pail, into which, by the motion of her arms, the dust is shaken from her dress, or the miasm is absorbed by the thin stream of milk as it flows; and the vessels stand for a time in an apartment exposed to an infective atmosphere. This freshly drawn animal fluid imbibes effluvia with great readiness, and is in the highest degree susceptible of the least mustiness or putrescence. Meanwhile, molecular changes are going on, and such effluvia are retained with peculiar tenacity, from the property of milk throwing to the surface an impervious cream. If I am correct in my inference, the fact is an important one; and the evident value of its practical bearings has induced me to bring it before the notice of the profession.

OBSERVATIONS ON THE USE OF INTRAUTERINE INJECTIONS AND OF THE CURETTE.

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IN the number of the BRITISH MEDICAL JOURNAL for the 5th November, there appear several extracts from the writings of Dr. T. G. Thomas of New York, on the subject of intrauterine injections. With his remarks on this particular subject I in the main concur. I disapprove of the injecting of any fluid into the cavity of the uterus, except in cases of *post partum* hæmorrhage occurring at the full period of utero-gestation, or at least not before the seventh month of pregnancy, and when, all the ordinary means of checking hæmorrhage having failed, the life of the patient is in the greatest jeopardy. In such cases, however, I have injected the liquor of the perchloride of iron, diluted with about two parts of water, with the most satisfactory results. Excepting such cases as these, Dr. Thomas's views are on this point almost identical with mine; but, further on, we meet with a paragraph to which I must take exception. Dr. Thomas there says: "I never use intrauterine injections even for the hæmorrhage of abortion. If we know anything about the pathology of uterine hæmorrhage, we know that it should be